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AN ASSESSMENT OF ICT ADOPTION LEVELS IN ZESA HOLDINGS

BY

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Abstract

This study assessed ICT adoption levels at ZESA Holdings, Zimbabwe's state-owned electricity utility, examining barriers constraining adoption, impacts on organisational performance, and strategies for enhancement. Employing a convergent parallel mixed methods design, the research collected quantitative data through questionnaires administered to 370 employees selected via stratified random sampling, and qualitative data through semi-structured interviews with 10 key informants selected purposively. The findings revealed bifurcated adoption characterised by widespread access to foundational digital infrastructure including desktop computers (93.0%), email systems (88.9%) and internet connectivity (84.3%), but limited deployment of advanced enterprise and operational systems such as ERP (50.5%), SCADA (26.5%) and AMI (14.1%). System integration remained predominantly low, with 60.6% of respondents rating integration as inadequate. Multiple interconnected barriers constrained adoption, including insufficient financial resources (mean severity 4.47 on 5-point scale), outdated infrastructure (4.39), power supply unreliability (4.31) and limited training provision (4.18). Regression analysis confirmed statistically significant positive relationships between ICT adoption and operational efficiency, revenue collection and service delivery ($p<.001$), though effect sizes were moderate and variance explained limited. Administrative functions demonstrated stronger improvements than operational domains, reflecting differential system availability and implementation completeness. The study proposes a comprehensive ICT Adoption Enhancement Framework encompassing strategic direction, governance mechanisms, implementation initiatives across infrastructure-systems-people dimensions, and continuous feedback loops. Recommendations emphasise increased budget allocation, comprehensive training programmes, infrastructure reliability improvements, strengthened management commitment and enhanced stakeholder engagement as prerequisites for sustainable digital transformation in resource-constrained utility contexts.

Key Words: ICT adoption, digital transformation, electricity utility, ZESA Holdings, Zimbabwe

Declaration

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor will it ever be submitted to another university for the award of a degree.

Tafadzwa Emmanuel Mureriwa

Student's Signature ______________(Date)_ Nov 12, 2025______

Prof. Yogesh Awasthi   Nov 12, 2025

Supervisor's Signature___________ (Date)_________________

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Dedication

To my parents, whose sacrifices in pursuit of education for their children laid the foundation for this achievement.

To my spouse and son, whose unwavering support, patience and understanding during countless hours of research and writing made this work possible.

To the employees of ZESA Holdings, whose daily commitment to keeping Zimbabwe's lights on despite formidable challenges inspired this investigation into how digital transformation might ease their burden and enhance their impact.

And to all scholars and practitioners working to advance Information and Communication Technology adoption in Africa's utility sector, that this research might contribute to the collective effort toward efficient, reliable and sustainable electricity services across the continent.

List of Acronyms and Abbreviations

Acronym/Abbreviation	Full Meaning
AfDB	African Development Bank
AMI	Advanced Metering Infrastructure
ANOVA	Analysis of Variance
API	Application Programming Interface
AU	Africa University
BERA	British Educational Research Association
BPS	British Psychological Society
CEO	Chief Executive Officer
ERP	Enterprise Resource Planning
GIS	Geographic Information System
HSD	Honest Significant Difference
ICT	Information and Communication Technology
IoT	Internet of Things
IS	Information Systems
IT	Information Technology
ITU	International Telecommunication Union
LPWAN	Low Power Wide Area Network
MIS	Management Information Systems
MW	Megawatt

Acronym/Abbreviation	Full Meaning
NDS1	National Development Strategy 1 (2021-2025)
OT	Operational Technology
SAPP	Southern African Power Pool
SCADA	Supervisory Control and Data Acquisition
SD	Standard Deviation
SME	Small and Medium Enterprise
SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TDC	Teacher Digital Competency
TOE	Technology-Organisation-Environment
UPS	Uninterruptible Power Supply
UTAUT	Unified Theory of Acceptance and Use of Technology
VNR	Voluntary National Review
ZERA	Zimbabwe Energy Regulatory Authority
ZESA	Zimbabwe Electricity Supply Authority
ZIMSTAT	Zimbabwe National Statistics Agency

List of Tables and Figures

Table of Contents

CHAPTER 1 INTRODUCTION

1.1 Introduction

The purpose of this chapter is to provide a comprehensive contextual foundation for the study on ICT adoption at ZESA Holdings, Zimbabwe. It explains why investigating ICT adoption is critical for operational efficiency, revenue management, and service delivery, situating the research within national and regional energy-sector realities. The chapter covers the background of the study, highlighting key debates in technology adoption, organisational change, and policy frameworks relevant to utilities. It identifies the processes, procedures, and stakeholders involved in ICT implementation, examines national and regional data and reports that justify the study, and outlines the research problem, objectives, questions, hypothesis, significance, delimitations, and limitations. Together, these sections frame the rationale and scope for the empirical investigation.

1.2 Background of the Study

This background synthesises recent, credible scholarship and official reports (2020–2025) to situate an empirical study of Information and Communication Technology (ICT) adoption at ZESA Holdings, Zimbabwe's state-owned electricity utility. The section outlines what the research area covers and the main debates, explains the importance of investigating ICT adoption in ZESA, summarises how ICT adoption processes typically unfold in utilities, identifies principal stakeholders, and documents the local and regional context and evidence that motivate the study. The discussion draws on global, African regional and Zimbabwe-specific literature and official documents to avoid unsupported assertion and to ground each claim in sources.

Defining the research area and key debates

Understanding ICT adoption in an electricity utility such as ZESA requires attention to both technology diffusion and organisational change, because the literature emphasises that adoption is not simply a procurement decision but an integrated socio-technical transformation. For example, Fortune Nwaiwu highlights that digitalisation in energy systems involves regulatory, policy and institutional dynamics as much as technical deployments, with case evidence from Nigeria and South Africa showing that successful digitalisation depends on regulatory alignment and organisational readiness (Nwaiwu, 2021). Similarly, scholars of technology adoption stress that diffusion in networked utilities depends on firm-level absorptive capacity and broader ecosystem capabilities, as described by Ejemeyovwi et al. who found that ICT adoption is closely interlinked with innovation capacity and financial sector development across African contexts (Ejemeyovwi, 2021). International telecommunications and development agencies underscore the infrastructural and connectivity preconditions for adopting advanced digital systems in utilities; the ITU's regional analysis demonstrates how uneven broadband penetration, spectrum policy and backbone capacity mediate the pace and shape of ICT uptake on the continent (International Telecommunication Union [ITU], 2020). Together these perspectives frame the central scholarly debate for this study: whether ICT adoption in state utilities like ZESA is primarily constrained by technical infrastructure, institutional governance and managerial capacity, or by market, policy and financing structures—and how these constraints interact. Evidence from energy-sector digitalisation case studies suggests that each factor matters and that interactions produce path-dependent outcomes.

Technology-focused debates further interrogate which ICT solutions yield most value in distribution and customer management: advanced metering infrastructure (AMI), outage-management systems, enterprise resource planning (ERP), geographic information systems (GIS) and mobile-enabled customer platforms have different investment profiles and organisational requirements. Researchers working on smart grids and digital energy systems note that while AMI and smart grid components drive operational gains, their deployment requires concurrent investments in cybersecurity, data governance and workforce digital skills (Kabeyi, 2023; Nwaiwu, 2021). At the same time, development-oriented literature points to a trade-off faced by many African utilities between investing scarce capital in core network rehabilitation and diverting funds to digital projects; policy analyses emphasise sequencing and blended finance solutions as means to reconcile these priorities (African Development Bank, 2022; World Bank, 2021). Thus, the research area sits at the intersection of technical innovation, organisational capability and public policy, with active debate about sequencing, financing, governance and equity of digitalisation in utilities.

Finally, a growing body of scholarship examines contextualised adoption models for developing-country utilities that adapt mainstream technology adoption theories (e.g. TOE—technology, organisation, environment) to account for infrastructural fragility, currency instability and political economy constraints common in Southern African states, finding that national macro conditions significantly moderate firm-level adoption determinants (Makiwa & Steyn, 2020; Oyetade, 2025). Taken together, these works construct a multi-layered conceptualisation of ICT adoption in utilities that is directly applicable to ZESA: technology choices, organisational readiness, regulatory frameworks and national context jointly determine both the level and the form of adoption

Importance of studying this phenomenon

Studying ICT adoption at ZESA is important for three interrelated reasons: operational reliability and service quality, financial sustainability of the utility, and broader socio-economic development outcomes in Zimbabwe. First, the utilities literature emphasises that digital systems such as outage-management, SCADA and AMI can materially improve reliability and loss reduction; international studies demonstrate measurable reductions in non-technical losses and faster restoration when utilities implement these solutions alongside organisational reforms (Kabeyi, 2023; Nwaiwu, 2021). African empirical analyses also show that digital systems are associated with improved demand-side management and better integration of distributed generation, which is critical in contexts where grid supply is constrained (Nwaiwu, 2021; Lukuyu et al., 2024). For ZESA, chronic load shedding, ageing infrastructure and technical losses make the case for ICT-enabled efficiency compelling and urgent, a point emphasised in regional energy reports and national energy strategy documents which identify digitalisation as a lever to improve service reliability (Southern African Power Pool [SAPP], 2021; Zimbabwe Energy Compact, 2024).

Second, ICT adoption can influence ZESA's financial position by strengthening billing, revenue collection and asset management, and by enabling demand-side innovations and new commercial models. The Auditor-General's recent audits of Zimbabwean state-owned enterprises document governance and financial control weaknesses across parastatals and highlight opportunities where improved information systems could enhance transparency and revenue realisation (Office of the Auditor-General Zimbabwe, 2023). Complementary research on ICT and financial performance in African firms finds a positive association between digital adoption and revenue growth when adoption is accompanied by process change and human capital investment (Ejemeyovwi, 2021; Makiwa & Steyn, 2020). Thus, rigorous investigation of ICT adoption at ZESA has direct fiscal policy relevance because improved billing systems and digital customer management have the potential to reduce commercial losses and strengthen the utility's balance sheet.

Third, the social and developmental dimension matters: digitalisation in the energy sector interfaces with national goals for economic transformation, digital inclusion and climate resilience. Zimbabwe's development strategies and national energy documents explicitly connect reliable electricity and ICT to industrialisation and service delivery objectives, such as in the National Development Strategy and the Energy Compact, which outline digital-enabled measures to enhance energy access and support economic growth (Government of Zimbabwe, 2021; Zimbabwe Energy Compact, 2024). Regional analyses also point out that digital energy services can broaden access to prepaid and pay-as-you-go models, encouraging productive uses of electricity in low-income households and micro-enterprises if implemented inclusively (ITU, 2020; African Development Bank, 2022). Therefore, assessing how ZESA adopts ICT is not only a managerial concern but also a policy matter that affects national development outcomes and distributive impacts.

Processes and procedures involved in the phenomenon

The process of ICT adoption in electricity utilities follows multiple sequential and iterative stages—strategic planning, procurement, technical integration, workforce adaptation and governance for operations and data—each with its own barriers and enablers. Conceptual and empirical studies in energy digitalisation describe an initial strategy and needs assessment phase where utilities must align technology choices with business objectives, regulatory obligations and financial capacity; Nwaiwu's comparative work emphasises the importance of explicit policy signals and regulatory frameworks to guide strategic digital investments (Nwaiwu, 2021). Procurement and financing are the next critical stages: African utilities often rely on a mix of grants, concessional loans and vendor financing to bridge capital constraints, and the sequencing of investments (for example, pilot AMI projects before full roll-out) is frequently recommended to manage risk and build organisational experience (African Development Bank, 2022; Kabeyi, 2023). Studies of procurement practice in public utilities caution that weak contract governance and limited project management capacity can convert technology projects into fiscal burdens rather than productivity enhancers.

Technical integration and interoperability with legacy systems present additional operational challenges. Research on smart grid and utility IT architectures shows that integrating SCADA, GIS, meter data management and ERP requires robust middleware, well-defined data standards and cybersecurity measures; the literature stresses that inadequate integration planning leads to fragmented information siloes and under-realised benefits (Kabeyi, 2023; Nwaiwu, 2021). Parallel to technical integration, human-resource processes—training, change management and retention of digital talent—determine whether the workforce can operate and maintain newly adopted systems, as documented in case studies of utilities that failed to capture promised efficiencies due to skills gaps and resistance to organisational change (Makiwa & Steyn, 2020; Ejemeyovwi, 2021). Finally, governance and data policies—covering data ownership, privacy and operational transparency—constitute an ongoing procedural requirement; both regional guidelines and empirical studies recommend that utilities adopt clear data governance frameworks to secure stakeholder trust and regulatory compliance (ITU, 2020; Nwaiwu, 2021). Together these stages show that ICT adoption is a holistic process requiring alignment across strategy, procurement, technical systems, people and governance.

Main stakeholders in the phenomenon

Multiple internal and external stakeholders are implicated in ICT adoption at ZESA, each with distinct interests and influence over decisions. Internally, senior management and the board set strategic priorities and approve capital investments, while technical divisions (distribution, generation, IT, metering teams) are responsible for implementation; academic and practitioner studies emphasise that leadership commitment and cross-departmental coordination are essential to successful ICT programmes (Ejemeyovwi, 2021; Kabeyi, 2023). Workforce stakeholders—engineers, IT staff, field technicians and customer-service agents—play operational roles and therefore must be engaged through training and change management;

Zimbabwe-focused studies on organisational digitalisation show that limited digital skills and resistance from staff can become decisive bottlenecks if not proactively managed.

Externally, government ministries and regulators shape the enabling environment through policy, tariffs and procurement rules: the Ministry of Energy and the national regulator influence the incentives for digital investment and the revenue frameworks that support them (Government of Zimbabwe, 2021; Zimbabwe Energy Compact, 2024). Financiers—multilateral development banks, bilateral donors and commercial lenders—provide the capital for large ICT-enabled network investments; the African Development Bank and World Bank programmes frequently provide blended financing and technical assistance for digitalisation projects in utilities across Africa, a point documented in regional investment analyses (African Development Bank, 2022; World Bank, 2021). Customers and civil-society actors are additional stakeholders because digital systems affect billing modalities, access and privacy; studies on digital customer platforms emphasise the need for consumer engagement and inclusive design to prevent unequal access to services (ITU, 2020; Nwaiwu, 2021). Finally, technology vendors, systems integrators and consultancy firms are crucial commercial stakeholders whose contract design and delivery capacity materially shape outcomes, and whose accountability is often scrutinised in the audit reports of public enterprises (Office of the Auditor-General Zimbabwe, 2023; SAPP, 2021). A stakeholder map for ZESA therefore includes internal leadership and staff, government and regulators, financiers and donors, customers and civil society, and commercial technology partners, and the literature shows that alignment (or misalignment) among these groups explains much of the observed variation in adoption success across utilities.

Context, events, documents and statistics that prompted the study

Zimbabwe's electricity sector faces severe and persistent supply-side constraints, driving the urgent need for ICT adoption at ZESA. National generation has averaged around 1,100 MW against a demand of 1,700–2,000 MW, causing frequent load-shedding and operational inefficiencies (Southern African Power Pool [SAPP], 2021; African Development Bank, 2022). Ageing infrastructure, limited maintenance, and high network losses exceeding 18% exacerbate system instability (World Bank, 2021).

In response, government policies such as the National Development Strategy 1 (2021–2025) and the Zimbabwe Energy Compact (2024) prioritise digitalisation through smart metering, data integration, and modern grid management (Government of Zimbabwe, 2021; Zimbabwe Energy Compact, 2024). Concurrently, the Auditor-General's Report (2023) highlights weak billing systems and internal controls, recommending digital reforms to enhance accountability. Collectively, these conditions underscore why assessing ICT adoption at ZESA is vital for sustainable energy reliability and governance.

Audit and oversight reports present clear, verifiable justification for assessing ICT adoption at ZESA. The Auditor-General's 2022 and 2023 reports revealed serious weaknesses in financial controls, asset management, and manual billing processes across ZESA subsidiaries, noting that outdated information systems contributed to revenue leakages and poor data accuracy (Office of the Auditor-General Zimbabwe, 2023). The reports explicitly recommended upgrading enterprise resource planning and digital billing systems to enhance efficiency and transparency. Regionally, the African Development Bank (2022) and World Bank (2021) confirm that digitalisation reduces commercial losses and improves performance in African utilities, with Zimbabwe identified as a priority for energy-sector digital investment. Complementary national data, including the Zimbabwe ICT Survey (2020) and Voluntary National Review (2021), demonstrate rising connectivity yet uneven access, framing the socio-technical environment within which ZESA's digital transformation must unfold (United Nations, 2021; ZIMSTAT, 2020).

The literature and official reports reviewed above show that ICT adoption in electricity utilities such as ZESA is a multi-dimensional phenomenon influenced by technological choices, organisational capability, governance arrangements and the national macro-environment. Regional and country-level evidence from Africa and Zimbabwe indicate both the promise of digitalisation for improving reliability, revenue collection and inclusion, and the concrete obstacles posed by infrastructure shortfalls, skills gaps, financing constraints and governance weaknesses. These findings justify an empirical assessment of ICT adoption levels at ZESA that combines documentary analysis, stakeholder interviews and technical appraisal so that policy-relevant recommendations can be grounded in the country's institutional and fiscal realities.

1.3 Statement of the Problem

Zimbabwe's electricity sector faces persistent challenges in adopting Information and Communication Technology (ICT), hindering operational efficiency and service delivery. While ZESA has implemented digital initiatives like prepaid metering and mobile payment systems, these efforts have been marred by technical failures, customer dissatisfaction, and internal resistance (Mazikana, 2023). Studies indicate that ZESA's ICT adoption is constrained by outdated infrastructure, inadequate staff training, and governance issues, leading to revenue losses and inefficiencies (Office of the Auditor-General Zimbabwe, 2023). Furthermore, national policies such as the National Development Strategy 1 (2021–2025) and the Zimbabwe Energy Compact (2024) emphasize digital transformation, yet their implementation remains sluggish (Government of Zimbabwe, 2021; Zimbabwe Energy Compact, 2024). Regional analyses suggest that African utilities, including ZESA, are underperforming in ICT adoption compared to peers in countries like Kenya and Nigeria (Astuti, 2025). While some studies have explored ICT adoption in Zimbabwean organizations (Makota et al., 2023), few have focused specifically on ZESA's ICT challenges and their impact on service delivery. This research aims to fill this gap by assessing the barriers to effective ICT adoption at ZESA and proposing strategies for improvement. Given the critical role of ICT in modernizing utilities, how can ZESA overcome its ICT adoption challenges to enhance operational efficiency and service delivery?

1.4 Research Objectives

The study seeks to achieve the following objectives:

1. To assess the current level of ICT adoption within ZESA Holdings.
2. To identify the key barriers and challenges hindering effective ICT adoption at ZESA.
3. To examine the impact of ICT adoption on operational efficiency, revenue collection, and service delivery.

4. To propose actionable strategies to enhance ICT adoption and digital transformation within ZESA.

1.5 Research Questions

1. What is the current level of ICT adoption within ZESA Holdings?
2. What are the main barriers and challenges hindering effective ICT adoption at ZESA?
3. How does ICT adoption influence operational efficiency, revenue collection, and service delivery at ZESA?
4. What strategies can be implemented to improve ICT adoption and support digital transformation within ZESA?

1.6 Hypothesis

Null Hypothesis (H_0): ICT adoption at ZESA has no significant impact on operational efficiency, revenue collection, or service delivery.

Alternative Hypothesis (H_1): ICT adoption at ZESA has a significant positive impact on operational efficiency, revenue collection, and service delivery.

1.7 Significance of the Study

This study has several implications:

- **Academic significance:** It contributes to the body of knowledge on ICT adoption in state-owned utilities in Africa, highlighting context-specific challenges and solutions.
- **Policy significance:** Findings can inform government and regulatory strategies for digital transformation in the energy sector.
- **Practical significance:** ZESA management can use the recommendations to optimise ICT investment, improve operational efficiency, and enhance customer service.
- **Researcher significance:** The study provides the researcher with experience in assessing ICT adoption in complex organisational and policy environments, contributing to research capacity building.

1.8 Delimitation of the Study

- **Geographical delimitation:** The study focuses exclusively on ZESA Holdings in Zimbabwe, including its main operational divisions.
- **Conceptual delimitation:** The study examines ICT adoption in the context of operational efficiency, revenue collection, and service delivery, rather than broader organisational change or financial performance unrelated to ICT.
- **Time delimitation:** Data collection and analysis will focus on the period 2020–2025, capturing recent ICT initiatives and policy interventions.

1.9 Limitation of the Study

- Limited access to proprietary ZESA data constrained the depth of operational analysis; this was addressed by relying on publicly available reports and structured interviews with authorised staff.
- Response bias among staff during interviews or surveys could have affected the accuracy of findings; this was minimised by guaranteeing anonymity and using neutral, well-structured questionnaires.
- Resource and time constraints restricted the sample size and scope to key operational units rather than the entire organisation; purposive sampling was employed to select representative units.

CHAPTER 2 REVIEW OF RELATED LITERATURE

2.1 Introduction

The adoption of Information and Communication Technology (ICT) has become a critical determinant of organisational success in the contemporary business environment, particularly within utility companies seeking to enhance operational efficiency and service delivery. ZESA Holdings, as Zimbabwe's primary electricity supply authority, operates within an increasingly digital landscape where technological integration is essential for addressing operational challenges, improving revenue collection mechanisms, and meeting evolving customer expectations. This literature review examines the theoretical foundations and empirical evidence surrounding ICT adoption in utility organisations, with specific focus on factors influencing adoption levels, barriers to implementation, and the resultant impact on organisational performance. The review draws upon recent scholarly research published from 2020 onwards to establish a comprehensive understanding of ICT adoption dynamics within the context of electricity utility companies in developing economies. Through systematic analysis of relevant theories, measurement criteria, and influencing factors, this chapter provides the conceptual foundation necessary for assessing ICT adoption levels within ZESA Holdings and developing strategies for enhanced digital transformation.

2.2 Theoretical Framework

The Technology Acceptance Model (TAM), originally developed by Davis in 1989 and subsequently refined through extensive empirical validation, provides a foundational framework for understanding user acceptance and adoption of information technology within organisational contexts. According to Granić and Marangunić (2019), the Technology Acceptance Model posits that perceived usefulness and perceived ease of use are primary determinants of technology acceptance, which subsequently influences behavioural intention to use and actual system usage. Figure 2.1 below illustrates the Technology Acceptance Model (TAM), showing how users' perceptions of usefulness and ease of use influence their attitude toward using a system, which in turn affects their behavioural intention and actual system usage. External factors may also impact these relationships.

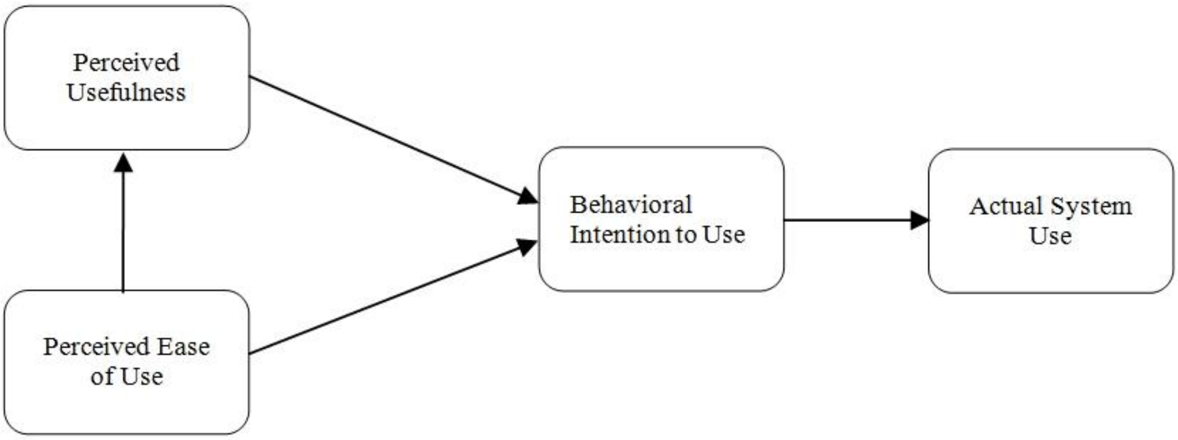

Figure 2.1. Technology Acceptance Model (TAM)

Source: (Naeini & BalaKrishnam, 2012)

The model has been extensively applied in utility sector research, demonstrating robust explanatory power in predicting ICT adoption patterns across diverse organisational settings. Marangunić and Granić (2015) emphasise that TAM's parsimony and theoretical robustness have made it the most widely applied model in information systems research, particularly when examining individual and organisational technology adoption decisions. The relevance of TAM to utility companies stems from its capacity to explain why employees and managers may resist or embrace new technological systems, thereby providing insights into adoption barriers and facilitators. Research by Tamilmani et al. (2021) confirms that TAM remains highly applicable in contemporary digital transformation initiatives, particularly when organisations seek to understand the cognitive and affective factors influencing technology acceptance amongst diverse user groups.

