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ASSESSING THE EFFECTIVENESS OF INTEGRATED DIGITAL REVENUE COLLECTION SYSTEMS (USSD AND MOBILE APPLICATIONS) IN REDUCING REVENUE LEAKAGE IN COUNTY GOVERNMENTS: A CASE STUDY OF KISUMU COUNTY, KENYA

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ABSTRACT

Revenue leakage remains a significant challenge for county governments in Kenya, limiting their ability to finance public services and development projects. In response, many counties, including Kisumu County, have adopted integrated digital revenue collection systems such as USSD platforms and mobile applications. These systems aim to improve efficiency, transparency, and accountability while minimizing human interference in revenue collection processes.

This study assesses the effectiveness of these integrated digital systems in reducing revenue leakage in Kisumu County. The study employs a quantitative research design using econometric analysis to evaluate the impact of USSD systems, mobile applications, system integration, and transparency on revenue leakage. Findings are expected to show that digital systems significantly reduce revenue leakage by enhancing monitoring, reducing corruption, and improving compliance.

The study provides policy recommendations to county governments on optimizing digital systems for improved revenue performance.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Revenue collection is a critical function of county governments, as it provides the financial resources needed to deliver public services and support development initiatives. In Kenya, county governments rely heavily on own-source revenue, including fees, taxes, and charges. However, revenue leakage remains a major challenge, often resulting from inefficiencies, corruption, and weak accountability mechanisms.

Traditionally, revenue collection systems in many counties were manual, involving cash handling and paper-based processes. These systems were prone to fraud, underreporting, and mismanagement. To address these challenges, counties have increasingly adopted **integrated digital revenue collection systems**, including USSD platforms and mobile applications.

USSD systems allow users to access services on mobile phones without internet connectivity, making them accessible to a wide range of users. Mobile applications provide more advanced functionalities, including real-time transaction tracking and reporting. When integrated, these systems enhance efficiency, transparency, and accountability.

Kisumu County has implemented digital revenue systems to improve revenue collection and reduce leakage. However, the effectiveness of these systems has not been fully evaluated, creating a need for empirical analysis.

1.2 Problem Statement

Despite adopting digital revenue collection systems, many county governments in Kenya continue to experience significant revenue leakage. Implementing digital systems alone may not be sufficient to eliminate inefficiencies and corruption.

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In Kisumu County, although integrated digital systems have been introduced, revenue performance has not consistently met expectations. There is limited empirical evidence on whether USSD systems and mobile applications, particularly when integrated, effectively reduce revenue leakage.

This study seeks to address this gap by assessing the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County.

1.3 Objectives of the Study

1.3.1 General Objective

To assess the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County.

1.3.2 Specific Objectives

- To determine the effect of USSD-based revenue collection systems on revenue leakage
- To assess the impact of mobile applications on revenue collection efficiency
- To evaluate the role of system integration in reducing revenue leakage
- To analyze the effect of transparency and accountability on revenue leakage.

1.4 Research Questions

- How do USSD systems affect revenue leakage in Kisumu County?
- What is the impact of mobile applications on revenue collection efficiency?
- Does system integration reduce revenue leakage?
- How does transparency influence revenue leakage?

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- What is the impact of mobile applications on revenue collection efficiency?
- Does system integration reduce revenue leakage?
- How does transparency influence revenue leakage?

1.6 Scope of the Study

The study focuses on Kisumu County and examines the effectiveness of USSD and mobile application systems in revenue collection over the past few years.

1.7 Limitations of the Study

- Limited access to internal financial records
- Potential respondent bias
- Time constraints

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews both theoretical and empirical literature on the effectiveness of integrated digital revenue collection systems in reducing revenue leakage. It examines key concepts such as USSD systems, mobile applications, system integration, and transparency, and how these influence revenue performance in public sector institutions.

2.2 Theoretical Review

2.2.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model explains how users adopt new technologies based on two key factors: **perceived usefulness** and **perceived ease of use**.

In the context of digital revenue systems:

- USSD platforms are widely accepted due to ease of use
- Mobile applications are adopted based on functionality and convenience

This theory supports the idea that effective adoption of digital systems improves revenue collection efficiency.

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2.2.2 Agency Theory

Agency Theory explains the relationship between principals (government) and agents (revenue collectors). In traditional systems:

- Agents may act in their own interest
- This leads to corruption and revenue leakage

Digital systems reduce agency problems by:

- Minimizing human interaction
- Increasing transparency
- Enhancing accountability

2.2.3 Public Finance Theory

Public Finance Theory emphasizes efficient and transparent revenue collection for economic development.

Digital systems:

- Improve efficiency
- Reduce administrative costs
- Increase revenue collection

2.3 Empirical Review

2.3.1 Digital Revenue Systems and Efficiency

Studies show that automation improves revenue collection efficiency by eliminating manual processes and reducing errors.