The Diffusion of Innovation Theory, formulated by Rogers in 1962 and continuously updated through subsequent editions, offers a comprehensive framework for understanding how technological innovations spread through social systems over time. As articulated by Dearing and Cox (2018), the Diffusion of Innovation Theory identifies five key attributes that determine the rate of innovation adoption: relative advantage, compatibility, complexity, trialability, and observability. These attributes interact with characteristics of the innovation itself, communication channels, time dimensions, and the social system to influence adoption patterns at both individual and organisational levels. Figure 2.2 below illustrates the Diffusion of Innovation Theory by Rogers (1983–2010), showing how new ideas and technologies are adopted over time. It categorises adopters into innovators, early adopters, early majority, late majority, and laggards, highlighting the stages of adoption and the factors influencing the diffusion process.

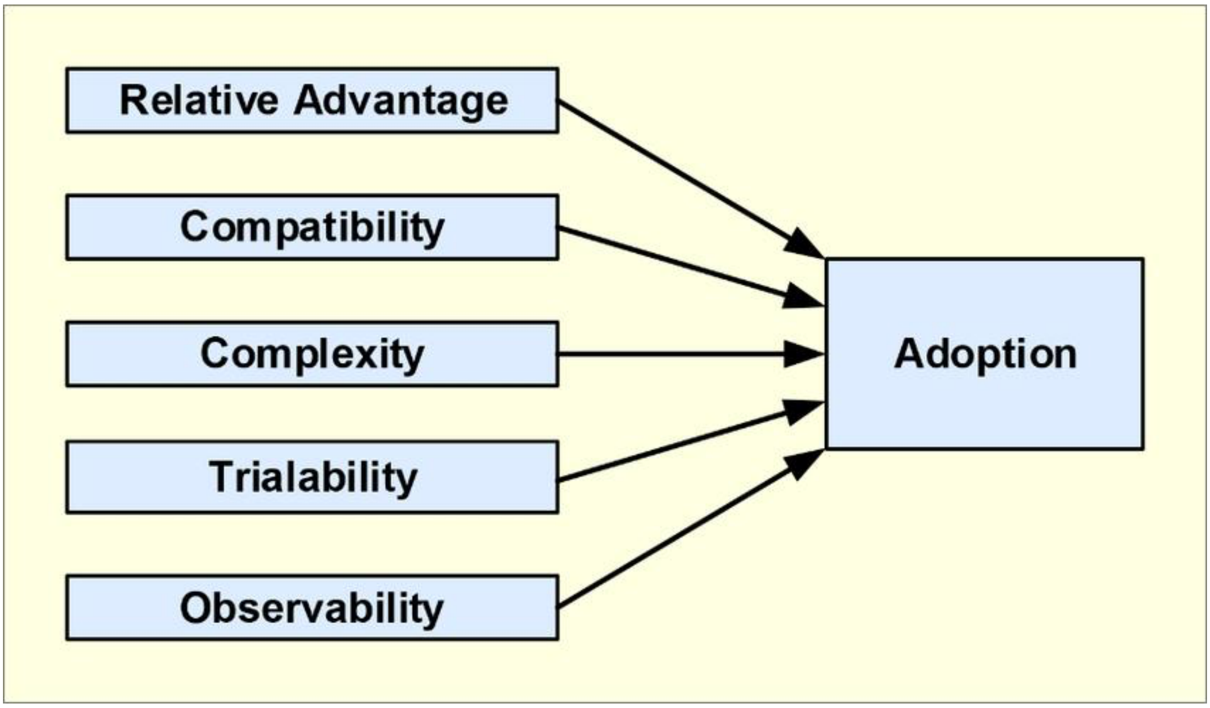

Figure 2.2. Diffusion of Innovation Theory

Source: (Rogers, 1983–2010)

Sahin (2006) notes that the theory's strength lies in its holistic approach to understanding adoption as a process rather than a single event, encompassing stages from initial knowledge through confirmation. The application of Diffusion of Innovation Theory to utility sector ICT adoption is particularly valuable because it acknowledges the role of organisational culture, leadership support, and peer influence in shaping adoption outcomes. According to Wisdom et al. (2014), the theory provides practical insights into how organisations can accelerate innovation adoption by addressing specific innovation attributes and leveraging social networks within the organisational structure.

The Technology-Organisation-Environment (TOE) Framework, developed by Tornatzky and Fleischer in 1990, presents a multi-dimensional perspective on organisational technology adoption by considering technological, organisational, and environmental contexts. Baker (2012) explains that the TOE framework examines how technological characteristics such as relative advantage and compatibility interact with organisational factors including firm size, managerial structure, and human resources, as well as environmental factors such as industry characteristics, market structure, and regulatory environment. This comprehensive approach makes the TOE framework particularly suitable for analysing ICT adoption in complex organisations such as utility companies, where multiple contextual factors simultaneously influence adoption decisions.

Figure 2.3 below illustrates the Technology–Organisation–Environment (TOE) Framework, which explains how technological, organisational, and environmental factors influence the adoption and implementation of innovations in organisations. It highlights the interplay between these three contexts, providing a structured approach to analyse determinants affecting technology adoption decisions.

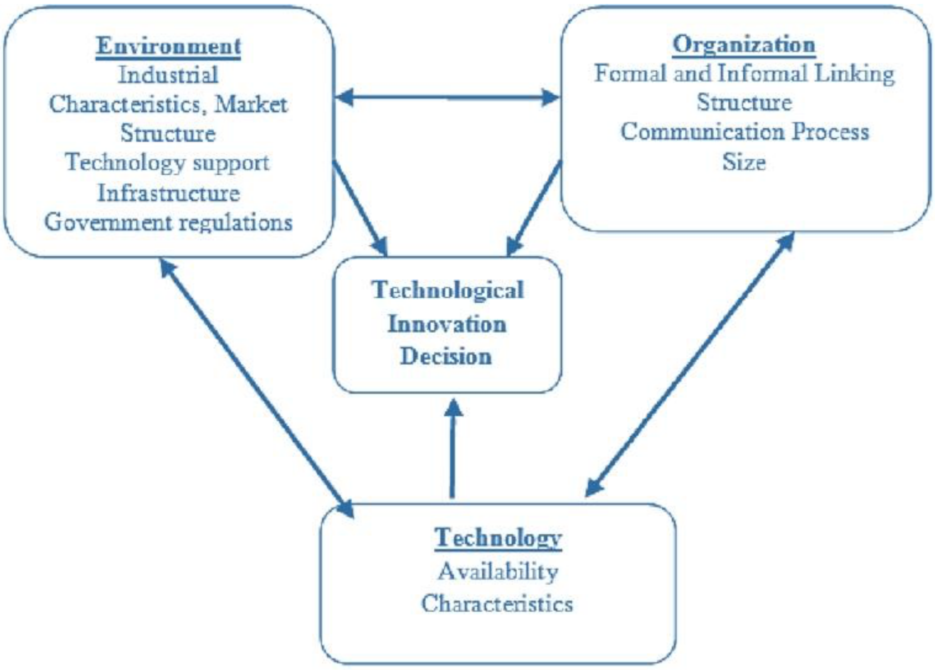

Figure 2.3. The Technology–Organisation–Environment (TOE) Framework

Source: (Mtebe & Nakaka, 2018)

Research by Malik et al. (2021) demonstrates that the TOE framework effectively explains variance in technology adoption across different organisational contexts, particularly in developing economies where environmental constraints may significantly impact adoption outcomes. Gangwar et al. (2015) further argue that the framework's multi-level perspective enables researchers to identify specific barriers and enablers at each contextual level, thereby facilitating the development of targeted intervention strategies. The TOE framework's capacity to accommodate industry-specific variables whilst maintaining theoretical coherence has established it as a dominant paradigm in organisational technology adoption research, particularly within sectors characterised by regulatory oversight and public service mandates.

2.3 Relevance of the Theoretical Framework to the Study

The Technology Acceptance Model provides essential insights for addressing the first research objective concerning assessment of current ICT adoption levels within ZESA Holdings by offering validated constructs for measuring technology acceptance amongst employees and managers. According to Scherer et al. (2019), TAM's core constructs of perceived usefulness and perceived ease of use serve as reliable indicators of adoption readiness and actual usage patterns, enabling researchers to quantify adoption levels across different organisational units and technological systems. The model's focus on user perceptions directly supports the measurement of ICT adoption by providing a structured approach to understanding why certain systems achieve high utilisation rates whilst others remain underutilised despite organisational investment. Marikyan et al. (2023) demonstrate that TAM-based assessments effectively reveal discrepancies between intended and actual technology usage, thereby illuminating the gap between ICT availability and genuine adoption. Furthermore, the model's emphasis on perceived usefulness aligns with the third research objective examining ICT impact on operational efficiency, revenue collection, and service delivery, as users' perceptions of technology benefits correlate strongly with actual performance improvements. Research by Chao (2019) confirms that organisations achieving high TAM scores on perceived usefulness typically experience greater operational benefits from ICT investments, establishing a direct link between acceptance factors and organisational outcomes.

The Diffusion of Innovation Theory addresses multiple research objectives by identifying factors that either facilitate or hinder ICT adoption within organisational contexts, thereby directly supporting the second objective concerning barriers and challenges to effective ICT adoption. As noted by Liao et al. (2021), the theory's five innovation attributes provide a comprehensive framework for diagnosing adoption barriers, with complexity and compatibility issues frequently emerging as primary obstacles in utility sector technology implementation. The theory's categorisation of adopter types ranging from innovators to laggards enables researchers to understand variation in adoption rates across different departments and hierarchical levels within ZESA Holdings, providing insights into why certain units may exhibit higher adoption levels than others. According to Hamari et al. (2016), the theory's temporal dimension acknowledges that adoption is a process requiring sustained effort and strategic communication, which directly informs the fourth research objective concerning actionable strategies for enhancing ICT adoption. The theory suggests that strategies should address specific innovation attributes such as demonstrating relative advantage through pilot programmes, ensuring compatibility with existing work processes, reducing perceived complexity through training, and increasing observability of benefits through success stories and visible improvements. Frambach and Schillewaert (2002) emphasise that understanding the diffusion process enables organisations to develop stage-appropriate interventions that accelerate adoption whilst minimising resistance.

The Technology-Organisation-Environment framework provides comprehensive support for all four research objectives by offering a multi-level analytical structure that encompasses individual, organisational, and contextual factors influencing ICT adoption. In relation to the first objective, the framework enables measurement of adoption levels across technological dimensions such as system sophistication and integration, organisational dimensions including management support and resource allocation, and environmental dimensions encompassing regulatory requirements and competitive pressures. Research by Abed (2020) demonstrates that TOE-based assessments capture the complexity of adoption situations more completely than single-level theories, providing a holistic picture of adoption status. The framework directly addresses the second objective by systematically identifying barriers at each contextual level, such as technological incompatibility, organisational resistance to change, and environmental regulatory constraints that may impede adoption progress. According to Oliveira and Martins (2011), the TOE framework's explicit recognition of environmental factors is particularly valuable for utility companies operating under regulatory oversight, as it acknowledges that adoption decisions are influenced by external stakeholders and policy requirements beyond internal organisational considerations. For the third objective, the framework facilitates examination of how technological capabilities, organisational readiness, and environmental pressures collectively shape ICT impacts on operational efficiency and service delivery. Regarding the fourth objective, Hsu and Yeh (2017) argue that the TOE framework's multi-dimensional perspective naturally suggests intervention strategies targeted at specific contextual levels, such as upgrading technological infrastructure, strengthening organisational change management capabilities, and engaging with regulatory bodies to create supportive policy environments.

2.4 Criteria to Measure Levels of ICT Adoption

2.4.1 System Integration and Interoperability

System integration and interoperability represent fundamental criteria for assessing ICT adoption levels within utility organisations, reflecting the extent to which diverse technological systems operate cohesively to support organisational processes. According to Vernadat (2020), system integration encompasses technical, semantic, and organisational dimensions, with higher integration levels indicating more mature adoption characterised by seamless data exchange, automated workflows, and unified user interfaces across multiple systems. The measurement of integration levels involves evaluating the degree to which core business systems such as billing, customer relationship management, asset management, and operational control systems communicate effectively without manual intervention or data duplication. Research by Lezoche et al. (2020) demonstrates that utility companies achieving high integration levels experience significant improvements in operational efficiency through reduced data entry errors, accelerated decision-making processes, and enhanced visibility across organisational functions. Interoperability assessment examines both technical compatibility in terms of data formats, communication protocols, and application programming interfaces, as well as organisational interoperability concerning standardised business processes and collaborative work practices. Panetto et al. (2016) emphasise that true interoperability extends beyond technical connectivity to encompass semantic understanding, where systems share common data definitions and business rules, enabling meaningful information exchange that supports coordinated action across organisational boundaries.

The evaluation of system integration maturity provides quantifiable indicators of ICT adoption progress by examining factors such as the percentage of automated data transfers between systems, frequency of manual data reconciliation requirements, and degree of real-time information availability to decision-makers. According to Rožanec et al. (2021), organisations with advanced integration capabilities typically exhibit adoption characteristics including enterprise-wide data visibility, cross-functional business process automation, and minimal system redundancy, whereas organisations with low integration levels demonstrate siloed systems, fragmented data landscapes, and extensive manual coordination requirements. The assessment framework should consider both horizontal integration across functional departments and vertical integration spanning operational, tactical, and strategic management levels within the utility organisation. Research by Lee et al. (2013) indicates that comprehensive integration assessment must examine technical infrastructure capabilities, data governance maturity, and organisational readiness to leverage integrated information for improved decision-making and service delivery. Furthermore, interoperability with external systems including regulatory reporting platforms, industry partners, and customer interfaces constitutes an important adoption dimension, particularly for utility companies operating within interconnected electricity networks and regulatory frameworks. Zdravković et al. (2022) argue that external interoperability capabilities increasingly differentiate high-performing utilities from their less digitally mature counterparts, as they enable participation in emerging smart grid initiatives, collaborative planning processes, and multi-party data sharing arrangements.

Measuring system integration and interoperability requires both quantitative metrics and qualitative assessments that capture technical capabilities and organisational utilisation patterns. Quantitative indicators include the number of integrated systems, percentage of automated business processes, data quality scores across integrated datasets, and system response times for cross-functional information requests. According to Corallo et al. (2020), effective measurement frameworks incorporate user satisfaction surveys assessing perceived integration effectiveness, efficiency gains from reduced manual processing, and strategic value derived from enhanced information visibility. The temporal dimension of integration measurement is equally important, examining whether integration capabilities have evolved over time to accommodate new technologies, expanded functional requirements, and changing business models within the utility sector. Research by Haseeb et al. (2019) demonstrates that sustained integration improvement correlates strongly with organisational commitment to digital transformation, suggesting that integration trajectory may be as informative as absolute integration levels in assessing overall ICT adoption maturity. The evaluation should also consider integration flexibility and adaptability, examining how readily the organisation can incorporate new systems and technologies into the existing integrated environment without disrupting established processes. Lu and Ramamurthy (2011) emphasise that integration agility represents an advanced adoption capability, reflecting organisational learning and technical sophistication that enables continuous digital evolution rather than periodic disruptive system replacements.

2.4.2 Digital Infrastructure Sophistication

Digital infrastructure sophistication is a key criterion for measuring ICT adoption, encompassing the technological foundation that supports information processing, communication, and service delivery. According to Yoo et al. (2010), digital infrastructure comprises computing resources, networking capabilities, data storage systems, security mechanisms, and software platforms, with sophistication reflecting capacity, reliability, scalability, and technological currency. In line with Tilson et al. (2010), the assessment of infrastructure considers hardware capabilities such as server capacity, network bandwidth, mobile devices, and specialised equipment including smart meters, sensors, and automated control systems. They argue that infrastructure sophistication directly affects adoption outcomes by determining which ICT applications are feasible, achievable performance levels, and the ease of deploying new digital services. Henfridsson and Bygstad (2013) further suggest that both internal and customer-facing infrastructure should be examined, as adoption maturity depends on robust capabilities across all technological domains.

Network infrastructure sophistication is particularly important for geographically dispersed utilities, as Macher and Mowery (2021) observe, since connectivity determines whether remote facilities can participate in digital operations. They recommend examining coverage, reliability, bandwidth, latency, and redundancy. Minerva et al. (2020) note that advanced utilities typically deploy multiple networking technologies optimised for different purposes, such as fibre for offices, cellular for mobile staff, and specialised radio networks for automation.

Bharadwaj et al. (2013) emphasise that data centre and cloud infrastructure support real-time analytics, machine learning, and predictive modelling, requiring substantial computing resources and sophisticated data management. In addition, Carcary et al. (2016) argue that quantitative metrics like bandwidth per user, server capacity, storage utilisation, uptime, and security response times, alongside qualitative factors such as architectural quality and operational effectiveness, indicate infrastructure sophistication. Brous et al. (2020) demonstrate that mature infrastructure management correlates strongly with ICT adoption levels, while Chowdhury and Chowdhury (2023) highlight that security infrastructure is essential for safe adoption amid growing cyber threats.

2.4.3 User Competency and Digital Literacy

User competency and digital literacy are essential criteria for measuring ICT adoption, as technological capabilities deliver value only when personnel can effectively use systems and tools. According to van Laar et al. (2020), digital literacy includes technical skills for operating systems, information literacy for locating and evaluating digital content, communication proficiency for collaborating digitally, and strategic thinking for applying technology to solve organisational problems. In line with Carretero et al. (2017), assessment should examine both baseline computer literacy and specialised skills for advanced applications such as data analytics, system configuration, and digital process design. They note that organisations with high ICT adoption invest in continuous skills development, recognising competency as a dynamic capability requiring ongoing enhancement. Iivari et al. (2020) argue that evaluations should differentiate between formal training completion and demonstrated performance across organisational levels, as adoption needs vary from frontline staff to senior executives.

Digital literacy assessment also considers attitudes towards technology, learning orientation, and willingness to adapt work practices. As Šorgo et al. (2017) observe, effective frameworks measure cognitive dimensions such as problem-solving and critical thinking, alongside affective dimensions including technology confidence and openness to change. Falloon (2020) highlights that gaps often arise not from technical inability but from failure to identify opportunities to apply technology strategically. Ng (2012) suggests leveraging complementary strengths across generations through mentoring, cross-generational teams, and collaborative learning to enhance workforce digital literacy.

Fraillon et al. (2020) emphasise using multiple assessment methods, combining objective performance-based evaluations with surveys of perceived self-efficacy, technology anxiety, and willingness to adopt new tools. Hatlevik et al. (2018) note that organisations with high digital literacy scores achieve faster adoption, more innovative applications, and greater employee satisfaction. Pettersson (2018) further argues that sustainable adoption requires a culture of continuous learning, where digital skills development is ongoing rather than a one-off event.

2.4.4 Data Utilisation and Analytics Capabilities

Data utilisation and analytics capabilities constitute increasingly important criteria for assessing ICT adoption maturity, reflecting organisational capacity to extract actionable insights from digital information assets and apply these insights to improve decision-making and operational performance. According to Gupta and George (2016), data analytics capability encompasses technical infrastructure for data processing, organisational skills and processes for analysis, and managerial vision regarding data-driven approaches to business challenges, with higher capability levels enabling more sophisticated analyses, faster insight generation, and greater business impact from digital information. The measurement of data utilisation examines whether organisational decisions across strategic, tactical, and operational levels are informed by systematic data analysis or rely primarily on intuition, experience, and anecdotal evidence. Research by Mikalef et al. (2019) demonstrates that utilities achieving advanced data utilisation levels typically exhibit widespread analytical thinking, where personnel routinely seek quantitative evidence to support decisions, challenge assumptions with data, and monitor outcomes through performance metrics linked to organisational objectives. The evaluation should assess not only the sophistication of analytical techniques employed, ranging from basic reporting through predictive modelling to prescriptive optimisation, but also the breadth of data utilisation across functional areas and organisational levels. Akter et al. (2016)

emphasise that comprehensive data utilisation requires integration of analytical insights into operational processes, tactical planning activities, and strategic direction setting, rather than treating analysis as an isolated activity performed by specialists without clear connection to decision-making and action.

Analytics capability assessment examines both technical infrastructure supporting data analysis and organisational capacity to generate meaningful insights and translate them into improved outcomes. According to Wamba et al. (2017), technical dimensions include data warehouse or data lake implementations providing integrated data repositories, analytical software tools enabling statistical analysis and visualisation, and increasingly, artificial intelligence and machine learning platforms capable of discovering complex patterns and generating predictions from large datasets. The evaluation should consider data quality and accessibility, as analytical capabilities deliver limited value when source data is incomplete, inconsistent, or difficult to access by personnel requiring information for decision support. Research by Janssen et al. (2017) indicates that organisations with mature analytics capabilities typically implement comprehensive data governance frameworks establishing clear data ownership, quality standards, access policies, and lifecycle management practices that ensure analytical activities rest upon reliable information foundations. Human capabilities represent equally critical adoption dimensions, encompassing statistical and analytical skills within dedicated analytical teams as well as data literacy across the broader workforce enabling effective interpretation and application of analytical insights. Kiron and Shockley (2011) argue that sustainable analytical capabilities require cultural transformation toward evidence-based decision-making, where managers and employees value data-driven insights and actively seek analytical support rather than viewing analysis as compliance activity or external imposition.

Measuring data utilisation and analytics capabilities involves assessing both the sophistication of analytical activities undertaken and the organisational impact achieved through data-driven approaches. Quantitative indicators include the percentage of decisions supported by formal data analysis, number of active data users relative to total workforce, analytical tool utilisation rates, and frequency of analytical report generation and consumption across organisational units. According to Davenport and Harris (2017), advanced analytics maturity assessment examines the types of analyses performed, with descriptive analytics addressing what happened, diagnostic analytics explaining why events occurred, predictive analytics forecasting future outcomes, and prescriptive analytics recommending optimal actions, with progression through these analytical types indicating increasing capability sophistication. The evaluation should examine specific use cases demonstrating business value from analytics, such as demand forecasting improvements, revenue leakage identification, equipment failure prediction, or customer segmentation enabling targeted service offerings. Research by Chen et al. (2012) demonstrates that organisations achieving high analytics capability consistently document and communicate business impacts from data-driven initiatives, creating virtuous cycles where analytical successes generate support for additional investments in data infrastructure and skills development. The assessment should also examine analytical agility, measuring how quickly the organisation can formulate analytical questions, access relevant data, perform analyses, and communicate insights to decision-makers. Vidgen et al. (2017) emphasise that analytical agility reflects organisational learning capabilities and technical flexibility, enabling rapid response to emerging business challenges and opportunities through timely evidence generation and insight delivery.

2.4.5 Service Digitalisation and Customer Engagement

Service digitalisation and customer engagement capabilities represent critical adoption criteria reflecting the extent to which utility organisations leverage ICT to transform service delivery models and enhance customer interactions. According to Reis et al. (2018), service digitalisation encompasses the conversion of traditionally manual or physical service processes into digital formats accessible through web portals, mobile applications, and automated communication channels, with higher digitalisation levels indicated by the breadth of services available digitally, the completeness of digital service functionality, and the proportion of customers actively utilising digital channels. The measurement of service digitalisation examines whether customers can perform key activities such as account management, bill payment, outage reporting, consumption monitoring, and service requests through digital channels without requiring telephone calls or physical office visits. Research by Alalwan et al. (2017) demonstrates that utilities achieving advanced service digitalisation typically offer comprehensive digital service suites with functionality matching or exceeding traditional service channels, seamless integration between digital and physical service touchpoints, and proactive digital communication keeping customers informed about consumption patterns, billing information, and service interruptions. The evaluation should assess not only service availability but also user experience quality, examining factors such as interface intuitiveness, transaction completion rates, customer satisfaction with digital channels, and the extent to which digital services reduce rather than increase customer effort in resolving issues or accessing information. Lemon and Verhoef (2016) emphasise that effective service digitalisation requires customer-centric design processes understanding user needs and preferences, rather than simply automating existing processes without considering how digital channels can fundamentally improve service experiences.

Customer engagement through digital channels extends beyond transactional service delivery to encompass ongoing communication, relationship building, and co-creation of value through interactive platforms that enable bidirectional information exchange. According to Brodie et al. (2011), customer engagement involves cognitive, emotional, and behavioural dimensions, with digital platforms facilitating engagement through personalised communication, responsive feedback mechanisms, community features connecting customers with similar interests, and participatory initiatives inviting customer input into service development and improvement activities. The measurement of digital engagement examines metrics such as active user percentages indicating what proportion of customers regularly interact with digital channels, session frequency and duration revealing depth of engagement, feature utilisation patterns showing which digital capabilities receive active usage, and customer-generated content volumes in forums, review sections, or social media channels. Research by Pansari and Kumar (2017) indicates that highly engaged customers typically exhibit stronger loyalty, higher satisfaction levels, and greater willingness to participate in demand response programmes, energy efficiency initiatives, or other cooperative activities requiring customer behavioural change. The evaluation should distinguish between passive digital presence, where customers occasionally access basic information, and active engagement characterised by regular interaction, utilisation of advanced features, and participation in digital community activities. Kumar and Pansari (2016) argue that digital engagement measurement should examine not only behavioural indicators but also attitudinal measures including emotional connection to the utility, identification with organisational values, and willingness to recommend services to others.

Measuring service digitalisation and customer engagement requires examining both supply-side capabilities reflecting organisational digital service offerings and demand-side adoption patterns revealing customer willingness and ability to utilise digital channels. Quantitative indicators include the number of digital services available, percentage of transactions completed through digital versus traditional channels, digital channel cost per transaction compared to traditional channels, customer acquisition and retention rates for digital service users, and digital channel satisfaction scores relative to traditional service experiences. According to Hoehle et al. (2012), comprehensive service digitalisation assessment incorporates user experience evaluations examining interface design quality, mobile responsiveness, accessibility for users with disabilities, multilingual support, and accommodation of varying digital literacy levels amongst the customer base. The evaluation should examine digital service reliability, measuring system availability, transaction success rates, error frequencies, and support responsiveness when customers encounter digital service difficulties. Research by Bhandari et al. (2021) demonstrates that service digitalisation success depends critically on reliability and ease of use, as customers quickly abandon digital channels that prove frustrating or unreliable, reverting to traditional service modes despite utility investments in digital capabilities. The assessment should also consider digital service evolution, examining whether capabilities expand over time to address broader customer needs, incorporate user feedback, and leverage emerging technologies such as artificial intelligence-enabled chatbots, personalised recommendation engines, or predictive service features. Verhoef et al. (2021) emphasise that sustainable service digitalisation requires continuous improvement informed by customer usage data and feedback, treating digital channels as dynamic platforms requiring ongoing investment rather than one-time implementation projects.

2.5 Factors Which Lead to High or Low Levels of ICT Adoption

2.5.1 Management Support and Leadership Commitment

Management support and leadership commitment represent foundational factors profoundly influencing ICT adoption levels within organisations, as executive backing determines resource availability, strategic priority, and cultural messages regarding technology importance. According to Masa'deh et al. (2016), management support encompasses financial resource allocation for ICT investments, visible leadership engagement in technology initiatives, communication of technology importance through organisational messaging, and personal exemplary behaviour where leaders actively utilise digital tools and champion innovative applications. The presence of strong management support typically correlates with accelerated adoption characterised by adequate budgets for technology acquisition and maintenance, dedicated personnel assigned to implementation activities, stakeholder engagement ensuring user input into system design, and sustained commitment through inevitable implementation challenges. Research by Al-Haddad and Kotnour (2015) demonstrates that leadership commitment particularly matters during critical adoption stages when organisations encounter technical difficulties, user resistance, or resource pressures that may tempt abandonment of partially completed technology initiatives. Executive persistence in working through these challenges, coupled with willingness to adjust implementation approaches based on experience, distinguishes organisations achieving successful adoption from those experiencing implementation failures despite equivalent technology investments. The evaluation of management support should examine both explicit endorsements in strategic plans and resource allocation decisions as well as implicit signals conveyed through leadership attention, recognition of technology achievements, and consequences for technology-related failures.

Leadership commitment extends beyond general technology support to encompass specific behaviours that facilitate adoption including championing change, managing resistance, and creating accountability for technology utilisation. According to Higgs and Rowland (2011), effective technology leadership involves articulating compelling visions explaining how ICT will improve organisational performance and stakeholder outcomes, building coalitions of supporters across hierarchical and functional boundaries, communicating progress and celebrating successes to maintain momentum, and addressing concerns raised by employees uncertain or anxious about technological change. The absence of visible leadership engagement often results in perfunctory adoption characterised by system availability without genuine utilisation, as employees perceive technology as optional enhancement rather than organisational priority requiring attention and effort. Research by Agarwal and Prasad (2020) indicates that management support influences adoption through multiple mechanisms including resource provision, cultural signalling, and direct intervention when adoption progress stalls or conflicts emerge between technology requirements and established work practices. The evaluation should examine whether leaders possess sufficient technology understanding to make informed decisions about ICT investments and priorities, or alternatively demonstrate humility in seeking expert counsel whilst maintaining strategic oversight responsibility. Benbya et al. (2020) argue that effective technology leadership in contemporary organisations requires balancing technical knowledge enabling informed decision-making with recognition of personal knowledge limitations necessitating delegation to specialists for detailed technical choices.

The relationship between management support and ICT adoption operates through intermediary mechanisms including organisational culture, resource availability, and institutional legitimacy that collectively shape employee attitudes and behaviours toward technology. According to Alshawi et al. (2003), management support influences organisational culture by establishing norms regarding innovation, risk-taking, and continuous improvement, with leadership emphasis on technological advancement fostering cultures where employees view technology adoption as professional expectation rather than discretionary choice. The provision of adequate resources including training, technical assistance, and time for learning enables employees to develop competencies required for effective technology utilisation, whereas resource constraints force personnel to choose between technology adoption and other work priorities, typically resulting in minimal adoption levels. Research by Kotter (2012) demonstrates that management support creates institutional legitimacy for technology initiatives, signalling that adoption efforts receive organisational endorsement and that employees investing time in learning new systems make valuable contributions aligned with organisational priorities. The absence of clear management support often generates ambiguity regarding technology importance, leading employees to question whether adoption efforts will receive recognition or prove wasted if initiatives are abandoned following leadership changes or budget pressures. Jeyaraj et al. (2006) emphasise that sustainable ICT adoption requires multi-level management support spanning executive champions providing strategic direction and resources, middle managers translating strategic vision into operational reality, and frontline supervisors creating daily work environments where technology utilisation is expected, supported, and recognised.

2.5.2 Organisational Culture and Change Readiness

Organisational culture and change readiness constitute powerful factors influencing ICT adoption outcomes, as technology implementation fundamentally represents organisational change requiring behavioural adaptation, process modification, and often revised power relationships amongst organisational actors. According to Schein (2010), organisational culture encompasses shared assumptions, values, and behavioural norms that guide how members perceive, think about, and respond to organisational situations, with culture-technology alignment facilitating adoption whilst cultural-technological misalignment generates resistance regardless of technical merit. Cultures emphasising innovation, continuous improvement, and learning typically demonstrate higher ICT adoption levels because members view new technologies as opportunities for enhancement rather than threats to established practices. Research by Cameron and Quinn (2011) indicates that different cultural orientations exhibit varying technology receptivity, with entrepreneurial cultures generally embracing technology enthusiastically, hierarchical cultures requiring demonstration of alignment with established procedures and authority structures, collaborative cultures needing evidence that technology enhances teamwork, and competitive cultures demanding proof of performance advantages over rivals. The evaluation of cultural factors should examine multiple dimensions including attitudes toward change, tolerance for ambiguity and temporary disruption during transitions, comfort with learning and skill development, and beliefs regarding whether technology complements or threatens human capabilities and employment security.

Change readiness reflects organisational capacity to manage transitions effectively, encompassing both structural capabilities such as change management processes and competencies, and psychological readiness reflected in employee attitudes toward change initiatives. According to Armenakis and Harris (2009), change readiness involves several components including discontent with current conditions creating motivation for improvement, collective efficacy beliefs that the organisation can successfully implement changes, valence perceptions that proposed changes will generate personally and organisationally beneficial outcomes, and principal support indicating that influential organisational members endorse change initiatives. Organisations exhibiting high change readiness typically implement multiple concurrent initiatives successfully whilst maintaining operational stability, demonstrate learning from previous change experiences that informs subsequent efforts, and possess change management competencies distributed across multiple organisational members rather than concentrated in a few specialists. Research by Rafferty et al. (2013) demonstrates that change readiness significantly predicts ICT adoption success, as ready organisations effectively manage technical, human, and political dimensions of technology implementation, whilst organisations lacking readiness struggle with adoption regardless of technology quality or resources invested. The assessment should examine previous change experiences, recognising that organisations with positive change histories generally exhibit greater confidence and competence for subsequent initiatives, whereas organisations with histories of failed or traumatic changes often demonstrate heightened resistance and scepticism toward new proposals.

The influence of organisational culture and change readiness on ICT adoption operates through mechanisms affecting both individual behaviour and collective action necessary for organisational transformation. According to Helfat and Peteraf (2015), cultural factors influence individual adoption decisions by shaping perceptions of whether technology aligns with personal and professional identities, whether learning efforts will receive appreciation or criticism, and whether technology competence contributes to or detracts from organisational status and advancement opportunities. Cultures valuing technical expertise generally motivate employees to develop technology skills and demonstrate proficiency, whilst cultures prioritising traditional domain knowledge may inadvertently discourage technology adoption by failing to recognise or reward digital competencies. Research by Jones et al. (2005) indicates that cultural factors influence collective adoption through social processes including peer influence, where employee adoption decisions are shaped by observing and discussing technology experiences with colleagues, and institutional pressures, where organisational norms create expectations for technology usage independent of individual preferences. The relationship between culture and adoption is reciprocal, as successful technology adoption can itself transform organisational culture by demonstrating innovation benefits, building confidence in organisational change capabilities, and establishing new norms regarding continuous improvement and technology-enabled work practices. Leidner and Kayworth (2006) emphasise that cultural transformation through technology adoption is neither automatic nor invariably positive, as poorly managed implementation may reinforce cultural conservatism by confirming fears that change initiatives generate disruption without commensurate benefits.

2.5.3 Technical Infrastructure and System Quality

Technical infrastructure and system quality represent fundamental enablers or constraints on ICT adoption, as even willing users with adequate skills cannot effectively adopt technologies that lack necessary infrastructure support or suffer from quality deficiencies. According to DeLone and McLean (2003), system quality encompasses technical characteristics including reliability, response time, ease of use , functionality completeness, and integration with other systems, with higher quality levels facilitating adoption by providing positive user experiences that encourage continued usage and exploration of advanced features. Infrastructure adequacy reflects whether fundamental technological foundations such as network connectivity, computing capacity, data storage, and security mechanisms can support intended ICT applications without performance degradation or service interruptions that frustrate users and undermine adoption efforts. Research by Petter et al. (2013) demonstrates that system quality consistently emerges as a significant predictor of technology adoption across diverse organisational contexts, with quality perceptions influencing both initial adoption decisions and sustained usage patterns over time. The evaluation of infrastructure and quality factors should examine both objective technical characteristics measurable through performance monitoring and subjective user perceptions that may diverge from technical assessments, recognising that perceived quality often matters more than actual quality in determining adoption behaviours.

Infrastructure limitations frequently manifest as connectivity constraints particularly affecting geographically dispersed organisations where remote locations may lack reliable network access necessary for cloud-based applications or real-time data synchronisation. According to Boateng et al. (2008), infrastructure deficiencies in developing economy contexts often force organisations to choose between ambitious technology strategies requiring robust infrastructure that may be unavailable or expensive, and conservative approaches emphasising standalone systems with minimal connectivity requirements but limited integration and collaboration capabilities. The infrastructure challenge extends beyond simple availability to encompass reliability and consistency, as intermittent connectivity or unpredictable performance undermines user confidence and forces development of workarounds that reduce technology benefits even when systems nominally function. Research by Avgerou (2008) indicates that infrastructure constraints particularly impact adoption of enterprise systems and cloud-based services requiring constant connectivity, whilst influencing technology architecture decisions toward hybrid approaches combining local processing with periodic synchronisation to central systems. The assessment should examine infrastructure investments over time, recognising that organisations demonstrating sustained infrastructure enhancement generally achieve higher adoption levels as technical constraints diminish, whereas organisations neglecting infrastructure development encounter growing gaps between technology ambitions and infrastructure capabilities.

System quality encompasses multiple dimensions including functional quality reflecting whether systems provide capabilities required for work processes, technical quality concerning reliability and performance, and usability quality determining ease of learning and operating systems effectively. According to Seddon (1997), functional quality assessment examines whether systems support complete work processes or require extensive manual supplementation, whether functionality matches user requirements or reflects generic capabilities poorly aligned with organisational needs, and whether systems accommodate work practice variations across different user groups or impose rigid standardisation. Technical quality evaluation considers system availability during required work periods, response time adequacy for time-sensitive tasks, error frequencies and severity, data accuracy and completeness, and security protection against unauthorised access or malicious attacks. Research by Gorla et al. (2010) demonstrates that technical quality deficiencies generate user frustration and workarounds that undermine adoption even when functional capabilities theoretically meet requirements, as users experiencing frequent errors, slow responses, or system unavailability develop negative attitudes toward technology and revert to manual processes when possible. Usability quality reflects interface design excellence, consistency of interaction patterns across system components, clarity of information presentation, and accommodation of varying user skill levels through progressive disclosure of complexity. Nielsen (2012) emphasises that usability directly impacts adoption by determining learning curve steepness, error proneness during operation, and cognitive load imposed on users attempting to accomplish work objectives, with poor usability generating adoption resistance even amongst otherwise motivated users.

2.5.4 Training and Capacity Development

Training and capacity development represent critical factors determining whether organisations translate technology investments into improved performance through effective user competency development and sustained skill enhancement. According to Sung and Choi (2014), training effectiveness depends on multiple factors including needs assessment ensuring instruction addresses actual skill gaps, instructional design incorporating adult learning principles and active practice opportunities, delivery timing providing training when users can immediately apply new skills, and reinforcement through ongoing support and refresher activities sustaining competencies over time. Organisations investing substantially in comprehensive training programmes typically achieve higher adoption levels because users develop confidence in their technology capabilities, understand how systems can improve work outcomes, and receive ongoing assistance when encountering difficulties that might otherwise generate frustration and abandonment. Research by Bell et al. (2017) demonstrates that training influences adoption through direct skill development enabling system operation and indirect effects on attitudes including self-efficacy beliefs, technology anxiety reduction, and motivation generated through understanding technology benefits and applications. The evaluation of training factors should examine not only formal training provision but also informal learning opportunities, peer support networks, and organisational norms regarding mutual assistance that collectively shape learning environments and skill development outcomes.

Capacity development extends beyond initial training to encompass ongoing learning opportunities ensuring skills evolve with technological advancement and expanding organisational requirements. According to Gegenfurtner et al. (2020), sustainable capacity development requires learning cultures where continuous skill enhancement is expected and supported, formal programmes providing advanced training as users progress from basic to sophisticated technology applications, and knowledge management systems capturing and disseminating best practices emerging from user experience with technology applications. Organisations achieving high adoption maturity typically implement multi-tiered training strategies addressing different user groups with tailored instruction, provide multiple learning modalities accommodating diverse learning preferences including classroom instruction, online modules, and hands-on practice, and establish mentoring or coaching arrangements enabling personalised assistance for users encountering specific challenges. Research by Grossman and Salas (2011) indicates that blended training approaches combining multiple methods and extending over time generally produce superior outcomes compared to one-time training events, as users benefit from initial structured instruction, subsequent reinforcement addressing emerging questions, and ongoing access to support resources when workplace situations requiring technology application arise. The assessment should examine training accessibility, recognising that training scheduled at inconvenient times, delivered in inaccessible locations, or assuming prerequisite knowledge unavailable to all users may limit participation and thereby constrain adoption despite organisational training investments.

The relationship between training provision and ICT adoption operates through multiple mechanisms including skill development enabling system operation, confidence building reducing technology anxiety, and motivation enhancement through understanding technology value and application opportunities. According to Compeau and Higgins (1995), training influences computer self-efficacy beliefs that shape whether individuals attempt technology usage when presented with opportunities, with higher self-efficacy associated with greater willingness to engage with technology despite encountering difficulties. Training quality impacts knowledge retention and transfer, determining whether users can apply training room learning to actual work situations that may differ from examples covered during instruction. Research by Baldwin et al. (2017) demonstrates that transfer-focused training incorporating workplace-relevant scenarios, opportunities to practice with actual organisational systems and data, and explicit discussion of application strategies produces superior adoption outcomes compared to generic training divorced from work contexts. The timing of training relative to system availability significantly affects learning outcomes, as training provided well before system access allows skill decay before application opportunities arise, whilst training delivered after systems become available forces users to muddle through without adequate preparation. Burke and Hutchins (2007) emphasise that training effectiveness depends substantially on post-training environment factors including supervisor support for skill application, peer encouragement and assistance, organisational removal of obstacles to technology usage, and accountability mechanisms ensuring trained skills receive active application rather than remaining dormant knowledge.

2.5.5 Resource Availability and Investment Capacity

Resource availability and investment capacity fundamentally constrain or enable ICT adoption by determining what technologies organisations can acquire, implement, and sustain over time given budgetary limitations and competing resource demands. According to Makabira and Wanjau (2013), resource factors encompass financial capital for technology purchases, skilled personnel for implementation and support activities, time allocated to adoption efforts amidst operational responsibilities, and physical resources such as facilities and equipment necessary for technology deployment. Organisations with substantial resource availability typically achieve more comprehensive adoption characterised by enterprise-wide system deployment, adequate technical infrastructure supporting reliability and performance, sufficient support personnel ensuring responsive assistance, and ongoing investment in upgrades, enhancements, and new capabilities as requirements evolve. Research by Zhu and Kraemer (2005) demonstrates that resource constraints force organisations to prioritise technology investments carefully, often resulting in partial adoption where only critical systems receive implementation whilst other potentially beneficial applications remain unfunded, or superficial adoption where systems are acquired but inadequate resources for training, customisation, and support limit actual utilisation and business value realisation.

Financial resource constraints manifest in multiple ways affecting different adoption aspects including initial acquisition costs for software licenses and hardware, implementation expenses for system configuration and data migration, ongoing operational costs for maintenance and support, and periodic upgrade costs ensuring systems remain current and secure. According to Awa et al. (2015), small organisations often struggle with total cost of ownership for enterprise systems exceeding initial purchase prices by substantial margins over system lifecycles, leading to situations where organisations successfully acquire technology but cannot sustain it adequately. Resource limitations may force choices between comprehensive solutions addressing multiple requirements through integrated systems and incremental approaches implementing standalone applications for specific needs with lower individual costs but higher long-term integration complexity. Research by Ramdani et al. (2013) indicates that cloud computing and software as a service model partially address resource constraints by converting large capital investments into manageable operational expenses and reducing infrastructure requirements, potentially enabling adoption by resource-constrained organisations previously unable to afford traditional technology deployment models. The assessment should examine not only absolute resource levels but also resource allocation priorities, recognising that organisations choosing to prioritise technology investments despite resource constraints may achieve adoption levels exceeding larger organisations with greater resources but lower technology prioritisation.

Human capabilities represent equally critical resource dimensions, as technology adoption requires skilled personnel for implementation, administration, support, and increasingly for advanced applications such as data analytics and system integration. According to Mikalef et al. (2020), human resource constraints manifest as shortage of technical specialists capable of configuring complex systems, limited support personnel relative to user populations requiring assistance, and insufficient analytical talent to extract value from data generated by digital systems. Organisations experiencing human resource constraints often suffer from implementation delays as limited staff juggle multiple priorities, inadequate system customisation as personnel lack time to tailor systems for organisational contexts, and poor user experiences as overwhelmed support teams cannot provide timely responsive assistance. Research by Bharadwaj (2000) demonstrates that human resource investments in technology competency development generate sustained competitive advantages because resulting capabilities are difficult for competitors to replicate, suggesting that personnel development should be viewed as strategic investment rather than operational expense. The challenge of human resource availability is particularly acute in developing economies where technology skills shortages force organisations to compete intensely for limited talent pools, often losing skilled personnel to international opportunities or domestic private sector positions offering higher compensation. Daniel and Wilson (2003) emphasise that resource constraints require creative solutions including partnerships with external service providers, knowledge sharing arrangements with peer organisations, and participation in professional communities enabling access to expertise beyond organisational boundaries.

2.5.6 Regulatory Environment and Policy Framework

The regulatory environment and policy framework constitute important contextual factors shaping ICT adoption within utility organisations operating under government oversight and regulatory mandates that influence technology investments, service standards, and operational practices. According to Joskow (2008), utility regulation encompasses multiple dimensions including rate setting determining allowed returns on investments, service quality standards establishing performance expectations, operational requirements specifying processes and capabilities, and reporting obligations mandating information provision to regulators and stakeholders. Regulatory frameworks that explicitly encourage or require technology adoption through performance standards, mandated capabilities, or preferential cost recovery for technology investments typically accelerate adoption by creating external pressures complementing internal motivations for technological advancement. Research by Jamasb and Pollitt (2005) demonstrates that regulatory mechanisms such as incentive regulation rewarding efficiency improvements or innovation-focused regulation explicitly promoting technological experimentation generate stronger adoption incentives compared to traditional cost-of-service regulation that may inadvertently discourage efficiency-enhancing technology investments by basing allowed revenues on costs incurred. The evaluation of regulatory factors should examine both explicit technology-related regulations and broader regulatory characteristics affecting organisational resources, priorities, and capacities available for technology initiatives.

Policy frameworks established by government authorities influence ICT adoption through funding mechanisms, standards requirements, coordination initiatives, and strategic direction setting that shape organisational technology contexts. According to Perez-Arriaga (2013), government policies addressing infrastructure development, digital economy promotion, cybersecurity requirements, and data governance establish parameters within which utility organisations make technology decisions, with supportive policies reducing adoption barriers whilst restrictive or unclear policies generating uncertainty and risk that may discourage investment. Government funding programmes providing grants, subsidies, or concessional financing for technology adoption directly address resource constraints whilst signalling policy support for digitalisation that may influence organisational prioritisation decisions. Research by Brown and Yücel (2002) indicates that government research and development programmes, standards development initiatives, and public-private partnership frameworks create enabling environments for utility technology adoption by reducing individual organisation risks, facilitating knowledge sharing, and establishing common technological foundations enabling interoperability and collaboration. The assessment should examine policy stability and predictability, recognising that uncertain regulatory environments characterised by frequent rule changes or inconsistent enforcement may discourage technology investments with long payback periods and high switching costs.

The interaction between regulatory environments and ICT adoption operates through multiple mechanisms including resource availability determined by allowed returns and cost recovery, operational requirements mandating specific capabilities, information requirements necessitating data management and reporting systems, and performance incentives rewarding technology-enabled improvements. According to Vogelsang (2012), performance-based regulation creates incentives for adoption of technologies improving efficiency, reliability, or service quality by allowing utilities to retain portions of resulting benefits rather than immediately flowing all gains to customers through rate reductions. Regulatory requirements for advanced metering infrastructure, outage management systems, or cybersecurity capabilities directly mandate adoption of specific technologies regardless of utility preferences, effectively converting technology adoption from strategic choice to compliance obligation. Research by Sappington et al. (2001) demonstrates that regulatory oversight influences not only whether adoption occurs but also how implementation proceeds, with stringent regulatory review processes potentially slowing adoption whilst protecting stakeholder interests, and lighter-touch regulation enabling faster adoption whilst possibly increasing risks of premature technology choices or inadequate safeguards. The regulatory influence on adoption extends to creating environments where experimentation and innovation are encouraged or discouraged, with innovation-friendly regulation explicitly providing safe harbours for pilot programmes, allowing cost recovery for reasonable technology experiments even if unsuccessful, and establishing processes for rapid approval of novel approaches. Newbery (1999) emphasises that regulatory frameworks developed for traditional utility business models may inadvertently constrain adoption of transformative technologies requiring new business models, suggesting that regulatory adaptation itself becomes a prerequisite for advanced ICT adoption in utility sectors undergoing digital transformation.