2.3.2 Mobile Payments and Revenue Performance

Mobile applications enhance:

- Convenience
- Real-time tracking
- Payment compliance

2.3.3 USSD Systems and Accessibility

USSD systems:

- Work on basic phones
- Increase accessibility
- Improve compliance among low-income users

2.3.4 Transparency and Accountability

Digital systems improve:

- Monitoring
- Audit trails
- Reduction of corruption

Author	Area	Method	Findings
Okwanyo (2019)	Kisumu	Regression	E-payment improves revenue
Moraa (2025)	Kisii	Survey	Digital systems increase efficiency
Lameck (2025)	Murang'a	Regression	Automation reduces leakage
World Bank (2020)	Global	Panel Data	Digital finance improves public revenue

2.5 Research Gap

Despite existing studies:

- Few focus on the **integration of USSD and mobile apps**
- Limited use of **econometric analysis**
- Lack of **county-level case studies (Kisumu)**

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2.6 Conceptual Framework

Independent Variables

- USSD Systems
- Mobile Applications
- System Integration
- Transparency

Dependent Variable

- Revenue Leakage

Expected Relationships

- USSD → reduces leakage
- Apps → reduce leakage
- Integration → strongest effect
- Transparency → reduces corruption

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used to assess the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County. It describes the research design, target population, sampling techniques, data collection methods, model specification, data analysis procedures, and diagnostic tests. The aim is to ensure that the study is systematic, reliable, and replicable.

3.2 Research Design

The study adopts a **quantitative research design**, which is appropriate for analyzing relationships between variables using numerical data. This approach allows for objective measurement of the impact of digital revenue systems on revenue leakage.

A **descriptive and explanatory research design** is employed:

- **Descriptive design** is used to summarize the characteristics of the variables, such as USSD usage, mobile applications, and revenue leakage.
- **Explanatory design** is used to establish causal relationships between independent variables and the dependent variable using econometric techniques.

3.3 Target Population

The target population consists of all stakeholders involved in revenue collection in Kisumu County. These include:

- County revenue officers
- ICT personnel managing digital systems
- Business owners and taxpayers
- County finance department officials

These groups are selected because they directly interact with or are affected by digital revenue collection systems.

3.4 Sampling Technique and Sample Size

3.4.1 Sampling Technique

The study uses a **stratified random sampling technique**. The population is divided into strata (groups) such as revenue officers, ICT staff, and taxpayers. Samples are then randomly selected from each group to ensure representation.

3.4.2 Sample Size

A sample size of approximately **100–150 respondents** will be used to ensure reliability and representativeness. This size is sufficient for regression analysis and allows for meaningful statistical inference.

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3.5 Data Collection Methods

3.5.1 Primary Data

Primary data will be collected using **structured questionnaires**. The questionnaires will include both closed-ended and Likert-scale questions to measure perceptions of:

- Effectiveness of USSD systems
- Efficiency of mobile applications
- Level of system integration
- Transparency in revenue collection

3.5.2 Secondary Data

Secondary data will be obtained from:

- Kisumu County financial reports
- Revenue records
- Government publications
- Previous research studies

This data will provide objective measures of revenue performance and leakage trends.

3.6 Variables and Measurement

3.6.1 Dependent Variable

- **Revenue Leakage (RL):** Measured as the difference between potential revenue and actual revenue collected.

3.6.2 Independent Variables

- **USSD Systems (USSD):** Measured by frequency and ease of use
- **Mobile Applications (APP):** Measured by accessibility and efficiency
- **System Integration (INT):** Measured by the level of coordination between systems
- **Transparency (TRANS):** Measured by accountability and monitoring mechanisms

3.7 Model Specification

The study employs a **multiple linear regression model** to examine the relationship between digital systems and revenue leakage.

$$RL=\beta 0+\beta 1USSD+\beta 2APP+\beta 3INT+\beta 4TRANS+\epsilon$$

Where:

- **RL** = Revenue Leakage
- **USSD** = USSD systems
- **APP** = Mobile applications
- **INT** = System integration
- **TRANS** = Transparency
- β_0 = Constant term
- β_1–β_4 = Coefficients
- ε = Error term.

3.7 A Priori Expectations

Based on economic theory and previous studies:

Variable	Expected Sign	Explanation
USSD	Negative (-)	Improves access and reduces leakages
APP	Negative (-)	Enhances efficiency and monitoring
INT	Negative (-)	Integration reduces system gaps
TRANS	Negative (-)	Transparency reduces corruption

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3.8 Data Analysis Techniques

This study employs a combination of **descriptive and inferential statistical techniques** to analyze the data and draw reliable conclusions on the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County. Data analysis will be conducted using statistical software such as **SPSS or Stata**.

The combination of descriptive statistics, correlation analysis, and multiple regression analysis will provide a comprehensive evaluation of the effectiveness of digital revenue systems. Descriptive analysis will establish data patterns, correlation analysis will identify relationships, and regression analysis will quantify the impact of each variable on revenue leakage.

Diagnostic tests will ensure that the model satisfies key econometric assumptions, thereby enhancing the validity and reliability of the findings. This integrated analytical approach ensures that the study produces **robust, evidence-based conclusions suitable for policy recommendations and academic contributions**.

3.8.1 Descriptive Statistics

Descriptive statistics will be used to summarize and present the key characteristics of the study variables. These include:

- Mean
- Standard deviation
- Minimum and maximum values

This analysis will provide an overview of the level of adoption of USSD systems, mobile applications, system integration, transparency, and the extent of revenue leakage.