2.6 Conceptual Framework

The conceptual framework conceptualizes adoption of ICT as an enabling factor which influences directly organisational performance dimensions namely service delivery, revenue collection and operational efficiency in ZESA Holdings. ICT Adoption is influenced by environmental and organisational enablers that include organisational culture, technical infrastructure, management support, technical resources and regulatory environment

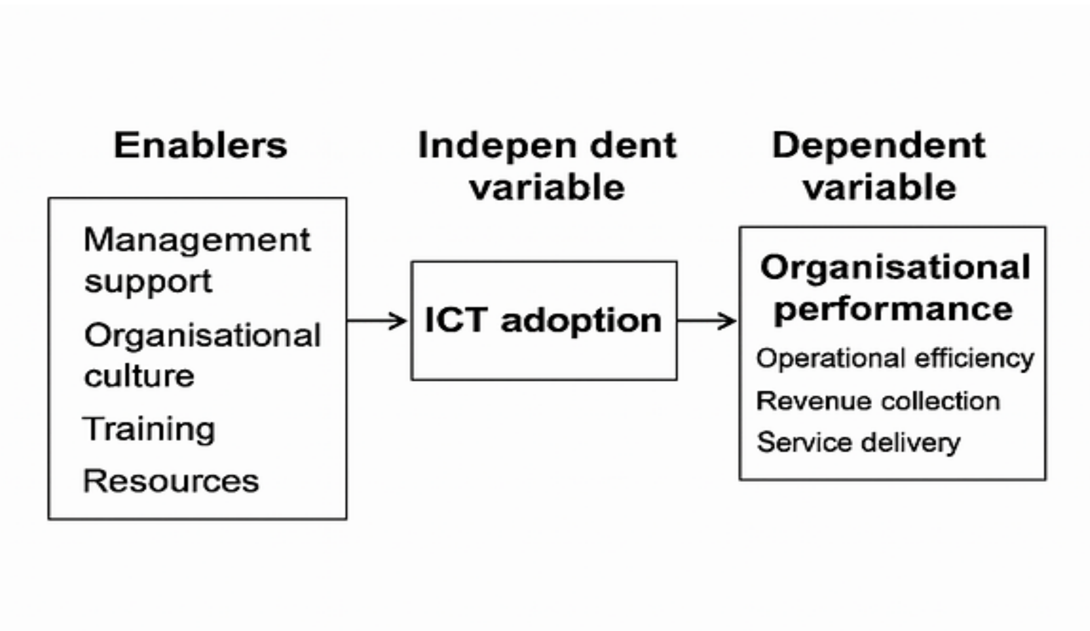

Figure 2.4. Conceptual Framework

Source: Author's synthesis of literature and theories, 2025.

2.7 Summary

This chapter established the theoretical and conceptual foundations for assessing ICT adoption at ZESA Holdings. Key frameworks, including the Technology Acceptance Model, Diffusion of Innovation Theory, and Technology-Organisation-Environment Framework, offer insights at individual, organisational, and contextual levels. Adoption was assessed using criteria such as system integration, infrastructure sophistication, user competency, data utilisation, and service digitalisation. Influencing factors identified include management support, organisational culture, technical infrastructure, training, resources, and regulatory environment. These elements were synthesised into a conceptual framework guiding the empirical investigation of relationships between contextual factors and adoption outcomes. The following chapter details the methodology used to collect and analyse data.

CHAPTER 3 METHODOLOGY

3.1 Introduction

This chapter outlines the methodological framework employed to investigate ICT adoption levels within ZESA Holdings. The research methodology encompasses the systematic procedures, techniques and strategies utilised to collect, analyse and interpret data pertaining to the research objectives. According to Creswell and Creswell (2018), a well-structured methodology chapter serves as the blueprint that guides the entire research process, ensuring rigour, validity and reliability in the findings. The chapter delineates the research design, population and sampling procedures, data collection instruments, pilot study, data collection procedures, data analysis techniques and ethical considerations. Saunders et al. (2019) emphasise that methodological transparency enables readers to evaluate the credibility of research findings and facilitates replication by other scholars. This chapter therefore provides a comprehensive account of the research methods employed to address the study objectives, which include assessing current ICT adoption levels at ZESA Holdings, identifying barriers to effective ICT implementation, examining the impact of ICT on operational efficiency and proposing actionable strategies for enhanced digital transformation. Kumar (2019) notes that the methodology chapter must demonstrate the researcher's competence in selecting appropriate methods and justify each methodological decision based on the research problem and objectives.

3.2 The Research Design

The study adopted a mixed methods research design, specifically the convergent parallel design, which involves the concurrent collection and analysis of both quantitative and qualitative data. According to Creswell and Plano Clark (2018), mixed methods research provides a more comprehensive understanding of research problems by integrating the strengths of both quantitative and qualitative approaches whilst mitigating their individual limitations. The quantitative component of the study employed a descriptive survey design to assess ICT adoption levels, usage patterns and perceived impacts among a large sample of ZESA employees. Bryman (2016) argues that descriptive surveys are particularly effective for capturing numerical data on attitudes, opinions and behaviours across diverse populations, thereby enabling statistical generalisation. The qualitative component utilised semi-structured interviews to explore in depth the experiences, perceptions and challenges related to ICT adoption from the perspective of key informants in management and technical positions. Kvale and Brinkmann (2015) contend that qualitative interviews generate rich, contextualised data that illuminate the meanings individuals attach to phenomena and the processes underlying observable patterns.

The rationale for adopting a convergent parallel design stems from the complexity of ICT adoption as a sociotechnical phenomenon that encompasses technological infrastructure, organisational processes, human factors and contextual influences. Tashakkori and Teddlie (2010) observe that mixed methods designs are particularly suited to research questions that require both breadth and depth of understanding, as they allow researchers to triangulate findings from multiple data sources and methods. In this study, the quantitative data provided statistical evidence regarding the extent and patterns of ICT adoption across different departments and hierarchical levels within ZESA Holdings, whilst the qualitative data offered explanatory insights into the factors facilitating or hindering adoption. Johnson et al. (2007) suggest that the integration of quantitative and qualitative data in a convergent design enhances the validity of research findings through methodological triangulation, wherein convergence across methods strengthens confidence in results whilst divergence prompts further investigation. The design enabled the researcher to obtain a holistic picture of ICT adoption at ZESA Holdings, combining statistical generalisability from the survey with contextual understanding from interviews.

The philosophical underpinning of this mixed methods approach aligns with pragmatism, which prioritises the research question over adherence to a single methodological tradition. Morgan (2014) articulates that pragmatism provides a flexible philosophical foundation for mixed methods research by emphasising the practical consequences of research and the utility of employing multiple methods to address complex research problems. Pragmatism rejects the incompatibility thesis that posits quantitative and qualitative methods as fundamentally incommensurable due to differing epistemological assumptions. Instead, Denscombe (2008) argues that pragmatism recognises the value of both positivist and interpretivist perspectives and encourages researchers to select methods based on their appropriateness for answering specific research questions. In the context of this study, the pragmatic stance enabled the researcher to draw upon both statistical analysis of survey data and thematic analysis of interview data to construct a comprehensive account of ICT adoption at ZESA Holdings.

3.3 Population and Sampling

3.3.1 Population

The target population for this study comprised employees of ZESA Holdings, which operates as Zimbabwe's principal electricity utility company responsible for generation, transmission and distribution of electrical power. The organisation's workforce consists of approximately 7,000 employees distributed across various departments, occupational categories and hierarchical levels. This figure was publicly confirmed by the organisation's Chief Executive Officer, Josh Chifamba, in testimony before Parliament, as reported in Bulawayo24 News on 21 November 2016, wherein Chifamba indicated that ZESA was spending over $155 million annually on salaries for this workforce (Chifamba, 2016). The employee base encompasses diverse occupational groups including engineers, technicians, administrative personnel, trade staff and managers, thereby creating scope for investigating differences in ICT adoption and perceptions across occupational categories and hierarchical levels. According to Bryman (2016), defining the population with precision is essential for determining sampling strategies and establishing the boundaries within which research findings can be generalised.

The population was deemed appropriate for this study because employees at all levels interact with or are affected by ICT systems within the organisation, whether through direct use of computerised systems, enterprise resource planning software, customer management systems or communication technologies. Castells (2010) observes that ICT adoption in organisations is not limited to technical specialists but permeates all functional areas and hierarchical levels as organisations integrate digital technologies into their core operations and business processes. Furthermore, employees' experiences, perceptions and practices related to ICT adoption provide valuable insights into the organisational, technical and human factors that influence the success of digital transformation initiatives. Venkatesh et al. (2003) argue that understanding user acceptance and adoption of information systems requires examining the attitudes, beliefs and behaviours of actual users within the organisational context. The diverse composition of ZESA's workforce, spanning multiple occupational categories and hierarchical levels, afforded the researcher the opportunity to capture a multifaceted understanding of ICT adoption across the organisation.

The geographical dispersion of ZESA's operations across Zimbabwe, with offices, power stations and distribution centres in various provinces, added complexity to the sampling process. However, this dispersion also enhanced the study's relevance by enabling the researcher to examine whether ICT adoption levels and challenges vary across different geographical locations and operational units. Saunders et al. (2019) note that population heterogeneity, whilst posing logistical challenges for data collection, enriches research findings by capturing variation in the phenomenon under investigation. For the purposes of this study, the accessible population was defined as ZESA employees working in major operational centres in Harare, Bulawayo and other key locations where the researcher could feasibly conduct data collection within the constraints of time and resources.

3.3.2 Sample Size Determination

For the quantitative component of the study, the researcher employed the Krejcie and Morgan (1970) formula to determine an appropriate sample size from the population of 7,000 employees. Krejcie and Morgan's (1970) formula is widely recognised in research methodology as a systematic approach to sample size calculation that balances statistical precision with practical feasibility. The formula is expressed as follows:

$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$

Where:

- s = required sample size
- X^2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841 for 95% confidence)
- N = the population size (7,000)

- P = the population proportion (assumed to be 0.50 as this provides the maximum sample size)
- d = the degree of accuracy expressed as a proportion (0.05)

Applying this formula to the population of 7,000 employees:

s = 3.841 × 7000 × 0.5(1-0.5) ÷ 0.05^2(7000-1) + 3.841 × 0.5(1-0.5) s = 3.841 × 7000 × 0.25 ÷ 0.0025(6999) + 3.841 × 0.25 s = 6721.75 ÷ 17.4975 + 0.960 s = 6721.75 ÷ 18.4575 s = 364

The required sample size for the quantitative survey was determined to be 364 respondents. Israel (2013) notes that the Krejcie and Morgan formula is useful for large populations, providing a standardised approach that ensures adequate representation without unnecessarily large samples. The calculated sample size of 364 represents approximately 5.2% of the total population, sufficient to achieve a 95% confidence level with a 5% margin of error. Sekaran and Bougie (2016) argue that using established formulas gives researchers a defensible basis for generalising findings. To allow for potential non-response, 400 questionnaires were distributed, anticipating a 90% response rate to yield the required 364 usable responses.

For the qualitative component, 10 participants were purposively selected for in-depth semi-structured interviews. Creswell and Poth (2018) note that smaller qualitative samples are appropriate for generating rich, detailed insights rather than statistical generalisation. This aligns with Kvale and Brinkmann's (2015) recommendation that 5–25 interviews are often sufficient, while Guest et al. (2006) found data saturation typically occurs within 12 interviews. Participants were chosen based on managerial, technical, or operational roles with significant involvement in ICT adoption, ensuring information-rich cases (Mason, 2010). The qualitative sample complemented the quantitative survey in a convergent parallel design, providing depth to observed patterns (Palinkas et al., 2015). Practical considerations such as time, budget, and access to senior personnel also informed the sample size (Patton, 2015).

3.3.3 Sampling Techniques

For the quantitative survey, the researcher used stratified random sampling to ensure proportional representation of different employee categories. Stratified random sampling involves dividing the population into mutually exclusive subgroups or strata and randomly selecting participants from each stratum in proportion to its size (Saunders et al., 2019). In this study, strata were based on occupational category, including managerial staff, engineers, technicians, administrative personnel, and trade staff, as these roles influence interaction with ICT systems. The researcher obtained a sampling frame from ZESA's Human Resources Department, containing anonymised employee lists organised by occupational group and location. Bryman (2016) notes that an accurate sampling frame is essential to ensure every population member has a known probability of selection. Proportionate sample sizes for each stratum were calculated by multiplying the total sample size (364) by the population proportion in each stratum, following Sekaran and Bougie (2016). Within strata, participants were selected using simple random sampling through a random number generator, ensuring unbiased selection and maintaining the probabilistic nature of the sample (Fowler, 2014).

For the qualitative interviews, purposive sampling using criterion sampling was employed to select 10 key informants with extensive knowledge of ICT adoption (Palinkas et al., 2015). Participants were chosen based on holding managerial or senior technical positions, having at least five years' experience at ZESA, direct involvement in ICT planning or usage, and willingness to participate (Patton, 2015; Creswell & Poth, 2018). The selected participants included senior managers and technical specialists from IT, Finance, and Operations, ensuring a diversity of strategic, operational, and technical perspectives. As Suri (2011) notes, purposive sampling with maximum variation captures the multidimensionality and complexity of the phenomenon under study.

3.4 Data Collection Instruments

The study used two primary data collection instruments: a structured questionnaire for the quantitative survey and a semi-structured interview guide for the qualitative component. The questionnaire collected numerical data on ICT adoption levels, usage patterns, perceived benefits and challenges, and demographic characteristics. As Bryman (2016) notes, structured questionnaires are effective for collecting standardised data from large samples, allowing systematic comparison and facilitating quantitative analysis. The questionnaire comprised four sections: Section A captured demographics such as occupational category, years of service, department, and education; Section B assessed access to and use of ICT systems; Section C measured perceived benefits using a five-point Likert scale; and Section D explored barriers to ICT adoption. DeVellis (2017) emphasises that clarity, relevance, and ease of completion are critical for high-quality responses.

Questionnaire items were developed from literature on ICT adoption and established models including the Technology Acceptance Model (Davis, 1989), the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003), and the Diffusion of Innovations Theory (Rogers, 2003). Fowler (2014) notes that linking items to theory enhances construct validity. Most items were closed-ended, including multiple-choice, Likert scale, and yes/no questions, facilitating quantitative analysis (Saunders et al., 2019), but some open-ended questions captured additional insights (Oppenheim, 2000).

The semi-structured interview guide explored key ICT adoption themes, including infrastructure, benefits, barriers, organisational support, and recommendations. Kvale and Brinkmann (2015) highlight that semi-structured interviews combine flexibility with focus, allowing emergent themes to be explored. Questions were open-ended, non-leading, and conversational, enabling participants to provide detailed narratives (Turner, 2010). Probing questions encouraged deeper reflection, capturing rich, context-specific experiences (Patton, 2015). Rubin and Rubin (2012) emphasise that this format is particularly suited to exploratory research, balancing coverage of key topics with the flexibility to pursue participants' insights.

3.5 Pilot Study

Prior to full-scale data collection, the researcher conducted a pilot study to test the reliability, validity, and practicability of the data collection instruments. As Van Teijlingen and Hundley (2002) note, pilot studies are vital preparatory phases that allow researchers to identify and resolve potential issues with instruments, procedures, or logistics before commencing the main study. The pilot involved administering the questionnaire to 30 ZESA employees excluded from the main sample and conducting two trial interviews with managers from non-participating departments. This pilot sample represented approximately 8% of the intended main study sample, consistent with Hertzog's (2008) recommendation of 5–10%.

The pilot study had several objectives. First, it assessed the clarity and comprehensibility of questionnaire items and interview questions, identifying ambiguous wording, confusing instructions, or culturally inappropriate language. According to Peat et al. (2002), piloting helps enhance content validity by revealing items that respondents may misinterpret. Feedback led to rewording several items and removing one redundant item. Second, the reliability of Likert scale items was evaluated using Cronbach's alpha coefficients. Tavakol and Dennick (2011) note that values above 0.70 indicate acceptable internal consistency; all pilot scales ranged from 0.76 to 0.88.

Third, the pilot examined the practicability of data collection procedures, including time required, setting suitability, and feasibility of accessing participants, as In et al. (2017) observe. Questionnaires took an average of 20 minutes to complete, and trial interviews lasted 45–60 minutes, providing sufficient depth without overburdening participants. Finally, the pilot allowed the researcher to practise and refine interview techniques, including rapport building, probing, and managing unexpected responses, which Chenail (2011) highlights as essential for novice qualitative researchers before the main study.

3.6 Data Collection Procedure

The data collection process began after the researcher obtained ethical clearance from the relevant institutional ethics committee and formal permission from ZESA Holdings management. As Bryman (2016) explains, securing organisational access and ethical approval is crucial for legitimising research and facilitating participant cooperation. A formal request was submitted to ZESA's executive management, outlining the study's objectives, methodology, anticipated benefits, and ethical safeguards. Following approval, the Human Resources Department assisted with disseminating information and recruiting participants.

For the quantitative survey, 400 employees were selected through stratified random sampling across various offices and operational sites. Questionnaires were distributed over four weeks in both hard copy and electronic formats to maximise accessibility, as Fowler (2014) notes that multiple response modes can improve participation. Hard copies were delivered personally with a cover letter explaining the study's purpose, voluntary participation, confidentiality, and completion instructions, while electronic questionnaires were sent via a secure online platform. Participants returned hard copies in sealed envelopes, and electronic responses were submitted directly online. To enhance response rates, clear instructions, confidentiality assurances, concise questionnaires, and reminder notifications were employed, following Dillman et al. (2014). A total of 370 questionnaires were returned, representing a 92.5% response rate, which exceeded the target and is considered exceptionally high in organisational surveys (Nulty, 2008).

For qualitative interviews, 10 purposively selected participants were invited via email or telephone, provided with information sheets, and interviewed in private locations to ensure comfort and privacy, as Irvine et al. (2013) highlight. Written informed consent was obtained before using a digital recorder, and active listening techniques were employed throughout (Kvale & Brinkmann, 2015). Interviews lasted 45–70 minutes, with participants assured of confidentiality and the proper use of their contributions.

3.7 Analysis and Organisation of Data

The analysis of quantitative data from the survey questionnaires was carried out using the Statistical Package for the Social Sciences (SPSS) version 26. The process began with data cleaning and screening to identify missing values, outliers, and data entry errors. According to Hair et al. (2010), data cleaning is an essential step to ensure the quality and integrity of the dataset before conducting further analysis. The researcher examined frequency distributions for all variables to detect unusual patterns or anomalies. Missing data were also assessed, with attention given to whether they were missing completely at random, at random, or not at random, as noted by Tabachnick and Fidell (2013). Given that missing data were minimal (less than 2% for any variable), listwise deletion was applied. Descriptive statistics were then computed to summarise the sample characteristics and response distributions, including frequencies, percentages, means, standard deviations, minima, and maxima, following the guidance of Pallant (2016). Visual representations such as tables, bar charts, and pie charts were used to illustrate demographic characteristics, ICT usage, and Likert scale responses, as recommended by Field (2018).

Inferential statistics were applied to test hypotheses and examine relationships between variables. Chi-square tests explored associations between categorical variables, while independent samples t-tests and one-way ANOVA compared means across groups (Pallant, 2016). Tukey HSD post hoc tests were conducted where ANOVA indicated significant differences. Pearson correlations were calculated to assess the strength and direction of relationships between continuous variables, following Cohen's (1988) interpretation guidelines.

The qualitative data from semi-structured interviews were analysed using thematic analysis, which Braun and Clarke (2006) describe as a flexible method for identifying and reporting patterns. Transcription allowed the researcher to familiarise deeply with the data (Bailey, 2008), followed by coding using both inductive and deductive approaches (Saldaña, 2016). Themes were iteratively reviewed and refined to ensure they reflected participants' experiences (Nowell et al., 2017; King, 2004), with the final report integrating illustrative extracts and analytic commentary (Guest et al., 2012).

3.8 Ethical Considerations

The study maintained rigorous ethical standards to protect participants' rights, dignity, and wellbeing. Ethical clearance was obtained from the institutional review board, and formal permission was granted by ZESA Holdings. Informed consent was secured: survey participation was voluntary, while interviewees provided written consent detailing procedures, risks, benefits, and confidentiality measures. Confidentiality and anonymity were ensured through pseudonyms, coded data, and secure storage of questionnaires, recordings, and transcripts. Power dynamics were carefully managed to prevent coercion, with interviews conducted privately. Minimal risks were anticipated, and participants could withdraw at any time. Ethical practices ensured responsible, respectful research aligned with established guidelines.

3.9 Summary

This chapter detailed the methodology used to examine ICT adoption at ZESA Holdings. A convergent parallel mixed methods design integrated quantitative survey data from 364 employees with qualitative interviews from 10 key informants to provide a comprehensive understanding. Stratified random sampling ensured representative participation for the survey, while purposive sampling selected experienced interviewees. Data were collected using a structured questionnaire and semi-structured interview guide, both piloted for reliability and validity. Quantitative data were analysed using SPSS, and qualitative data underwent thematic analysis, allowing integration of numerical patterns with contextual insights. Ethical standards were upheld throughout. The next chapter presents the findings, discussing ICT adoption levels, barriers, impacts, and strategic recommendations.

CHAPTER 4 DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents, analyses, and interprets data collected through the mixed methods convergent parallel design described in Chapter 3. As Creswell and Plano Clark (2018) note, effective mixed methods research requires systematic integration of quantitative and qualitative findings to gain a comprehensive understanding of the phenomenon. The chapter addresses four research objectives: assessing ICT adoption levels at ZESA Holdings, identifying barriers to adoption, examining ICT's impact on operational efficiency, revenue collection, and service delivery, and proposing strategies for digital transformation. Quantitative data from 370 questionnaires (92.5% response rate) were analysed using SPSS 26, including descriptive statistics, chi-square tests, t-tests, ANOVA, and Pearson correlations. Qualitative data from 10 semi-structured interviews were analysed using Braun and Clarke's (2006) six-phase thematic analysis. The chapter is structured into data presentation and analysis, discussion and interpretation, and a summary of key findings.

4.2 Data Presentation and Analysis

4.2.1 Demographic Characteristics of Survey Respondents

The demographic profile of the 370 survey respondents is presented in Table 4.1. As prescribed by the stratified random sampling strategy detailed in Section 3.3.3, the sample maintained proportional representation across occupational categories within ZESA Holdings. The distribution reflects the organisational structure documented in Section 1.2, wherein technical and operational staff constitute the majority of the workforce.

Table 4.1: Demographic Characteristics of Survey Respondents (N=370)

Characteristic	Category	Frequency	Percentage
Occupational Category	Managerial Staff	45	12.2%
	Engineers	92	24.9%
	Technicians	118	31.9%
	Administrative Personnel	71	19.2%

	Trade Staff	44	11.9%
Years of Service	Less than 5 years	89	24.1%
	5-10 years	112	30.3%
	11-15 years	94	25.4%
	More than 15 years	75	20.3%
Department	Generation	78	21.1%
	Transmission	64	17.3%
	Distribution	127	34.3%
	Corporate Services	55	14.9%
	Finance	46	12.4%
Highest Education Level	Certificate/Diploma	142	38.4%
	Bachelor's Degree	168	45.4%
	Postgraduate Degree	60	16.2%
Age Group	20-30 years	82	22.2%
	31-40 years	143	38.6%
	41-50 years	98	26.5%
	Above 50 years	47	12.7%

Source: Survey Data, 2025

According to the data presented in Table 4.1, technicians represented the largest occupational group (31.9%), followed by engineers (24.9%) and administrative personnel (19.2%). This distribution aligns with Castells' (2010) observation that utility organisations maintain substantial technical workforces to support infrastructure operations. The majority of respondents (55.7%) possessed between 5 and 15 years of service, indicating an experienced workforce with institutional knowledge relevant to assessing ICT adoption trajectories. The distribution across departments showed concentration in Distribution (34.3%), reflecting ZESA's extensive network spanning Zimbabwe's geographical landscape as noted in Section 3.3.1. Educational attainment was relatively high, with 61.6% holding bachelor's or postgraduate degrees, suggesting baseline capacity for technology adoption that Carretero et al. (2017) identify as foundational for digital literacy development.

4.2.2 Assessment of Current ICT Adoption Levels

4.2.2.1 ICT Infrastructure and Systems Availability

Respondents were asked to indicate which ICT systems and infrastructure components were available and operational within their departments. Table 4.2 presents the frequency and percentage of respondents reporting access to various ICT systems.

Table 4.2: Availability of ICT Systems and Infrastructure (N=370)

ICT System/Infrastructure	Available	Not Available	Don't Know
Desktop Computers	344 (93.0%)	22 (5.9%)	4 (1.1%)
Internet Connectivity	312 (84.3%)	49 (13.2%)	9 (2.4%)
Email System	329 (88.9%)	35 (9.5%)	6 (1.6%)
Enterprise Resource Planning (ERP) System	187 (50.5%)	156 (42.2%)	27 (7.3%)
Customer Management System	164 (44.3%)	178 (48.1%)	28 (7.6%)
Billing System (Computerised)	203 (54.9%)	142 (38.4%)	25 (6.8%)
Mobile Devices for Field Work	128 (34.6%)	229 (61.9%)	13 (3.5%)
SCADA/Outage Management System	98 (26.5%)	243 (65.7%)	29 (7.8%)
Geographic Information System (GIS)	76 (20.5%)	271 (73.2%)	23 (6.2%)
Advanced Metering Infrastructure (AMI)	52 (14.1%)	294 (79.5%)	24 (6.5%)
Data Analytics Platform	41 (11.1%)	305 (82.4%)	24 (6.5%)

Source: Survey Data, 2025

The data in Table 4.2 reveal a tiered pattern of ICT availability at ZESA Holdings. Basic infrastructure components including desktop computers (93.0%), email systems (88.9%) and internet connectivity (84.3%) demonstrated high availability, suggesting foundational digital infrastructure exists across the organisation. According to Yoo et al. (2010), such baseline infrastructure constitutes a necessary precondition for advanced ICT adoption, though it does not guarantee sophisticated system integration. However, availability declined sharply for enterprise systems and specialised applications. Only half of respondents (50.5%) reported access to ERP systems, whilst customer management systems were available to 44.3% and computerised billing systems to 54.9%. This pattern indicates what Tilson et al. (2010) characterise as incomplete digital infrastructure, wherein organisations possess foundational connectivity but lack integrated enterprise systems enabling cross-functional data flow and process automation.

The limited availability of advanced technologies was particularly pronounced. Mobile devices for field work were accessible to only 34.6% of respondents, SCADA/outage management systems to 26.5%, GIS to 20.5%, AMI to 14.1% and data analytics platforms to merely 11.1%. These findings align with Nwaiwu's (2021) observation that African utilities often struggle to deploy sophisticated grid management and customer-facing technologies that characterise digitally mature electricity sectors. The relatively high "Don't Know" responses for specialised systems (ranging from 6.2% to 7.8%) suggest communication gaps regarding technology deployment, wherein some employees remain unaware of systems implemented in other departments. As Bryman (2016) notes, such patterns may indicate siloed operations that impede organisation-wide digital transformation.

4.2.2.2 Frequency of ICT System Usage

Respondents who indicated access to various ICT systems were asked to report their frequency of usage on a five-point scale ranging from "Never" to "Daily". Table 4.3 presents mean usage frequencies and standard deviations for each system type.

Table 4.3: Frequency of ICT System Usage

ICT System	N	Mean*	Std. Deviation	Usage Level**
Email System	329	4.62	0.68	Very High
Desktop Computers	344	4.58	0.72	Very High
Internet for Work Purposes	312	4.31	0.89	High
Computerised Billing System	203	3.87	1.12	High
ERP System	187	3.54	1.28	Moderate
Customer Management System	164	3.42	1.35	Moderate
Mobile Devices for Field Work	128	3.18	1.41	Moderate
SCADA/Outage Management	98	2.89	1.52	Moderate
GIS	76	2.67	1.48	Low
AMI	52	2.31	1.39	Low
Data Analytics Platform	41	2.15	1.33	Low

*Scale: 1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Daily

**Usage Level Classification: Very High (4.50-5.00), High (3.50-4.49), Moderate (2.50-3.49), Low (1.50-2.49), Very Low (1.00-1.49)

Source: *Survey Data, 2025*

According to Table 4.3, usage patterns displayed considerable variation across system types. Email systems (M=4.62, SD=0.68) and desktop computers (M=4.58, SD=0.72) demonstrated very high utilisation frequencies, with means approaching daily usage and low standard deviations indicating consistency across respondents. Internet usage for work purposes also achieved high frequency (M=4.31, SD=0.89). These findings support the Technology Acceptance Model's proposition that systems perceived as useful and easy to use achieve high adoption rates (Davis, 1989; Granić & Marangunić, 2019). Basic communication and computing tools have become normalised work technologies in contemporary organisational settings, as Venkatesh et al. (2003) documented in their unified theory of technology acceptance.

Enterprise and operational systems exhibited moderate usage frequencies. Computerised billing systems (M=3.87, SD=1.12) and ERP systems (M=3.54, SD=1.28) fell into the high-to-moderate range, whilst customer management systems (M=3.42, SD=1.35) and mobile devices for field work (M=3.18, SD=1.41) registered moderate usage. The higher standard deviations for these systems (ranging from 1.12 to 1.41) indicate substantial variation in usage patterns across respondents. According to Petter et al. (2013), such variation typically reflects differences in job requirements, with some roles necessitating frequent system interaction whilst others require only occasional access. However, the moderate usage levels for enterprise systems suggest that even employees with access may not fully integrate these tools into daily workflows, indicating incomplete adoption consistent with the TOE framework's emphasis on organisational readiness factors (Baker, 2012).

Advanced technologies including SCADA/outage management systems (M=2.89, SD=1.52), GIS (M=2.67, SD=1.48), AMI (M=2.31, SD=1.39) and data analytics platforms (M=2.15, SD=1.33) demonstrated low usage frequencies. These systems, which Kabeyi (2023) and Nwaiwu (2021) identify as critical for operational efficiency and loss reduction in modern utilities, remain underutilised at ZESA Holdings. The large standard deviations (exceeding 1.33 for all advanced systems) suggest highly variable usage patterns, wherein small groups of specialists may use these systems regularly whilst the majority rarely or never engage with them. This pattern reflects Rogers' (2003) Diffusion of Innovation Theory, which predicts that complex innovations with limited relative advantage or compatibility will diffuse slowly through organisational populations.

4.2.2.3 System Integration and Interoperability

As outlined in Section 2.4.1, system integration and interoperability constitute fundamental criteria for assessing ICT adoption maturity. Respondents were asked to evaluate the extent to which different ICT systems within their departments communicated and shared data effectively. Figure 4.1 presents the distribution of responses.

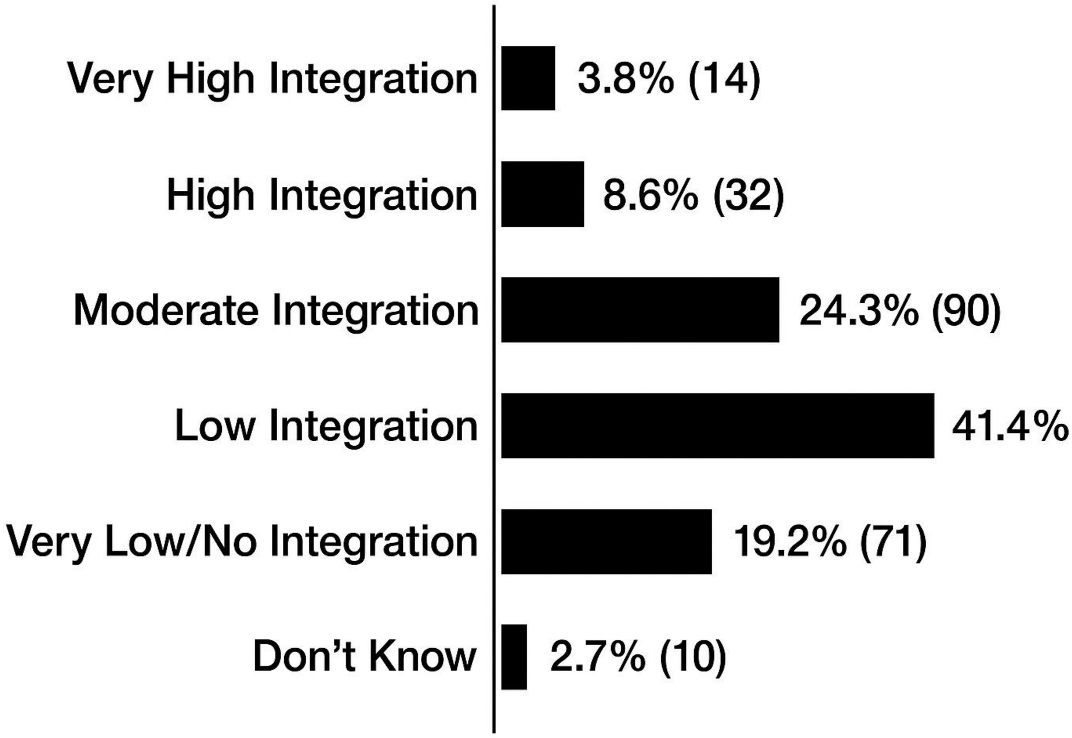

Figure 4.1: Perceived Level of System Integration and Interoperability (N=370)

Source: Survey Data, 2025

Figure 4.1 demonstrates that the majority of respondents (60.6%) perceived system integration at ZESA Holdings as low or very low, with 41.4% reporting low integration and 19.2% reporting very low or no integration. Only 12.4% of respondents assessed integration as high or very high, whilst 24.3% rated it as moderate. These findings substantiate concerns raised in the Auditor-General's Report (Office of the Auditor-General Zimbabwe, 2023) regarding fragmented information systems and limited data accuracy resulting from inadequate system integration. According to Vernadat (2020), low integration levels constrain organisational efficiency by necessitating manual data transfers, creating opportunities for errors and inconsistencies, and limiting real-time visibility across functional areas.

The qualitative interview data provided contextual depth to these quantitative findings. One senior manager in the IT Department explained:

"*We have multiple systems that were implemented at different times by different vendors. These systems don't talk to each other automatically. When we need* *information from the billing system to inform our financial reporting, someone has to manually extract data, manipulate it in Excel, and then upload it to the financial system. This process is time-consuming and prone to errors."*

This account illustrates what Lezoche et al. (2020) identify as technical and semantic integration deficiencies, wherein systems lack both technical connectivity through application programming interfaces and semantic alignment through shared data definitions. Another informant, a Distribution Manager, noted:

"*The lack of integration between our outage management system and customer billing system means that when we implement load shedding, the billing system doesn't automatically adjust customer bills. This creates customer complaints and revenue recognition issues that require extensive manual reconciliation."*

These qualitative insights reveal that integration deficiencies generate cascading operational challenges affecting service delivery, customer satisfaction and financial management. As Panetto et al. (2016) observe, true interoperability extends beyond technical connectivity to encompass organisational processes and collaborative work practices, suggesting that ZESA's integration challenges reflect both technical infrastructure limitations and organisational coordination deficits.

4.2.2.4 User Competency and Digital Literacy

Respondents completed a self-assessment of their digital literacy and competency across various domains using a five-point Likert scale (1=Very Poor, 5=Very Good). Table 4.4 presents mean scores and standard deviations for each competency domain.

Table 4.4: Self-Assessed Digital Competency Levels (N=370)

Competency Domain	**Mean**	**Std. Deviation**	**Competency Level***
Basic Computer Operations	4.23	0.79	Good
Email and Communication Tools	4.31	0.74	Good
Internet and Information Search	4.08	0.86	Good
Microsoft Office Applications	3.89	0.92	Good

ERP System Navigation	3.12	1.24	Moderate
Data Entry and Database Management	3.45	1.08	Moderate
Data Analysis and Interpretation	2.87	1.15	Moderate
Troubleshooting Technical Problems	2.64	1.21	Moderate
Learning New Software Quickly	3.21	1.18	Moderate
Understanding Cybersecurity Best Practices	2.93	1.26	Moderate

*Competency Level Classification: Very Good (4.50-5.00), Good (3.50-4.49), Moderate (2.50-3.49), Fair (1.50-2.49), Poor (1.00-1.49)

Source: Survey Data, 2025

The competency assessment revealed a bifurcated pattern consistent with van Laar et al.'s (2020) distinction between basic digital literacy and advanced digital competencies. Respondents reported good competency levels in foundational areas including basic computer operations (M=4.23, SD=0.79), email and communication tools (M=4.31, SD=0.74), internet and information search (M=4.08, SD=0.86) and Microsoft Office applications (M=3.89, SD=0.92). These scores indicate that ZESA employees possess baseline technology skills enabling routine computer-based work. According to Falloon (2020), such foundational competencies are necessary but insufficient for organisational digital transformation, which requires advanced capabilities in system-specific applications, data analytics and adaptive learning.

Competency levels declined for more specialised and advanced domains. ERP system navigation (M=3.12, SD=1.24), data analysis and interpretation (M=2.87, SD=1.15), troubleshooting technical problems (M=2.64, SD=1.21) and understanding cybersecurity best practices (M=2.93, SD=1.26) all registered moderate mean scores with substantial standard deviations exceeding 1.15. These findings suggest that whilst employees can operate basic productivity tools, many lack specialised competencies required for enterprise system administration, analytical work and security management. The higher standard deviations indicate heterogeneity in advanced competencies, wherein some employees possess strong capabilities whilst others report limited skills. As Iivari et al. (2020) observe, such variation typically reflects differential access to training, variation in job requirements and differences in intrinsic technology orientations.

Qualitative interview data illuminated the lived experiences behind these quantitative patterns. A Finance Department manager reported:

"*Many of our staff can use computers for basic tasks like email and Word documents, but when we ask them to generate reports from the ERP system or analyse trends in the data, they struggle. We don't have enough people with advanced Excel skills or understanding of our enterprise systems, so a few specialists end up doing all the analytical work."*

This account reflects Compeau and Higgins' (1995) finding that computer self-efficacy varies substantially even within organisations with comparable access to technology and training. Another informant, an engineer with 12 years' service, observed:

"The training we receive when new systems are introduced is often inadequate. They give us a one-day session showing basic functions, but when we encounter problems or need to use advanced features, there's limited support. Many colleagues revert to manual methods because they're more confident doing things the old way."

These qualitative insights reveal that competency challenges stem not only from individual skill gaps but also from inadequate training provision and ongoing support, consistent with findings by Sung and Choi (2014) that training effectiveness depends on comprehensive needs assessment, appropriate instructional design and post-training reinforcement.

4.2.3 Barriers and Challenges to ICT Adoption

4.2.3.1 Perceived Barriers to Effective ICT Adoption

Respondents rated the severity of various barriers to effective ICT adoption at ZESA Holdings using a five-point scale (1=Not a Barrier, 5=Major Barrier). Table 4.5 presents mean severity ratings ranked in descending order.

Table 4.5: Perceived Severity of ICT Adoption Barriers (N=370)

Barrier	Mean	Std. Deviation	Severity Level*
Insufficient Financial Resources	4.47	0.82	Major
Outdated/Inadequate ICT Infrastructure	4.39	0.87	Major
Frequent Power Outages Affecting Systems	4.31	0.91	Major
Limited Training and Capacity Development	4.18	0.96	Major
Resistance to Change from Employees	3.89	1.08	Significant
Poor Internet Connectivity	3.76	1.15	Significant
Lack of Management Support	3.64	1.22	Significant
Inadequate Technical Support Staff	3.58	1.18	Significant
Complexity of ICT Systems	3.42	1.14	Moderate
Incompatibility Between Systems	3.37	1.21	Moderate
Unclear ICT Policies and Procedures	3.29	1.26	Moderate
Cybersecurity Concerns	3.18	1.19	Moderate
Vendor/Supplier Reliability Issues	3.05	1.24	Moderate

*Severity Level Classification: Major (4.20-5.00), Significant (3.40-4.19), Moderate (2.60-3.39), Minor (1.80-2.59), Not a Barrier (1.00-1.79)

Source: *Survey Data, 2025*

According to Table 4.5, respondents identified insufficient financial resources (M=4.47, SD=0.82) as the most severe barrier to ICT adoption at ZESA Holdings, followed closely by outdated/inadequate ICT infrastructure (M=4.39, SD=0.87) and frequent power outages affecting systems (M=4.31, SD=0.91). These findings substantiate the resource availability and investment capacity factors discussed in Section 2.5.5, wherein Makabira and Wanjau (2013) documented that resource constraints fundamentally limit what technologies organisations can acquire, implement and sustain. The high mean scores (all exceeding 4.18) and relatively low standard deviations (below 1.00) for these resource-related barriers indicate strong consensus across respondents regarding their severity, transcending occupational category and departmental boundaries.

Limited training and capacity development (M=4.18, SD=0.96) also emerged as a major barrier, aligning with the competency gaps identified in Section 4.2.2.4 and supporting Bell et al.'s (2017) assertion that training provision critically determines whether technology investments translate into improved performance. The second tier of significant barriers encompassed resistance to change from employees (M=3.89, SD=1.08), poor internet connectivity (M=3.76, SD=1.15), lack of management support (M=3.64, SD=1.22) and inadequate technical support staff (M=3.58, SD=1.18). These barriers reflect organisational culture, infrastructure quality and human resource dimensions of the TOE framework (Baker, 2012), indicating that adoption challenges at ZESA Holdings span technological, organisational and environmental contexts rather than concentrating in a single domain.

Moderate barriers included system complexity (M=3.42, SD=1.14), incompatibility between systems (M=3.37, SD=1.21), unclear ICT policies (M=3.29, SD=1.26), cybersecurity concerns (M=3.18, SD=1.19) and vendor reliability issues (M=3.05, SD=1.24). The larger standard deviations for these items (all exceeding 1.14) suggest greater variability in perceptions, possibly reflecting differences in direct exposure to these challenges across occupational roles and departments. Notably, cybersecurity concerns registered lower mean severity (M=3.18) than might be expected given the literature's emphasis on security as a critical adoption consideration (Chowdhury & Chowdhury, 2023). This finding may indicate either limited awareness of cybersecurity risks or perception that other barriers constitute more immediate constraints.

To examine whether barrier perceptions varied significantly across occupational categories, one-way ANOVA was conducted comparing mean severity ratings for key barriers across the five occupational groups. Table 4.6 presents the results for selected barriers.

Table 4.6: ANOVA Results - Barrier Severity by Occupational Category

Barrier	F-statistic	p-value	Significant Difference?
Insufficient Financial Resources	1.87	.115	No
Outdated ICT Infrastructure	2.43	.047*	Yes
Limited Training	4.21	.002**	Yes
Resistance to Change	3.16	.014*	Yes
Lack of Management Support	2.89	.022*	Yes
System Complexity	5.34	<.001***	Yes

*p<.05, **p<.01, ***p<.001

Source: Survey Data, 2025

The ANOVA results revealed statistically significant differences across occupational categories for several barriers. Post hoc tests using Tukey HSD indicated that engineers and technicians rated "outdated ICT infrastructure" significantly higher than administrative personnel (p=.041), likely reflecting their direct engagement with operational systems. Managers rated "limited training" significantly lower than technicians and trade staff (p=.001), possibly because managers receive preferential access to training opportunities as noted by Grossman and Salas (2011). Conversely, trade staff rated "system complexity" significantly higher than all other occupational categories (p<.001), suggesting that systems may not be designed with the needs of non-specialist users in mind, consistent with Nielsen's (2012) usability principles emphasising user-centred design.

4.2.3.2 Qualitative Exploration of Adoption Barriers

The semi-structured interviews provided rich contextual understanding of the barriers identified in the quantitative survey. Thematic analysis of interview transcripts revealed five major themes elaborating adoption challenges: resource scarcity and competing priorities, infrastructural fragility and unreliability, skills gaps and training inadequacy, organisational inertia and change resistance, and coordination deficits and communication breakdowns.

Resource Scarcity and Competing Priorities

All ten interview participants emphasised financial constraints as the fundamental barrier to ICT adoption. A senior manager in Corporate Services explained:

"*ZESA faces enormous financial challenges. We're struggling to maintain the basic electrical infrastructure – repairing transformers, replacing cables, keeping the power stations running. When it comes to allocating the limited funds we have, ICT investments are often seen as a luxury we can't afford compared to keeping the lights on. Even when we recognise that digital systems could improve efficiency and revenue collection in the long term, the immediate operational needs take precedence.*"

This account illustrates what Awa et al. (2015) characterise as the resource allocation dilemma facing organisations with constrained budgets, wherein short-term operational necessities crowd out investments in technologies offering longer-term benefits. A Distribution Manager elaborated on competing priorities:

"*We submitted a proposal to implement a comprehensive outage management system that would significantly improve our response times and customer communication. The business case was sound, showing potential savings from reduced restoration times and improved customer satisfaction. But the funds were ultimately redirected to procure emergency generation capacity during a power crisis. It's hard to argue against keeping the power on today for a system that promises efficiency improvements tomorrow.*"

This narrative reflects Brown and Yücel's (2002) observation that utilities in resource-constrained environments face difficult trade-offs between maintaining current operations and investing in future capabilities, often resulting in underinvestment in enabling technologies.

Infrastructural Fragility and Unreliability

Multiple participants highlighted how Zimbabwe's broader infrastructural challenges undermine ICT system reliability. A Finance Manager described:

"*Load shedding is a constant problem for our ICT systems. Even though we have generators and UPS systems at some facilities, frequent power interruptions damage equipment, corrupt data, and disrupt workflows. Staff lose work when systems go down unexpectedly, and it creates a sense that digital systems are unreliable. People are hesitant to trust electronic records or processes when power cuts can wipe out hours of data entry."*

This experience exemplifies Avgerou's (2008) finding that developing-country contexts characterised by infrastructure fragility create unique challenges for ICT adoption, as unreliable power supply undermines system availability and user confidence. An IT specialist elaborated on connectivity challenges:

"*Internet connectivity is extremely inconsistent, especially at our remote substations and depots. We've tried various solutions – fibre, wireless, satellite – but each has limitations in terms of cost, reliability or bandwidth. Without dependable connectivity, cloud-based systems and real-time data synchronisation are impractical. We're forced to rely on standalone systems with periodic manual data transfers, which defeats the purpose of integrated enterprise systems."*

These accounts validate the infrastructure inadequacy identified in the quantitative data (Table 4.5) and support Boateng et al.'s (2008) argument that connectivity constraints in sub-Saharan African contexts necessitate hybrid technology architectures combining local processing with periodic synchronisation, rather than fully connected cloud-based approaches.

Skills Gaps and Training Inadequacy

Participants consistently identified inadequate training and skills development as critical adoption barriers. An Operations Manager in Distribution explained:

"*When we implemented the new billing system three years ago, staff received a two-day training session covering basic functions. That was it. No follow-up training, no resources for self-study, no internal experts designated to provide ongoing support. Most staff learned just enough to perform their immediate tasks but never developed deeper understanding. When the system needs updating or when problems arise, we're dependent on expensive external consultants because we haven't built internal capacity.*"

This narrative illustrates Burke and Hutchins' (2007) finding that one-time training events without reinforcement and ongoing support generate superficial learning insufficient for sustained technology adoption. A Human Resources Manager contextualised the training challenge:

"*Our training budget has been severely constrained for years. We prioritise mandatory compliance training and health and safety programmes. ICT training is often sacrificed. Additionally, we face high turnover of skilled IT personnel who are recruited by better-paying private sector or international positions. We're constantly training people who then leave, which discourages investment in extensive training programmes.*"

This account reflects Daniel and Wilson's (2003) observation that human resource constraints in developing economies force organisations to compete intensely for limited technical talent pools, often losing skilled personnel before organisational investments in training generate returns. The resulting skills gaps perpetuate dependence on external consultants and inhibit development of internal digital capabilities.

Organisational Inertia and Change Resistance

Several participants discussed cultural and behavioural resistance to technology-enabled change. An engineer with 18 years' service observed:

"*There's definitely resistance to new systems, especially among longer-serving staff who've developed their own work methods over decades. When we introduce new software or processes, some people see it as questioning their competence or* *threatening their job security. There's also scepticism because we've had failed IT projects in the past – systems that were implemented with much fanfare but then abandoned when they didn't work properly or when vendor support ended. This history makes people wary of investing effort in learning new systems that might not last."*

This account illustrates Armenakis and Harris's (2009) change readiness construct, wherein previous negative change experiences reduce organisational confidence in new initiatives and foster cynicism toward management-sponsored transformation programmes. A Manager in Corporate Services described generational dimensions of resistance:

"*We see differences between younger employees who grew up with technology and are comfortable learning new systems, versus older employees who find the transition more challenging. But it's not purely about age – it's about mindset. Some of our most technology-resistant staff are relatively young, whilst some veterans are enthusiastic early adopters. The real divide is between people who see technology as empowering their work versus those who view it as an additional burden imposed by management."*

This observation aligns with Rogers' (2003) innovation adoption categories, suggesting that individual differences in innovation orientation transcend demographic characteristics and reflect deeper psychological dispositions toward change and technology. As Schein (2010) argues, addressing such cultural resistance requires deliberate change management interventions that build trust, demonstrate value and provide psychological safety during transitions.

Coordination Deficits and Communication Breakdowns

Participants identified organisational silos and inadequate coordination as barriers to integrated ICT adoption. An IT Manager explained:

"*Different departments have purchased and implemented systems independently without consulting the IT Department or considering enterprise-wide integration requirements. Finance installed their own accounting software, Operations deployed a maintenance management system, and Customer Service implemented a call centre platform – all from different vendors with no interoperability. Now we're stuck with a* *fragmented technology landscape that's extremely difficult and expensive to integrate retrospectively."*

This narrative exemplifies the coordination challenges Panetto et al. (2016) associate with decentralised technology acquisition decisions, wherein individual departments optimise local solutions without considering enterprise architecture implications. A senior engineer elaborated:

"*There's insufficient communication between technical staff who will actually use systems and management who make procurement decisions. Often systems are purchased based on vendor presentations to executives without adequately consulting the people who will operate them daily. The result is that we get systems that look impressive in demos but don't fit well with our actual work processes or technical environment. By the time we discover the mismatch, significant resources have already been committed."*

This account supports Jeyaraj et al.'s (2006) finding that successful technology adoption requires multi-level stakeholder engagement, with end-user input essential for ensuring compatibility between technological capabilities and operational requirements. The coordination deficits identified by participants reflect broader organisational governance challenges documented in the Auditor-General's Report (Office of the Auditor-General Zimbabwe, 2023), suggesting that ICT adoption barriers at ZESA Holdings are symptomatic of systemic management and communication weaknesses rather than isolated technical issues.

4.2.4 Impact of ICT Adoption on Organisational Performance

4.2.4.1 Perceived Benefits of ICT Adoption

Respondents rated the extent to which ICT adoption had improved various aspects of organisational performance using a five-point Likert scale (1=No Improvement, 5=Major Improvement). Table 4.7 presents mean improvement ratings for key performance dimensions.

Table 4.7: Perceived Impact of ICT on Organisational Performance (N=370)

Performance Dimension	**Mean**	**Std. Deviation**	**Impact Level***
Communication and Information Sharing	3.92	0.98	Moderate-High
Speed of Administrative Processes	3.67	1.06	Moderate-High
Record Keeping and Documentation	3.58	1.11	Moderate-High
Access to Information for Decision-Making	3.41	1.18	Moderate
Customer Service and Responsiveness	3.29	1.24	Moderate
Accuracy of Billing and Revenue Collection	3.16	1.31	Moderate
Operational Efficiency	3.08	1.27	Moderate
Reduction in Operational Costs	2.87	1.35	Low-Moderate
Equipment Maintenance and Asset Management	2.79	1.29	Low-Moderate
Outage Management and Response Times	2.64	1.42	Low-Moderate
Reduction in System Losses	2.51	1.38	Low
Revenue Growth	2.43	1.41	Low

*Impact Level Classification: Major (4.20-5.00), Moderate-High (3.50-4.19), Moderate (2.80-3.49), Low-Moderate (2.20-2.79), Low (1.40-2.19), No Impact (1.00-1.39)

Source: *Survey Data, 2025*

According to Table 4.7, ICT adoption demonstrated strongest positive impacts in administrative and communication domains. Communication and information sharing (M=3.92, SD=0.98), speed of administrative processes (M=3.67, SD=1.06) and record keeping (M=3.58, SD=1.11) all achieved moderate-to-high improvement ratings.

These findings support the Technology Acceptance Model's proposition that technologies demonstrating clear usefulness in daily work activities achieve higher acceptance and generate observable benefits (Davis, 1989; Granić & Marangunić, 2019). The relatively low standard deviations (below 1.12) for these top-rated dimensions indicate reasonable consensus across respondents, suggesting that basic digital infrastructure improvements have delivered recognisable value in routine organisational functions.

However, perceived impacts declined markedly for operational and financial performance dimensions. Customer service (M=3.29, SD=1.24), billing accuracy (M=3.16, SD=1.31) and operational efficiency (M=3.08, SD=1.27) registered moderate impacts, whilst cost reduction (M=2.87, SD=1.35), asset management (M=2.79, SD=1.29) and outage management (M=2.64, SD=1.42) showed low-to-moderate improvements. Most concerning from a strategic perspective, reduction in system losses (M=2.51, SD=1.38) and revenue growth (M=2.43, SD=1.41) – critical performance metrics for utility sustainability – demonstrated low perceived impacts. The large standard deviations for these operational and financial dimensions (all exceeding 1.24) indicate substantial disagreement across respondents, suggesting that ICT impacts vary considerably across departments or that awareness of system-wide performance outcomes remains limited among frontline staff.

Figure 4.2 visualises the gap between ICT investment priorities and perceived performance impacts across key organisational functions.

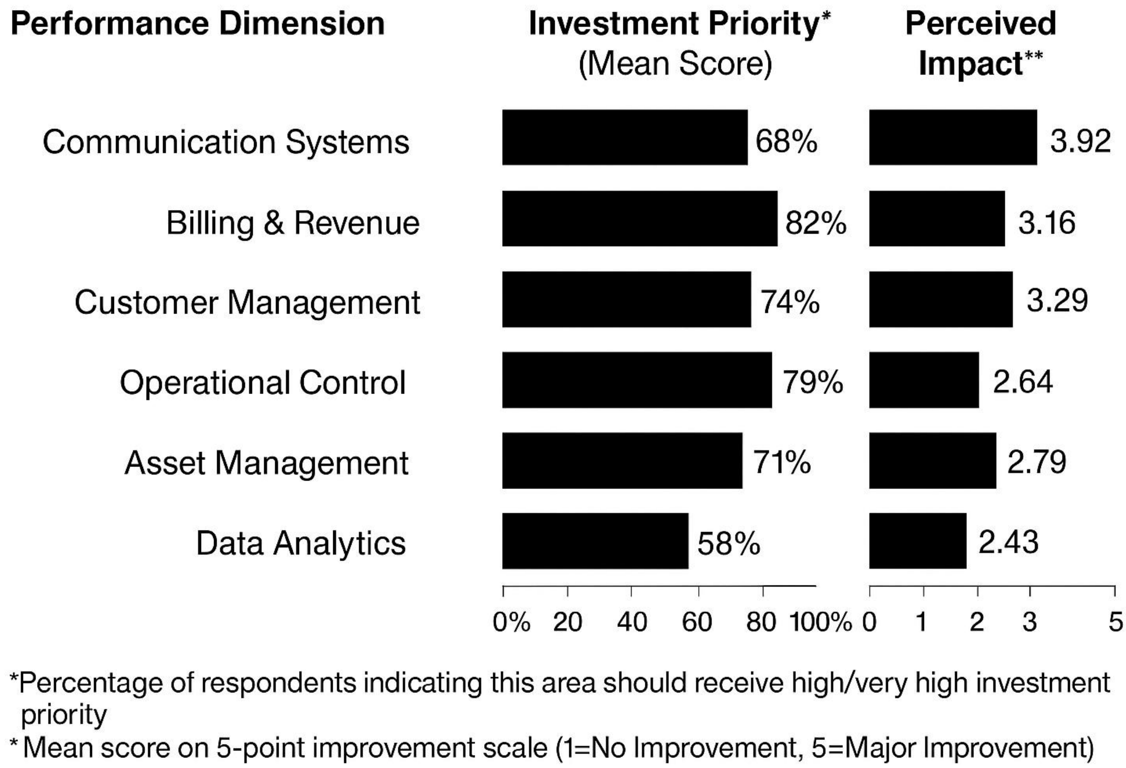

Figure 4.2: ICT Investment Areas versus Perceived Performance Impact (N=370)

Source: *Survey Data, 2025*

Figure 4.2 reveals a concerning mismatch between investment priorities and perceived impacts. Billing and revenue collection, operational control systems and asset management – areas where 71% to 82% of respondents indicated high investment priority – demonstrated substantially lower perceived impacts (means ranging from 2.64 to 3.16) compared to communication systems, where 68% prioritised investment and impact reached 3.92. This pattern suggests what Bharadwaj et al. (2013) characterise as unrealised digital business value, wherein organisations invest in technologies expected to deliver strategic benefits but fail to achieve anticipated returns due to implementation challenges, inadequate process integration or insufficient organisational capability development.

Pearson correlation analysis examined relationships between ICT adoption levels (measured as composite scores of system availability and usage frequency) and perceived performance impacts. Table 4.8 presents correlation coefficients for selected relationships.

Table 4.8: Correlations Between ICT Adoption and Performance Outcomes

Performance Outcome	**ICT Adoption Level**	**Statistical Significance**
Communication Effectiveness	r = .524	p < .001***
Administrative Efficiency	r = .487	p < .001***
Access to Information	r = .456	p < .001***
Customer Service Quality	r = .382	p < .001***
Billing Accuracy	r = .341	p < .001***
Operational Efficiency	r = .318	p < .001***
Cost Reduction	r = .267	p < .001***
Revenue Growth	r = .223	p < .001***

***p < .001

Source: Survey Data, 2025

All correlations were statistically significant (p<.001), indicating reliable positive relationships between ICT adoption levels and performance outcomes. However, according to Cohen's (1988) guidelines for interpreting correlation coefficients, the strength of associations varied considerably. Communication effectiveness (r=.524), administrative efficiency (r=.487) and access to information (r=.456) demonstrated moderate-to-large correlations, suggesting that higher ICT adoption substantially improves these dimensions. Conversely, cost reduction (r=.267) and revenue growth (r=.223) showed small correlations, indicating that ICT adoption explains limited variance in these financial outcomes. These patterns support the hypothesis that ICT adoption impacts operational efficiency positively but that the magnitude of impact varies across performance domains, with administrative and communication functions benefiting more directly than complex operational and financial outcomes.

4.2.4.2 Qualitative Insights on ICT Impact

Interview participants provided nuanced perspectives on how ICT adoption had affected their work and organisational performance. A Manager in Finance described tangible benefits:

"*Before we implemented the computerised billing system, bill preparation was entirely manual – clerks literally writing bills by hand or using typewriters. The error rate was high, processing took weeks, and we had massive backlogs. The computerised system has dramatically improved speed and accuracy. We can now generate bills much faster, track payment histories electronically, and identify defaulters more systematically. This has definitely improved our revenue collection efficiency.*"

This account exemplifies the process automation benefits documented by Vernadat (2020), wherein routine transactional activities are particularly amenable to efficiency gains through computerisation. However, the same participant qualified these benefits:

"*That said, we're still not realising the full potential of the billing system. The system has analytical capabilities that could help us identify consumption patterns, predict revenue, and detect anomalies indicating meter tampering or system losses. But we don't have staff with the skills to use these advanced features, so we're basically using a sophisticated system as a glorified electronic typewriter. The data is there but we're not extracting insights from it.*"

This observation reflects Wamba et al.'s (2017) finding that organisations often acquire advanced technologies but fail to develop complementary analytical capabilities required to translate data into actionable insights and performance improvements. An Operations Manager elaborated on unrealised potential:

"*We invested in a SCADA system for some substations that theoretically allows remote monitoring and control. But because of connectivity problems and inadequate training, operators don't trust the remote readings and still insist on physical inspections. We're maintaining two parallel systems – the digital one that management wanted and the traditional manual one that staff rely on. This actually increases workload rather than reducing it, which was the original objective.*"

This narrative illustrates what Seddon (1997) characterises as system quality deficiencies undermining adoption and benefit realisation, wherein technical problems and user scepticism prevent intended usage patterns from emerging. The parallel maintenance of manual and digital processes represents organisational inefficiency and suggests that ICT investments may not achieve positive returns on investment when implementation is incomplete.

An engineer provided a balanced assessment acknowledging both achievements and limitations:

"*ICT has definitely improved certain aspects of our work. Email and digital communication have made coordination much easier, especially across our geographically dispersed operations. File sharing and electronic documentation have reduced physical paperwork and improved record retention. But in terms of the core engineering challenges we face – reducing technical losses, improving power quality, optimising network configuration – I haven't seen ICT making significant impact. Those problems require infrastructure investment, not just information systems.*"

This perspective aligns with Tilson et al.'s (2010) argument that digital infrastructure, whilst enabling certain organisational improvements, cannot substitute for physical infrastructure investment in capital-intensive utility sectors. The informant's observation suggests realistic expectations regarding ICT capabilities, recognising that information systems address information-processing challenges but cannot resolve underlying physical infrastructure deficiencies or resource constraints.

4.2.4.3 Comparative Analysis by Department and Occupational Category

To examine whether ICT impacts varied across organisational units, independent samples t-tests compared mean impact ratings between departments and occupational categories. Figure 4.3 presents comparative results for operational efficiency impacts across departments.

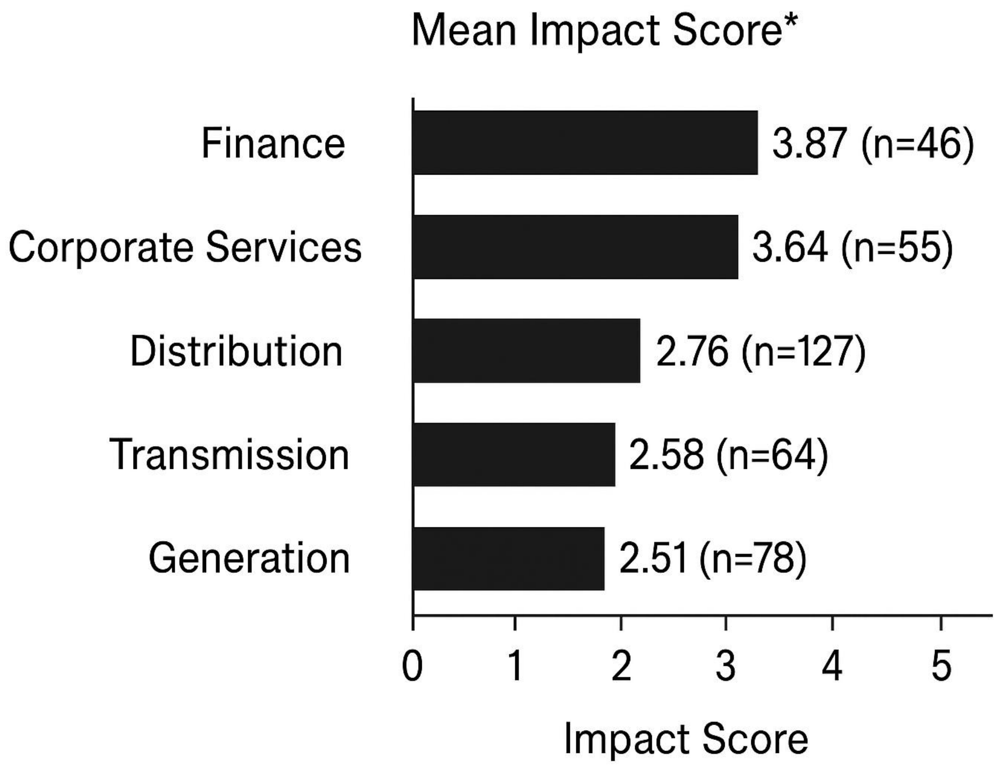

Figure 4.3: Perceived ICT Impact on Operational Efficiency by Department (N=370)

*Scale: 1=No Improvement, 5=Major Improvement

$F(4,365) = 12.84$, $p < .001$

Post hoc comparisons (Tukey HSD):

- Finance significantly higher than Distribution, Transmission, Generation ($p < .001$)
- Corporate Services significantly higher than Distribution, Transmission, Generation ($p < .01$)
- No significant differences among Distribution, Transmission, Generation ($p > .05$)

Source: Survey Data, 2025

Figure 4.3 demonstrates substantial variation in perceived ICT impacts across departments. Finance (M=3.87) and Corporate Services (M=3.64) reported significantly higher operational efficiency improvements than Distribution (M=2.76), Transmission (M=2.58) and Generation (M=2.51) departments. One-way ANOVA confirmed these differences were statistically significant, $F(4,365)=12.84$, $p<.001$. Post hoc tests using Tukey HSD revealed that Finance and Corporate Services departments differed significantly from all operational departments ($p<.001$ and $p<.01$ respectively), whilst the three operational departments showed no significant differences among themselves ($p>.05$).

These patterns suggest that ICT adoption has delivered differential benefits across ZESA's organisational structure. According to Kabeyi (2023), administrative functions including finance and corporate services typically benefit more immediately from standard enterprise systems than operational engineering functions, which require specialised operational technology (OT) systems addressing unique sectoral requirements. The lower impact ratings in Distribution, Transmission and Generation may reflect the limited deployment of specialised systems identified in Table 4.2, including SCADA (26.5% availability), GIS (20.5%) and AMI (14.1%), which Nwaiwu (2021) identifies as critical for operational improvement in electricity utilities. Alternatively, as interview participants suggested, operational staff may hold more stringent criteria for assessing ICT impact, expecting systems to address core technical challenges rather than merely improving administrative efficiency.

4.2.5 Testing the Research Hypothesis

The study hypothesised that ICT adoption at ZESA has a significant positive impact on operational efficiency, revenue collection and service delivery. To test this hypothesis, multiple regression analysis was conducted with ICT adoption level (composite score incorporating system availability, usage frequency and integration) as the independent variable and three dependent variables representing the hypothesised impact dimensions: operational efficiency index, revenue collection effectiveness index and service delivery quality index. Each index comprised multiple survey items averaged to create composite scores (Cronbach's α ranging from .78 to .84, indicating good internal consistency).

Table 4.9: Regression Analysis - ICT Adoption Impact on Performance Dimensions

Dependent Variable	β	R^2	Adjusted R^2	F	p-value
Operational Efficiency Index	.412	.170	.167	75.38	<.001***
Revenue Collection Effectiveness Index	.356	.127	.124	53.42	<.001***
Service Delivery Quality Index	.387	.150	.147	64.89	<.001***

***$p < .001$

Source: Survey Data, 2025

According to Table 4.9, ICT adoption demonstrated statistically significant positive relationships with all three performance dimensions ($p<.001$), supporting rejection of the null hypothesis. The standardised regression coefficients (β) indicated moderate positive relationships: operational efficiency (β=.412), service delivery quality (β=.387) and revenue collection effectiveness (β=.356). ICT adoption explained 17.0% of variance in operational efficiency (R^2=.170), 15.0% in service delivery quality (R^2=.150) and 12.7% in revenue collection effectiveness (R^2=.127). Whilst these R^2 values indicate that ICT adoption accounts for modest proportions of performance variance – suggesting that other factors including physical infrastructure, human resources and management practices also substantially influence outcomes – the statistically significant relationships confirm that ICT adoption does contribute positively to organisational performance.

These findings align with the alternative hypothesis (H_1) positing that ICT adoption has a significant positive impact on organisational performance dimensions. However, the moderate effect sizes (β values between .356 and .412) and limited variance explained (R^2 between .127 and .170) suggest that ICT adoption is a contributing factor rather than a dominant determinant of performance. As Petter et al. (2013) observe, technology adoption typically interacts with organisational, human and environmental factors to produce performance outcomes, implying that ZESA's ability to realise substantial performance gains from ICT investments depends on simultaneously addressing the barriers identified in Section 4.2.3 and developing complementary organisational capabilities.

4.2.6 Recommendations for Enhancing ICT Adoption

Survey respondents were asked to indicate which strategies they believed would most effectively enhance ICT adoption and digital transformation at ZESA Holdings, selecting up to three options from a provided list. Table 4.10 presents the frequency and percentage of respondents endorsing each recommended strategy.

Table 4.10: Recommended Strategies for Enhancing ICT Adoption (N=370)

Recommended Strategy	Frequency	Percentage
Increase budget allocation for ICT infrastructure and systems	298	80.5%
Provide comprehensive training and capacity development programmes	287	77.6%
Improve reliability of power supply and internet connectivity	264	71.4%
Strengthen management commitment and leadership support	219	59.2%
Engage staff in system and implementation planning	208	56.2%
Establish dedicated ICT support team with adequate staffing	197	53.2%
Implement change management programmes to reduce resistance	183	49.5%
Develop clear ICT policies, standards and procedures	176	47.6%
Ensure system integration and interoperability across departments	168	45.4%
Partner with reliable vendors and service providers	154	41.6%
Establish performance monitoring and evaluation mechanisms	142	38.4%
Strengthen cybersecurity infrastructure and policies	137	37.0%

Source: *Survey Data, 2025*

The recommendations endorsed by respondents strongly emphasised resource provision and capacity development. Increasing budget allocation (80.5%), providing comprehensive training (77.6%) and improving infrastructure reliability (71.4%) emerged as the top three priorities, directly addressing the major barriers identified in Table 4.5. According to Zhu and Kraemer (2005), resource availability and organisational readiness constitute fundamental prerequisites for successful technology adoption, suggesting that respondents' recommendations align with established adoption frameworks. The high endorsement of management commitment and leadership support (59.2%) and staff engagement in planning (56.2%) reflects recognition that successful digital transformation requires multi-level stakeholder alignment, consistent with Masa'deh et al.'s (2016) findings regarding management support as a critical adoption enabler.

Moderate endorsement levels for change management programmes (49.5%), clear ICT policies (47.6%) and system integration (45.4%) indicate awareness that organisational and technical factors beyond resource provision influence adoption outcomes. The comparatively lower prioritisation of cybersecurity strengthening (37.0%) may reflect either limited awareness of security risks or perception that security concerns are secondary to more immediate adoption barriers. As Chowdhury and Chowdhury (2023) argue, however, cybersecurity infrastructure should be developed proactively rather than reactively, particularly as utilities increasingly deploy internet-connected operational systems vulnerable to cyber threats.

Qualitative interview data provided detailed insights into how recommended strategies might be implemented effectively. A senior IT manager proposed a phased approach:

"*We need a comprehensive ICT strategy with realistic timelines and secured funding commitments. Rather than trying to implement everything simultaneously, we should prioritise systems delivering quick wins and demonstrable value, use those successes to build momentum and stakeholder confidence, then progressively tackle more complex integration challenges. We also need to establish governance structures ensuring coordination across departments and preventing the fragmented procurement that created our current integration problems.*"

This recommendation reflects Rafferty et al.'s (2013) emphasis on change readiness and Kotter's (2012) guidance regarding creating short-term wins to sustain momentum during transformation initiatives. Another participant, a Finance Manager, emphasised the importance of user involvement:

"*Systems imposed from the top without consulting the people who will use them rarely succeed. We need participatory approaches where end-users contribute to requirements specification, system selection and implementation planning. This builds ownership, ensures systems actually fit work requirements, and reduces resistance because people feel their concerns have been heard and addressed.*"

This perspective aligns with Venkatesh et al.'s (2003) Unified Theory of Acceptance and Use of Technology, which emphasises that user perceptions of technology relevance and value critically influence adoption outcomes, and with Hammersley and Traianou's (2012) observation that organisational hierarchies can create power dynamics undermining genuine stakeholder engagement.

4.3 Discussion and Interpretation

4.3.1 Current ICT Adoption Levels at ZESA Holdings

The empirical findings in Section 4.2.2 show that ICT adoption at ZESA Holdings is uneven, with strong baseline infrastructure but limited deployment of advanced systems. While desktop computers (93%), email (88.9%) and internet access (84.3%) are widely available, integrated enterprise systems such as ERP (50.5%), customer management (44.3%) and billing systems (54.9%) are only partially deployed, and specialised operational technologies like SCADA (26.5%), GIS (20.5%) and AMI (14.1%) are minimally available. This pattern places ZESA in an early-to-intermediate stage of digital maturity, where foundational connectivity exists but integrated systems capable of supporting full digital transformation remain largely absent, as Tilson et al. (2010) note.

Applying the TOE framework, technological readiness is uneven: basic computing and communication infrastructure approaches universality, but enterprise integration and operational systems remain underdeveloped. Organisational capacity shows moderate readiness, with employees possessing strong basic digital skills (means above 4.00) but limited advanced competencies in analytics and enterprise system use (means between 2.64 and 3.45). As van Laar et al. (2020) observe, such skill gaps prevent full utilisation of available technologies, creating a cycle where underutilisation discourages investment in further training and support. Environmental factors including unreliable power supply (M=4.31), poor internet connectivity (M=3.76) and severe financial constraints (M=4.47) further limit adoption, consistent with Avgerou's (2008) observation that infrastructure fragility and external volatility shape technology implementation in developing countries.

Assessment against digital maturity criteria highlights specific weaknesses. System integration and interoperability remain low, with 60.6% of respondents rating integration as low or very low, and qualitative data confirm fragmented systems and manual data transfers. Digital infrastructure and service digitisation are partially developed, but analytics capabilities are particularly weak, with only 11.1% of staff accessing analytics platforms and average self-assessed competency at 2.87. According to Rogers' (2003) Diffusion of Innovation Theory, ZESA sits between early adopter and early majority for basic infrastructure but remains at early adopter or innovator stages for enterprise and operational systems. Resource limitations, unreliable infrastructure, training gaps and coordination deficits constrain trialability, observability, and perceived compatibility, slowing progress along the adoption curve.

4.3.2 Barriers and Challenges Constraining ICT Adoption

The findings from Section 4.2.3 show that barriers to ICT adoption at ZESA are wide-ranging, cutting across technological, organisational, human, and environmental dimensions. Resource scarcity emerged as the most pressing challenge (M=4.47, SD=0.82), echoing findings from Awa et al. (2015) and Makabira and Wanjau (2013), who note that financial constraints often hinder technology adoption in developing economies. The interviews reinforced this, showing that limited funding creates a chain reaction: the lack of capital prevents infrastructure upgrades and new system acquisitions, while operational budget shortages restrict training and technical staffing. According to Baker (2012), the technological environment, including infrastructure and system quality, directly influences the feasibility of ICT adoption. In ZESA's case, outdated systems (M=4.39), weak internet connectivity (M=3.76), and unreliable electricity supply (M=4.31) combine to create what Avgerou (2008) terms infrastructural fragility. These weaknesses make it difficult to implement modern ICT solutions such as cloud platforms and real-time analytics, which Bharadwaj et al. (2013) identify as essential for digital transformation.

Organisational barriers also limit ICT adoption. Employee resistance to change (M=3.89, SD=1.08) mirrors what Schein (2010) describes as cultural conservatism, where existing routines and beliefs resist new systems. Interviews revealed that staff fear job losses, doubt system effectiveness, and recall previous ICT failures. Armenakis and Harris (2009) argue that such attitudes indicate low change readiness and insufficient belief in the value of transformation. Management support (M=3.64, SD=1.22) also emerged as inconsistent. Although leaders initially back digital projects, enthusiasm often fades during implementation. As Al-Haddad and Kotnour (2015) highlight, true leadership commitment requires visible, sustained engagement, protection of digital budgets, and a clear transformation roadmap—elements that appear weak at ZESA.

Human resource limitations and poor coordination further compound the problem. Training inadequacy (M=4.18, SD=0.96) and lack of skilled staff (M=3.58, SD=1.18) restrict ZESA's capacity to maintain systems effectively. Bell et al. (2017) and Sung and Choi (2014) emphasise that effective training should include ongoing support, practical exercises, and reinforcement—areas where ZESA falls short. Additionally, fragmented procurement and poor communication between departments have led to incompatible systems, reflecting what Panetto et al. (2016) describe as interoperability failures. According to Helfat and Peteraf (2015), strong coordination and communication are dynamic capabilities that enable integration and adaptation. The analysis therefore suggests that ZESA's ICT challenges are interconnected: resource shortages undermine training and support; poor infrastructure fuels resistance; and fragmented management weakens integration. As Jeyaraj et al. (2006) conclude, addressing such barriers requires a holistic strategy targeting financial, technical, organisational, and cultural factors simultaneously.

4.3.3 Impact of ICT Adoption on Organisational Performance

The findings on the impact of ICT on organisational performance at ZESA present a mixed picture. The most visible improvements were noted in administrative and communication areas, such as information sharing (M=3.92), faster administrative processes (M=3.67), and better record keeping (M=3.58). These results support DeLone and McLean's (2003) information systems success model, which explains that system quality and information quality influence user satisfaction and usage, which then affect performance. Vernadat (2020) also notes that structured administrative tasks are well suited to automation. However, core operational and financial areas, such as revenue growth (M=2.43), system loss reduction (M=2.51), and outage management (M=2.64), showed only limited gains. Regression results confirmed positive but moderate effects (β between .356 and .412, R^2 between .127 and .170), indicating that ICT alone cannot drive major improvements without complementary organisational and infrastructural support.

Performance differences between departments provided further insights. Finance and Corporate Services reported stronger impacts (M=3.87 and M=3.64) than operational departments, where averages ranged from 2.51 to 2.76. Kabeyi (2023) explains that administrative functions benefit more from standard enterprise systems, while operational units depend on complex technologies such as SCADA and AMI, which require costly infrastructure and advanced skills (Nwaiwu, 2021). Qualitative interviews confirmed that ICT improved communication and reporting but had little effect on engineering performance, supporting Tilson et al. (2010), who argue that digital systems cannot replace physical infrastructure investment in capital-intensive sectors like electricity.

Respondents also revealed a mismatch between investment priorities and actual outcomes. High investments in billing (82%), operational control (79%), and asset management (71%) systems have not yielded proportional benefits. Petter et al. (2013) describe this as an "implementation gap," where technologies are acquired but not fully integrated. Interviewees cited poor training, unused system features, and continued manual processes. As Seddon (1997) suggests, both system quality and user benefits must align for success; yet, infrastructure unreliability, low integration, and insufficient training continue to undermine progress.

To maximise ICT's impact, ZESA must enhance system reliability, promote integration, and strengthen user skills (Petter et al., 2013). It must also develop complementary capabilities such as process redesign, analytical competence, and strong change management (Bharadwaj, 2000; Wamba et al., 2017). Finally, as Masa'deh et al. (2016) and Al-Haddad and Kotnour (2015) argue, sustained leadership commitment and strategic alignment are essential for translating ICT investment into real organisational performance gains.

4.3.4 Strategic Recommendations for Enhanced ICT Adoption

The recommendations from both the survey and interviews show a practical understanding that sustainable ICT adoption at ZESA depends on addressing financial, skills, infrastructure, and governance challenges at the same time. The top three priorities—increased budget allocation (80.5%), comprehensive training (77.6%), and improved infrastructure reliability (71.4%)—directly respond to the key barriers identified earlier. This demonstrates what Armenakis and Harris (2009) describe as recognition of the gap between current and desired performance, which encourages organisational change. The strong support for training reflects awareness of existing competency gaps. As Bell et al. (2017) argue, effective training requires proper needs assessment, well-designed content, timely delivery, and reinforcement. However, interviews revealed that ZESA's training efforts have often been limited. Gegenfurtner and colleagues (2020) suggest blended learning—combining classroom, online, and practical sessions—as a useful approach for organisations facing resource and geographical constraints. Respondents also emphasised leadership commitment (59.2%) and staff engagement (56.2%), supporting Kotter's (2012) view that successful change depends on shared vision, guiding coalitions, and short-term wins to build momentum.

Moderate support for change management programmes (49.5%) and clear ICT policies (47.6%) highlights recognition that governance and organisational culture also influence ICT outcomes. As Rafferty et al. (2013) explain, readiness for change depends on motivation, belief in success, and leadership support. Qualitative feedback from ZESA's Finance and IT managers further reinforced this by recommending participatory planning, where end-users contribute to system selection and implementation. According to Venkatesh et al. (2003) and Kvale and Brinkmann (2015), such participation builds ownership and reduces resistance. The IT manager also proposed governance structures to coordinate departments and prevent fragmented procurement, supporting Panetto et al.'s (2016) view that organisational interoperability requires shared standards and integrated planning.

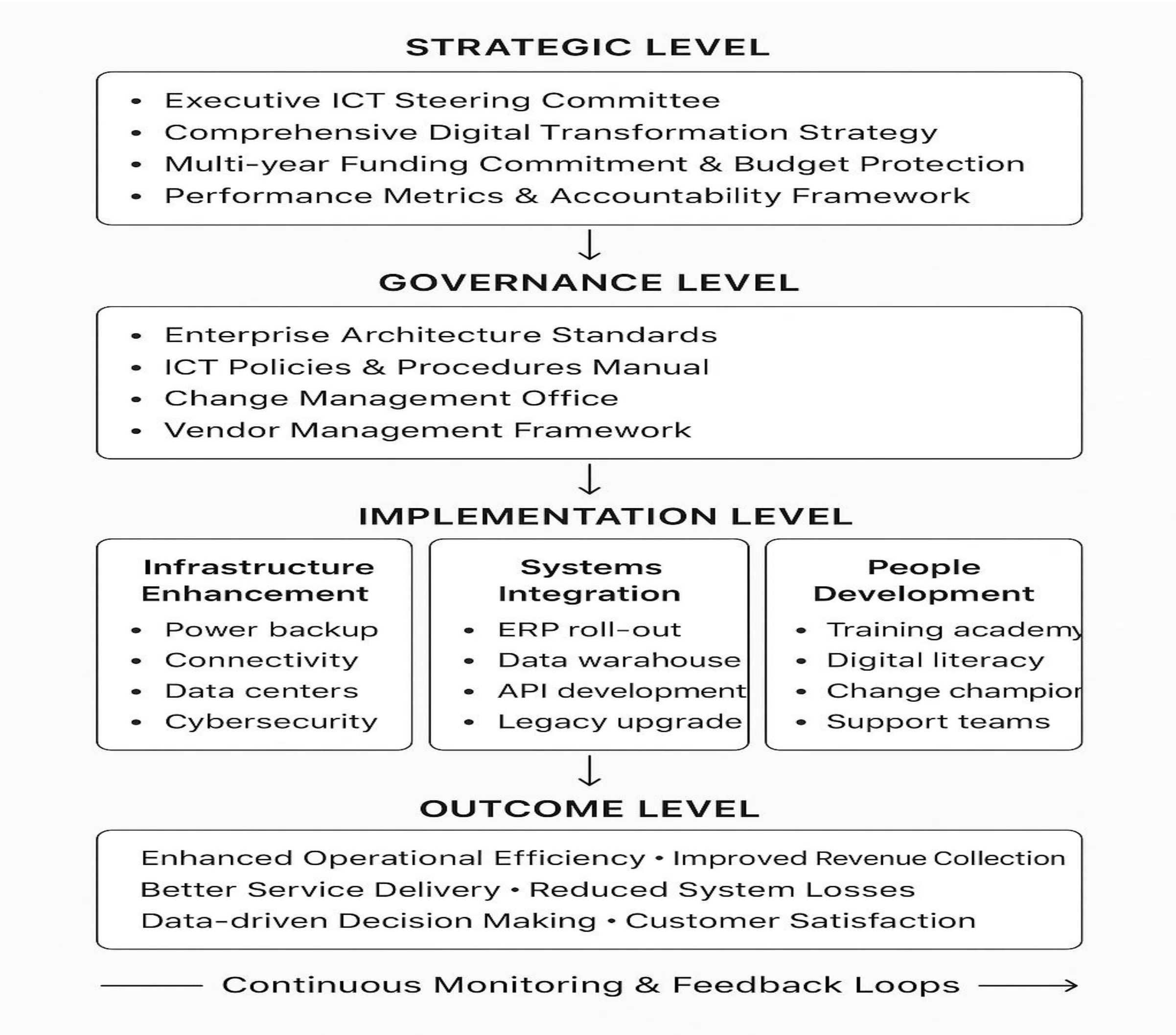

Figure 4.4: Proposed ICT Adoption Enhancement Framework - ZESA Holdings

Source: Researcher's Synthesis, 2025

Figure 4.4 integrates empirical findings and theoretical models into a four-level ICT adoption enhancement framework tailored for ZESA. The strategic level ensures leadership commitment and resource security through an Executive ICT Steering Committee, a digital transformation strategy, and multi-year funding commitments protecting ICT budgets from short-term pressures. According to Masa'deh et al. (2016), executive leadership critically influences adoption through resource allocation, cultural signalling, and timely intervention. The governance level operationalises strategic direction through enterprise architecture standards, ICT policies, a change management office, and vendor management frameworks, promoting coherence across ZESA’s dispersed operations as Vernadat (2020) emphasises. The implementation level addresses technological, organisational, and human dimensions—improving infrastructure reliability (e.g., backup systems, cloud connectivity), systems integration (ERP access rising from 50.5%), and people development through structured training. Finally, the outcome level targets enhanced efficiency, better revenue collection, reduced losses, and improved customer satisfaction, supported by continuous monitoring and adaptive feedback loops (Rafferty et al., 2013).

4.3.5 Integration of Quantitative and Qualitative Findings

The study used a convergent parallel mixed methods design, which allowed both quantitative and qualitative findings to be compared and combined to improve validity through triangulation. According to Creswell and Plano Clark (2018), effective integration involves recognising where findings converge, diverge, or elaborate on each other. In this study, there was strong convergence across most areas. For example, the quantitative finding that lack of financial resources was the most severe barrier to ICT adoption (M=4.47) was supported by qualitative evidence describing limited budgets, competing priorities, and resource allocation challenges. Likewise, the low level of system integration (60.6%) and the weak advanced ICT skills (means between 2.64 and 3.45) identified in the survey were reinforced by interviews that revealed fragmented procurement processes, dependence on external consultants, and inadequate training. As noted by Johnson and colleagues (2007), such consistency across methods strengthens confidence in the reliability of results.

Only a few discrepancies emerged, particularly regarding cybersecurity. While it appeared as a minor barrier in the quantitative results (M=3.18), interview participants, especially technical experts, described it as a serious and growing concern. This difference reflected what Hammersley and Traianou (2012) describe as varied stakeholder perspectives—technical staff were more aware of cyber threats than administrative personnel. This suggests the need for cybersecurity awareness programmes within ZESA.

The qualitative findings also explained why certain statistical results occurred. For instance, low adoption of advanced technologies was linked to unreliable power supply, high costs, and lack of skilled staff. Regression analysis showed ICT explained only 12.7 to 17 per cent of performance variation, which, as Kvale and Brinkmann (2015) suggest, can be better understood through contextual explanations such as incomplete implementation and continued reliance on manual systems. Overall, the integrated findings revealed that financial, infrastructural, and human barriers are interconnected, meaning successful ICT adoption requires coordinated, organisation-wide solutions rather than isolated interventions.

4.4 Summary

This chapter analysed and interpreted data on ICT adoption levels, barriers, impacts, and enhancement strategies at ZESA Holdings using a convergent parallel mixed-methods design. Findings showed high adoption of basic ICT tools but low integration and limited use of advanced systems. Major barriers included inadequate funding, outdated infrastructure, unreliable power, and insufficient training. ICT adoption positively influenced performance, though effects were moderate and uneven across departments. Stakeholders recommended greater budget support, capacity building, improved infrastructure, and stronger management commitment. The proposed ICT Adoption Enhancement Framework offers practical guidance for digital transformation. Overall, the chapter highlighted that ICT success depends on technology readiness, organisational capacity, and contextual factors. The next chapter concludes, recommends, and outlines future research directions.

CHAPTER 5 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This final chapter synthesises the key findings from the empirical investigation of ICT adoption at ZESA Holdings and presents actionable recommendations for enhancing digital transformation within Zimbabwe's electricity utility sector. According to Creswell and Creswell (2018), the concluding chapter should demonstrate how research findings address the original objectives, articulate theoretical and practical contributions, and provide clear guidance for stakeholders seeking to apply research insights. This chapter is structured into five sections following this introduction. Section 5.2 summarises the main findings in relation to each research objective, whilst Section 5.3 draws overarching conclusions regarding ICT adoption dynamics at ZESA. Section 5.4 discusses implications for theory, policy and practice, and Section 5.5 presents specific recommendations for ZESA management, government regulators and development partners. Finally, Section 5.6 identifies opportunities for further research that would deepen understanding of ICT adoption in African utility contexts. Together, these sections provide a comprehensive synthesis that translates empirical findings into practical guidance whilst acknowledging the study's contributions and limitations.

5.2 Discussion

5.2.1 Current ICT Adoption Levels at ZESA Holdings

The first research objective sought to assess current ICT adoption levels within ZESA Holdings. The findings revealed a bifurcated digital landscape characterised by widespread access to foundational technologies but limited deployment of advanced enterprise and operational systems. Basic infrastructure including desktop computers (93.0% availability), email systems (88.9%) and internet connectivity (84.3%) approached universal coverage, demonstrating that ZESA possesses baseline digital infrastructure. However, availability declined sharply for integrated systems such as ERP (50.5%), customer management platforms (44.3%) and computerised billing (54.9%). Advanced operational technologies essential for modern utility management—SCADA (26.5%), GIS (20.5%) and AMI (14.1%)—remained scarce, limiting ZESA's capacity to leverage digitalisation for operational improvements.

System integration emerged as a critical weakness, with 60.6% of respondents rating integration as low or very low. Qualitative interviews revealed that fragmented procurement decisions had created a patchwork of incompatible systems requiring manual data transfers and preventing organisation-wide visibility. User competency assessments showed good baseline skills in routine computing tasks (mean scores exceeding 4.0 on a 5-point scale) but underdeveloped capabilities in specialised domains including ERP navigation (3.12), data analysis (2.87) and troubleshooting (2.64). These patterns position ZESA at an early-to-intermediate stage of digital maturity according to Tilson et al.'s (2010) framework, wherein foundational connectivity exists but lacks the integrated architecture enabling comprehensive transformation.

5.2.2 Barriers Hindering Effective ICT Adoption

The second objective examined barriers constraining ICT adoption at ZESA. Resource scarcity emerged unambiguously as the most severe impediment, with insufficient financial resources rated at 4.47 on a 5-point severity scale. Qualitative interviews contextualised this constraint within ZESA's broader financial challenges, revealing that competing operational priorities—maintaining power stations, repairing transmission networks, procuring emergency generation capacity—consistently crowd out ICT investments despite acknowledged long-term benefits. Outdated infrastructure (4.39) and frequent power outages (4.31) compounded these challenges, creating an unreliable technical environment that damages equipment, corrupts data and undermines user confidence in digital systems.

Human resource barriers including limited training (4.18), inadequate technical support staff (3.58) and resistance to change (3.89) constituted the second major constraint category. Interview participants described training provision as sporadic and superficial, typically consisting of brief introductory sessions during system implementation without follow-up reinforcement or advanced skill development. High turnover of trained IT personnel to better-paying opportunities further depleted organisational capacity. Organisational factors including inconsistent management support (3.64), poor coordination across departments and communication breakdowns created governance deficits that produced fragmented technology landscapes and prevented integrated digital strategies. These barriers span technological, organisational and environmental dimensions of the TOE framework (Baker, 2012), indicating that adoption challenges reflect systemic rather than isolated constraints.

5.2.3 Impact of ICT Adoption on Organisational Performance

The third objective investigated ICT adoption impacts on operational efficiency, revenue collection and service delivery. Regression analysis confirmed statistically significant positive relationships between ICT adoption and all three performance dimensions ($p<.001$), supporting the alternative hypothesis. However, effect sizes were moderate (β ranging from .356 to .412) and variance explained limited (R^2 between 12.7% and 17.0%), indicating that ICT contributes positively but accounts for only modest proportions of performance variance. Administrative and communication functions demonstrated the strongest improvements, with communication effectiveness (3.92), administrative process speed (3.67) and record keeping (3.58) showing moderate-to-high gains. Conversely, operational and financial outcomes including revenue growth (2.43), system loss reduction (2.51) and outage management (2.64) registered low perceived impacts.

Departmental analysis revealed substantial variation, with Finance and Corporate Services reporting significantly higher operational efficiency improvements (3.87 and 3.64 respectively) than Distribution, Transmission and Generation departments (means between 2.51 and 2.76). This pattern reflects differential system availability and implementation completeness across functional areas. Qualitative interviews illuminated mechanisms constraining impact realisation, including incomplete implementation wherein systems are acquired but inadequately deployed, skills gaps preventing utilisation of advanced features, and parallel maintenance of manual processes that negate efficiency gains. These findings suggest that whilst ICT has delivered tangible benefits in administrative domains, substantial potential remains unrealised in operational and financial areas critical for ZESA's sustainability.

5.2.4 Recommended Enhancement Strategies

The fourth objective explored strategies for improving ICT adoption and supporting digital transformation. Survey respondents prioritised increased budget allocation (80.5%), comprehensive training (77.6%), infrastructure reliability improvements

(71.4%), strengthened management commitment (59.2%) and enhanced staff engagement (56.2%). These recommendations directly address the major barriers identified and reflect pragmatic recognition that sustainable adoption requires simultaneous attention to resource, capability, infrastructure and governance dimensions. Qualitative interviews provided implementation guidance emphasising phased approaches that deliver quick wins to build momentum, participatory planning processes that engage end-users in system selection and design, and formal governance structures including enterprise architecture standards and cross-functional steering committees to prevent fragmented procurement.

The proposed ICT Adoption Enhancement Framework synthesises findings into a four-level structure encompassing strategic direction through executive steering and multi-year funding commitments, governance mechanisms including policies and change management coordination, implementation initiatives across infrastructure-systems-people dimensions, and expected outcomes with continuous feedback loops. This framework addresses limitations in previous initiatives including inadequate integration planning, insufficient stakeholder engagement, underinvestment in training and inconsistent leadership commitment. By coordinating interventions across multiple dimensions simultaneously rather than sequentially, the framework creates conditions wherein barriers are addressed holistically, accelerating progress toward comprehensive digital transformation.

5.3 Conclusions

This study confirms that ICT adoption at ZESA Holdings remains incomplete despite foundational digital infrastructure investments, with significant barriers constraining progression toward the integrated enterprise systems and advanced operational technologies that characterise digitally mature utilities. The research validates theoretical frameworks including the TOE model, which predicts that adoption reflects technological readiness, organisational capacity and environmental context operating in combination. ZESA's adoption challenges span all three dimensions: technological constraints including outdated infrastructure and poor system integration, organisational deficits encompassing training inadequacy and coordination failures, and environmental factors including power supply unreliability and resource scarcity rooted in Zimbabwe's macroeconomic challenges.

The study demonstrates that ICT adoption generates measurable positive impacts on organisational performance but that realised benefits fall substantially short of potential gains. Administrative efficiency improvements have materialised where systems directly support routine transactional activities, validating the Technology Acceptance Model's proposition that technologies demonstrating clear usefulness achieve higher adoption and deliver observable benefits. However, operational and financial performance dimensions critical for utility sustainability remain largely unaffected, reflecting incomplete implementation, skills gaps and insufficient complementary capability development. This pattern supports DeLone and McLean's (2003) IS Success Model, which posits that system quality deficiencies and inadequate user competencies prevent technology investments from translating into organisational benefits.

The research reveals that effective ICT adoption in resource-constrained utility contexts requires more than technology procurement; it demands holistic organisational transformation addressing infrastructure reliability, human capital development, process redesign, governance strengthening and sustained leadership commitment simultaneously. Partial interventions targeting isolated barriers prove insufficient because adoption factors interact synergistically—resource scarcity constrains training provision, infrastructure unreliability undermines system benefits perception, competency deficits prevent effective utilisation, and coordination failures perpetuate fragmentation. Consequently, sustainable digital transformation necessitates integrated strategies that recognise interdependencies amongst technological, organisational and human factors whilst adapting implementation approaches to contextual realities including infrastructure fragility and macroeconomic volatility characteristic of developing-country settings.

5.4 Implications

5.4.1 Theoretical Implications

This study contributes to technology adoption literature by demonstrating how established frameworks including TAM, Diffusion of Innovation Theory and the TOE model operate in resource-constrained African utility contexts. The findings validate these frameworks' core propositions whilst highlighting contextual moderators that amplify or attenuate predicted relationships. For instance, the TOE framework accurately identified technological, organisational and environmental factors as adoption determinants, but the environmental dimension—particularly infrastructure unreliability and resource scarcity—exerted stronger influence at ZESA than literature from developed economies typically reports. This suggests that developing-country contexts require explicit theoretical attention to infrastructural fragility and macroeconomic volatility as critical environmental variables shaping adoption trajectories.

The research extends understanding of the implementation gap between ICT investment and performance realisation by documenting specific mechanisms through which system quality deficiencies, competency gaps and organisational inertia prevent benefit capture. Whilst DeLone and McLean's (2003) IS Success Model predicts that system quality influences performance through usage and user satisfaction, the ZESA findings reveal that even willing users with positive attitudes fail to realise benefits when infrastructure unreliability undermines system availability, training inadequacy prevents advanced feature utilisation, and coordination deficits perpetuate parallel manual processes. These insights suggest that IS Success models should incorporate contextual reliability factors and organisational complementarities as explicit mediating variables when applied to infrastructure-constrained settings.

5.4.2 Policy Implications

The findings carry important implications for government policy regarding digital transformation in Zimbabwe's utility sector and beyond. First, the resource scarcity identified as the primary adoption barrier suggests that sustainable digitalisation requires dedicated funding mechanisms protecting ICT investments from short-term operational pressures. Policy interventions might include ring-fenced digital transformation funds, blended finance arrangements combining grants with concessional loans, or regulatory frameworks allowing utilities to recover prudent ICT investments through tariffs. The World Bank (2021) and African Development Bank (2022) have advocated such financing mechanisms as essential for enabling utilities in resource-constrained contexts to undertake necessary digital investments.

Second, the infrastructure unreliability documented as a critical barrier highlights interdependencies between electricity sector performance and broader national infrastructure development. Policy strategies promoting utility digitalisation must simultaneously address power supply reliability and telecommunications connectivity, recognising that unstable foundational infrastructure undermines digital system viability. This implies coordinated planning across energy, telecommunications and ICT policy domains rather than siloed sectoral approaches. Third, the skills gaps identified suggest that national digital transformation strategies should prioritise capacity development through formal education system reforms, vocational training expansion and industry-academia partnerships that build sustainable technical workforces rather than depending on expensive short-term expatriate expertise.

5.4.3 Practical Implications

For ZESA management, the research provides empirical evidence justifying investments in training, infrastructure reliability enhancement and system integration initiatives that may face scepticism during budget deliberations. The documented performance impacts, whilst modest, demonstrate measurable returns on ICT investments that can inform business cases for further digitalisation. The proposed enhancement framework offers practical guidance for structuring digital transformation initiatives through phased implementation, participatory planning and formal governance mechanisms that address coordination deficits evident in previous fragmented procurement approaches.

The findings emphasise that technology acquisition constitutes only one component of successful adoption; complementary investments in human capital development, change management and infrastructure reliability are equally critical. This implies that ZESA should structure ICT projects as comprehensive organisational change initiatives rather than purely technical implementations, allocating budgets for training, process redesign and stakeholder engagement alongside hardware and software procurement. The differential impacts across departments suggest that adoption strategies should acknowledge functional heterogeneity, tailoring approaches to different operational contexts whilst maintaining enterprise-wide integration through governance standards and architectural frameworks.

5.5 Recommendations

5.5.1 Recommendations for ZESA Management

Establish an Executive ICT Steering Committee (0 to 6months) - with representation from all major operational divisions, reporting directly to the Chief Executive Officer and Board. This committee should develop a comprehensive five-year digital transformation strategy with explicit milestones, secured multi-year funding commitments and accountability mechanisms. According to Masa'deh et al. (2016), visible executive leadership fundamentally influences adoption success by providing resources, removing obstacles and signalling organisational priority. Resources required – board approval, ICT planning budget, workshops for capacity building and framework development consultancy support

Implement enterprise architecture governance (6 to 12 months) - preventing fragmented departmental procurement that created current integration challenges. Establish mandatory review processes requiring all technology acquisitions to demonstrate compatibility with enterprise standards, interoperability with existing systems and contribution to organisation-wide digital strategy. Develop a vendor management framework ensuring reliable partnerships with technology suppliers and preventing dependence on single providers. Resources required – ICT internal auditors, policy and enterprise specialists.

Create a structured training academy (6 to 24 months) - providing tiered digital skills development from foundational computer literacy through advanced specialisations in enterprise systems, data analytics and operational technologies. Implement competency-based progression pathways, certification programmes and refresher training addressing skill decay. Partner with universities and technical colleges to develop curricula aligned with utility sector requirements. According to Bell et al. (2017), effective training requires systematic needs assessment, evidence-based design and ongoing reinforcement rather than one-time events. Resources required – Learning Management system, training budget, partnership agreements with universities and competent instructors.

Strengthen infrastructure reliability (Immediate to 36 months) - including comprehensive backup power systems protecting equipment from load shedding damage, redundant connectivity through diverse telecommunications providers and data centre modernisation supporting growing data volumes and analytical workloads. Negotiate service level agreements with infrastructure providers ensuring predictable availability and responsive fault resolution. Resources required – Service Level Agreements with manufacturers, ICT engineers, capital investment.

Adopt phased implementation approaches (Continuous over 5 years) - delivering quick wins that build stakeholder confidence and momentum. Begin with systems addressing clearly identified pain points, demonstrate measurable benefits, then progressively tackle more complex integration challenges. Establish pilot programmes testing new technologies in limited deployments before organisation-wide roll-out, allowing learning and adjustment whilst managing risk. Resources required – funding for pilot project, monitoring tools.

5.5.2 Recommendations for Government and Regulators

Develop utility digitalisation financing mechanisms (within 12 months) - including dedicated digital transformation funds, blended finance arrangements and regulatory frameworks allowing cost recovery for prudent ICT investments through tariffs. The Zimbabwe Energy Regulatory Authority should establish clear guidance regarding ICT capital expenditure treatment in tariff determinations, providing certainty that enables multi-year planning. Resources required – policy reform unit, donor coordination units, financial analysts.

Coordinate energy, telecommunications and ICT policy (continuous/ongoing) - recognising interdependencies between utility digitalisation and foundational infrastructure reliability. Establish inter-ministerial working groups developing integrated strategies addressing power supply stability, telecommunications connectivity expansion and digital skills development simultaneously rather than through siloed sectoral initiatives. Resources required – budget for coordination, policy advisory unit, shared platforms for digital policy.

Mandate adoption of specific digital technologies (18 to 24 months) - where regulatory requirements can accelerate beneficial deployment. For instance, requiring advanced metering infrastructure roll-out within defined timelines, establishing data reporting standards necessitating integrated management systems, or mandating cybersecurity frameworks protecting critical electricity infrastructure. According to Perez-Arriaga (2013), regulatory mandates can overcome organisational inertia when technologies deliver clear public benefits. Resources required – technical experts, regulatory experts, legal experts, compliance experts.

Invest in national digital skills development (1 to 5 years) - through education system reforms incorporating ICT competencies at all levels, vocational training expansion in technical specialisations and industry-academia partnerships enabling work-integrated learning. Establish scholarship programmes incentivising study in critical shortage areas including data analytics, cybersecurity and operational technology systems engineering. Resources required – donor funding, institutional partnerships, budget for educational reform.

5.5.3 Recommendations for Development Partners

Provide technical assistance alongside financial support (immediate to 5 years) - for utility digitalisation initiatives, recognising that successful adoption requires capability development not merely capital provision. Structure assistance programmes incorporating training, change management support and knowledge transfer ensuring sustainable internal capacity development rather than perpetual external consultant dependence. Resources required – joint taskforces for implementation, advisory partnerships, training budget.

Support pilot programmes testing innovative technologies and implementation approaches (12 to 24 months) - in controlled settings before large-scale deployment. Provide grant funding or risk-sharing mechanisms enabling utilities to experiment with emerging technologies including artificial intelligence for predictive maintenance, blockchain for secure transactions and Internet of Things sensors for grid monitoring without bearing full commercial risk. Resources required – research partnerships, financing through grants, mentors with technical skills.

Facilitate regional knowledge-sharing platforms (continuous/ongoing) - connecting African utilities pursuing digital transformation, enabling peer learning from successes and failures across similar contexts. Establish communities of practice, organise study tours and document case studies capturing implementation lessons applicable to resource-constrained settings. Resources required – virtual collaboration platforms, sponsorship from donors, forum secretariat.

5.6 Suggestions for Further Research

This study provides a comprehensive assessment of ICT adoption at ZESA Holdings but raises several questions warranting further investigation. First, longitudinal research tracking adoption progression over time would illuminate how interventions influence trajectories and whether enhancement strategies deliver anticipated benefits. The current cross-sectional design captures adoption status at one point but cannot demonstrate causal relationships or trajectory shifts resulting from specific initiatives.

Second, comparative studies examining ICT adoption across multiple utilities in Southern Africa would identify common patterns versus organisation-specific challenges, enabling more robust generalisations regarding adoption dynamics in the regional context. Such research might reveal whether ZESA's experiences reflect widespread patterns or idiosyncratic circumstances, informing policy applicable beyond individual utilities.

Third, detailed case studies investigating successful ICT implementation projects within ZESA or peer utilities would document best practices, implementation strategies and success factors enabling effective adoption despite resource constraints. While this study identified barriers broadly, in-depth examination of exemplar implementations would provide actionable guidance regarding how to overcome obstacles.

Fourth, research investigating customer perspectives on utility digitalisation would complement the internal organisational focus of this study. Understanding how customers experience and value digital service channels, what barriers prevent adoption of prepaid meters or mobile payment systems, and which digital services would most enhance satisfaction could inform customer-facing technology priorities.

Fifth, quantitative studies employing structural equation modelling could test relationships amongst adoption factors, examining whether the conceptual framework's proposed linkages hold empirically and identifying which intervention points generate greatest leverage for adoption enhancement. Such research would advance theoretical understanding whilst providing evidence-based guidance for resource allocation.

Finally, investigations exploring the long-term sustainability of ICT systems in infrastructure-constrained contexts would illuminate whether current adoption approaches create dependence on external support or build genuine internal capabilities enabling autonomous management and evolution. This research would inform development partner strategies regarding appropriate balance between providing immediate implementation support and developing sustainable local capacity.

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APPENDICES

APPENDIX 1: AUREC Approval Letter

"Investing in Africa's future"

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax:
(+263 20) 61785 Website: www.africau.edu

Ref: AU4015/25 26 September, 2025

TAFADZWA EMMANUEL MURERIWA
C/O Africa University

Box 1320

MUTARE

RE: ***AN ASSESSMENT OF ICT ADOPTION LEVELS IN ZESA HOLDINGS***

Thank you for submitting the above-titled proposal to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 4015/25
  This number should be used on all correspondence, consent forms, and appropriate documents
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** September 26, 2025
- **EXPIRATION DATE** September 26, 2026
- **TYPE OF MEETING**: Expedited
  After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.

- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

AFRICA UNIVERSITY
RESEARCH ETHICS COMMITTEE (AUREC)
APPROVED
P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU
FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE

APPENDIX 2: Informed Consent Form

My name is Tafadzwa Emmanuel Mureriwa (243011), a final year Executive Master in Business Administration (EMBA) student from Africa University. I am carrying out a study on "An Assessment of ICT Adoption Levels in ZESA Holdings". I am kindly asking you to participate in this study by completing a questionnaire or taking part in an interview about your experiences with Information and Communication Technology (ICT) usage in your workplace.

Purpose of the study:
The purpose of this study is to assess the current level of ICT adoption in ZESA Holdings and examine the factors that influence this adoption. Specifically, the study aims to:

- Determine the level of ICT adoption across ZESA Holdings subsidiaries
- Examine organizational factors influencing ICT adoption
- Investigate environmental factors affecting ICT adoption
- Make strategic recommendations for ICT adoption in State Owned Enterprises

You were selected for this study because you are an employee of ZESA Holdings whose daily duties involve the use of ICT in some form, and you have worked within the organization for at least one year. A total of 222 participants from across all ZESA Holdings subsidiaries (ZETDC, ZPC, ZENT, and Powertel Communications) are being invited to participate in this research.

Procedures and duration
If you decide to participate, you will complete a questionnaire or be interviewed about ICT usage, adoption patterns, and your attitudes toward ICT in your workplace. The interview process will take about 20-30 mins. The questionnaire takes about 10 minutes and will be available through:

- Google Forms (online completion)
- Email attachment (download, complete, and return)
- Physical copy (in-person completion)

Risks and discomforts
The risks associated with participating in this study are minimal. Potential discomforts may include:

- Time required to complete the questionnaire or be interviewed
- Possible concern about providing honest feedback about workplace ICT systems

To address these concerns:

- Your participation is completely voluntary
- All responses will be kept strictly confidential and anonymous
- No individual responses will be shared with ZESA Holdings management
- Data will be analysed collectively, not individually

Benefits and/or compensation

While there is no direct financial compensation for participating in this study, the benefits include:

- Contributing to research that may improve ICT systems and processes at ZESA Holdings
- Helping identify factors that could enhance technology adoption in your workplace
- Contributing to knowledge that may benefit other State-Owned Enterprises in Zimbabwe and similar developing countries
- Potential improvements in ICT services based on study findings and recommendations

Please note that participation is voluntary and no compensation will be provided.

Confidentiality

Any information obtained in this study that can be identified with you will not be disclosed without your written permission. Specifically:

- Names and any other personal identification will not be asked for in the questionnaires
- All data will be collected anonymously Information will be stored securely and accessible only to the researcher
- Results will be presented in aggregate form only, with no individual responses identifiable
- Raw data will be destroyed after completion of the research and submission of the dissertation

Voluntary participation

Participation in this study is entirely voluntary. If you decide not to participate in this study, your decision will not affect your employment status or future relationship with ZESA Holdings, Africa University, or any other authority. If you choose to participate, you are free to:

- Skip any questions you do not wish to answer
- Withdraw your consent at any time during the questionnaire completion
- Discontinue participation without any penalty or consequences

Offer to answer questions

Before you sign this form, please ask any questions about any aspect of this study that is unclear to you. You may take as much time as necessary to think it over. The researcher will be available to clarify any concerns you may have about the study, procedures, or your rights as a participant.

Authorization

If you have decided to participate in this study, please sign this form in the space provided below as an indication that you have:

- Read and understood the information provided above
- Had the opportunity to ask questions

- Agreed to participate voluntarily in this research

Name of Research Participant (please print): ___________________________
Date: __________________

Signature of Research Participant: ___________________________________

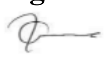
Contact Information

If you have any questions concerning this study or consent form beyond those answered by the researcher, including questions about the research, your rights as a research participant, or if you feel that you have been treated unfairly and would like to talk to someone other than the researcher, please feel free to contact:

Africa University Research Ethics Committee

Telephone: (020) 60075 or 60026 extension 1156
Email: aurec@africau.edu

Researcher: Tafadzwa Emmanuel Mureriwa

Signature of Researcher:

___________________________________ **Date:** __________________

APPENDIX 3: Questionnaire Survey Instrument

ICT Adoption at ZESA Holdings

Estimated Time: 10 minutes

This questionnaire assesses the level of ICT adoption at ZESA Holdings. Your responses are confidential and will be used for academic research only

Section A: Demographic Information

A1. Gender (Tick one):

[ ] Male

[ ] Female

[ ] Prefer not to say

A2. Age Group (Tick one):

[ ] 18-25 years

[ ] 26-35 years

[ ] 36-45 years

[ ] 46-55 years

[ ] 56 years and above

A3. Highest Level of Education (Tick one):

[ ] High School/O-Level

[ ] Diploma

[ ] Bachelor's Degree

[ ] Master's Degree

[ ] PhD

A4. Department/Division (Tick one):

[ ] ZETDC

[ ] ZPC

[ ] Powertel

[ ] Finance

[ ] Customer Service

[ ] Human Resources

[ ] ICT

[ ] Other (specify): ____________________

A5. Years at ZESA (Tick one):

[ ] Less than 1 year

[ ] 1-5 years

[ ] 6-10 years

[ ] 11-15 years

[ ] 16-20 years

[ ] More than 20 years

A6. Position Level (Tick one):

[ ] Junior Staff

[ ] Middle Management

[ ] Senior Management

[ ] Executive Management

Section B: Current ICT Adoption Level

Instructions: Please tick the box that best represents your agreement with each statement.

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

B1. My department uses modern ICT systems for daily operations

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B2. I have adequate ICT tools to perform my job effectively

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B3. ZESA uses integrated software systems across departments

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B4. Digital platforms are used for customer service delivery

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B5. Automated billing and payment systems are in place

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B6. ICT systems are regularly maintained and updated

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

B7. How would you rate the overall level of ICT adoption at ZESA? (Tick one)

[ ] Very Low

[ ] Low

[ ] Moderate

[ ] High

[ ] Very High

Section C: Barriers To ICT Adoption

Instructions: Please rate the extent to which each factor hinders ICT adoption at ZESA.

Scale: 1 = Not a Barrier, 2 = Minor Barrier, 3 = Moderate Barrier, 4 = Major Barrier, 5 = Critical Barrier

C1. Insufficient financial resources for ICT investment

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C2. Lack of ICT infrastructure (hardware, software, networks)

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C3. Limited ICT skills and competencies among staff

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C4. Resistance to change from employees

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C5. Inadequate top management support for ICT initiatives

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C6. Poor internet connectivity and bandwidth limitations

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C7. Lack of clear ICT strategy and policies

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C8. Cybersecurity concerns and data protection issues

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C9. Inadequate training and capacity building programs

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C10. Frequent power outages affecting ICT operations

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

C11. In your opinion, what is the MOST significant barrier to ICT adoption at ZESA? (Tick ONE)

[ ] Financial constraints

[ ] Skills gap

[ ] Poor infrastructure

[ ] Management support

[ ] Resistance to change

[ ] Other (specify): ______________________

Section D: Impact Of ICT Adoption

Instructions: Please indicate your level of agreement with the following statements.

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree

Operational Efficiency

D1. ICT adoption has reduced processing time for tasks

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D2. ICT systems have improved workflow coordination

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D3. Automation has reduced manual errors in operations

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D4. ICT has enhanced information sharing across departments

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

Revenue Collection

D5. Digital payment platforms have increased revenue collection

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D6. Automated billing systems have reduced billing errors

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D7. ICT systems have reduced revenue leakages

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

Service Delivery

D8. ICT has improved response time to customer complaints

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D9. Digital channels have enhanced customer communication

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D10. ICT systems have improved fault detection and resolution

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

D11. Overall, how has ICT adoption impacted ZESA's performance? (Tick one)

[ ] Very Negative Impact

[ ] Negative Impact

[ ] Neutral/No Impact

[ ] Positive Impact

[ ] Very Positive Impact

Section E: Strategies For Enhancing ICT Adoption

Instructions: Please rate the importance of each strategy for improving ICT adoption.

Scale: 1 = Not Important, 2 = Slightly Important, 3 = Moderately Important, 4 = Important, 5 = Very Important

E1. Increase budget allocation for ICT infrastructure

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

E2. Develop comprehensive ICT training programs for staff

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

E3. Establish a clear ICT strategy and implementation roadmap

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

E4. Strengthen top management commitment to digital transformation

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

E5. Upgrade internet connectivity and network infrastructure

[ ] 1 [ ] 2 [ ] 3 [ ] 4 [ ] 5

E6. Implement change management programs to reduce resistance

[ ] 1   [ ] 2   [ ] 3   [ ] 4   [ ] 5

E7. Develop robust cybersecurity policies and frameworks

[ ] 1   [ ] 2   [ ] 3   [ ] 4   [ ] 5

E8. How willing are you to embrace new ICT technologies in your work? (Tick one)

[ ] Very Unwilling

[ ] Unwilling

[ ] Neutral

[ ] Willing

[ ] Very Willing

E9. Have you received any ICT training in the past 12 months? (Tick one)

[ ] Yes

[ ] No

E10. Please provide any additional suggestions for improving ICT adoption at ZESA:

THANK YOU VERY MUCH FOR YOUR PARTICIPATION

Your responses are valuable to this research and will contribute to improving ICT adoption at ZESA Holdings.

APPENDIX 4: Semi-Structured Interview Guide

ICT Adoption at ZESA Holdings

Duration: 20 - 30 minutes

INTERVIEW DETAILS

Interviewee Code: ____________________

Date of Interview: ____________________

Time of Interview: ____________________

Position of Interviewee: ________________

Department of Interviewee: _____________

Introduction Script

"Good morning/afternoon. Thank you for agreeing to participate in this research study. I am conducting research on ICT adoption and digital transformation at ZESA Holdings.

This interview will take approximately 20-30 minutes. Your participation is voluntary, and all responses will be kept strictly confidential. Your identity will be anonymized in the research report.

With your permission, I would like to audio record this interview for accuracy. The recording will be destroyed after transcription.

Do you consent to participate and to have this interview recorded?"

Section A: Background Information (5 Minutes)

1. Please describe your role at ZESA and how you interact with ICT systems in your work.

2. What ICT tools or systems do you use in your typical workday?

Section B: Current Level of ICT Adoption (8 Minutes)

3. How would you describe the current state of ICT adoption in your department?

Follow Up: Which specific technologies or systems are being used?

Follow Up: How consistently are they used?

4. In your view, which areas of ZESA have adopted ICT most successfully? Why do you think that is?

Follow Up: Can you give specific examples?

5. Where does ZESA lag behind in ICT adoption?

Follow Up: What are the consequences of low adoption in those areas?

6. Can you walk me through how a typical process (such as billing, customer complaints, or maintenance) is handled using current ICT systems?

Follow Up: What works well in the process?

Follow Up: Where do you see inefficiencies?

Section C: Barriers And Challenges to ICT Adoption (10 Minutes)

7. What do you consider the biggest challenges ZESA faces in adopting ICT systems?

Follow Up: Can you identify the top three barriers?

Follow Up: Why are these the most significant?

8. How do financial constraints affect ICT investments at ZESA?

Follow Up: How are ICT budgets allocated?

Follow Up: Are there competing priorities that limit ICT funding?

9. How would you describe the ICT skills level of staff at ZESA?

Follow Up: Are there specific skill gaps you have observed?

Follow Up: How adequate is the training provided?

10. In your experience, how do employees typically respond to new technology implementations?

Follow Up: Can you share a specific example of resistance or acceptance?

Follow Up: What drives resistance, if any?

11. How would you characterize top management's support for ICT initiatives?

Follow Up: Are ICT projects prioritized at the executive level?

Follow Up: Is there a clear vision for digital transformation from leadership?

12. What infrastructure challenges does ZESA face that affect ICT adoption?

Follow Up: Issues with internet connectivity, power supply, hardware?

Follow Up: How do these infrastructure issues impact daily operations?

Section D: Impact of ICT Adoption (10 Minutes)

13. How has ICT adoption affected operational efficiency in your department or at ZESA overall?

Follow Up: Can you give concrete examples of improvements or challenges?

Follow Up: What processes have become more efficient?

14. Can you share a specific success story where ICT significantly improved operations?

Follow Up: What was the situation before ICT implementation?

Follow Up: What changed afterward?

Follow Up: What were the measurable outcomes?

15. How has ICT adoption impacted revenue collection at ZESA?

Follow Up: Changes in billing accuracy, payment processing, debt management?

Follow Up: Can you quantify any improvements?

16. How has ICT adoption affected customer service delivery at ZESA?

Follow Up: Changes in response times, accessibility, quality of service?

Follow Up: What feedback have you received from customers?

17. Overall, would you say ICT adoption has had a positive or negative impact on ZESA's performance and why?

Follow Up: What evidence or indicators support your assessment?

Section E: Strategies For Enhancing ICT Adoption (10 Minutes)

18. What do you think ZESA needs to do to improve ICT adoption going forward?

Follow Up: What are the short-term priorities versus long-term vision?

Follow Up: Are there any quick wins that could be achieved?

19. What kind of support would you need to better utilize ICT in your role?

Follow Up: Training, tools, resources, management support?

20. How can ZESA overcome resistance to technological change?

Follow Up: What change management approaches would work?

Follow Up: What role should leadership play?

21. In your view, what should be ZESA's ICT priorities for the next 3-5 years?

Follow Up: Which systems or capabilities are most critical?

Follow Up: How should priorities be sequenced?

22. If you were in charge of ICT strategy at ZESA, what would be your first three actions?

Follow Up: Why these specific actions?

Follow Up: What outcomes would you expect?

Section F: Closing

23. Is there anything important about ICT adoption at ZESA that we have not discussed but you think I should know?

Closing Script

"Thank you very much for your time and valuable insights. Your perspectives will contribute significantly to understanding ICT adoption at ZESA and developing recommendations for improvement.

As mentioned, all your responses will be kept confidential and your identity will be anonymized in any reports or publications.

Would you like to receive a summary of the research findings once completed?"

Post-Interview Notes

Key observations:

____

Notable quotes or themes:

____

Follow-up required:

____