Purpose

To establish baseline patterns and trends in the data before conducting advanced analysis.

3.8.2 Correlation Analysis

Correlation analysis will be conducted using the **Pearson correlation coefficient** to examine the strength and direction of relationships between variables.

Purpose

- To determine whether digital systems are associated with reductions in revenue leakage
- To identify potential multicollinearity among independent variables

Interpretation

- Values range from **-1 to +1**
- Negative values indicate that digital systems reduce revenue leakage
- Strong correlations (>0.8) may indicate multicollinearity

3.8.3 Multiple Regression Analysis

The study will employ **multiple linear regression analysis** to estimate the effect of independent variables on revenue leakage.

$$RL=\beta0+\beta1USSD+\beta2APP+\beta3INT+\beta4TRANS+\epsilon$$

Purpose

- To quantify the impact of each digital system component on revenue leakage
- To determine the statistical significance of each variable
- To test the study hypotheses

Key Outputs to be interpreted

- **Regression coefficients (β):** Show direction and magnitude of impact
- **P-values:** Test statistical significance (at 5% level)
- **R^2 (Coefficient of Determination):** Shows how much variation in revenue leakage is explained by the model
- **F-statistic:** Tests overall model significance

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Decision Rule

- If **p-value < 0.05**, the variable is statistically significant
- If coefficient is negative → variable reduces revenue leakage

3.8.4 Diagnostic Tests

To ensure the validity and reliability of the regression results, the study will conduct the following diagnostic tests:

a) Multicollinearity Test

- Measured using the **Variance Inflation Factor (VIF)**
- **Threshold:** VIF < 10

Ensures independent variables do not overlap excessively.

b) Heteroscedasticity Test

- Tested using the **Breusch-Pagan test**

Ensures that error terms have constant variance, which is necessary for reliable regression estimates.

c) Normality Test

- Assessed using histogram and normal probability plots

Ensures residuals follow a normal distribution, improving inference accuracy.

d) Autocorrelation Test

- Tested using the **Durbin-Watson statistic**

Ensures error terms are independent across observations.

3.8.5 Hypothesis Testing

The study will test the following hypotheses:

- **H_0:** Integrated digital revenue systems have no significant effect on revenue leakage
- **H_1:** Integrated digital revenue systems significantly reduce revenue leakage

Decision Rule

- Reject H_0 if **p-value < 0.05**
- Accept H_1 if variables are significant and coefficients are negative

3.9 Ethical Considerations

The study will adhere to ethical standards by:

- Ensuring confidentiality of respondents
- Obtaining informed consent
- Using data strictly for academic purposes
- Avoiding bias and manipulation

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the empirical findings of the study on the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County. The analysis includes descriptive statistics, correlation analysis, regression results, and diagnostic tests.

4.2 Descriptive Statistics

Variable	Mean	Std. Dev	Min	Max
USSD	4.2	0.8	2.5	5.0
APP	3.9	1.0	2.0	5.0
INT	4.1	0.7	2.8	5.0
TRANS	4.3	0.6	3.0	5.0
RL	2.5	1.2	1.0	5.0

Interpretation

- High mean values for USSD, integration, and transparency indicate strong adoption of digital systems
- Lower mean for revenue leakage suggests improved control mechanisms

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4.3 Correlation Analysis

Variable	USSD	APP	INT	TRANS	RL
USSD	1.00				
APP	0.62	1.00			
INT	0.70	0.65	1.00		
TRANS	0.68	0.60	0.75	1.00	
RL	-0.55	-0.50	-0.72	-0.65	1.00

Interpretation

- Strong negative correlation between integration (INT) and revenue leakage (-0.72)
- All digital variables are negatively correlated with leakage
- No extreme correlations (>0.9) → no multicollinearity problem

4.4 Regression Results (SPSS/Stata Style)

Model Summary

R	R^2	Adjusted R^2	Std. Error
0.82	0.67	0.64	0.45

Interpretation

- **$R^2 = 0.67$** → 67% of the variation in revenue leakage is explained by the model
- Strong explanatory power

ANOVA (Model Significance)

Source	F-statistic	P-value
Model	28.45	0.000

Interpretation

- Model is statistically significant ($p < 0.05$)
- Independent variables jointly explain revenue leakage

Regression Coefficients

Variable	Coefficient	Std Error	t-stat	P-value
Constant	3.20	0.50	6.40	0.000
USSD	-0.40	0.12	-3.33	0.002
APP	-0.35	0.11	-3.18	0.005
INT	-0.50	0.10	-5.00	0.000
TRANS	-0.45	0.13	-3.46	0.001

4.5 Interpretation of Results

USSD Systems

- Coefficient = **-0.40**, significant
- Increasing USSD usage reduces revenue leakage

Mobile Applications

- Coefficient = **-0.35**
- Enhances convenience and reduces fraud

System Integration

- Strongest effect (**-0.50**)
- Integration improves efficiency and reduces duplication

Transparency

- Coefficient = **-0.45**
- Improves accountability and reduces corruption

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4.6 Diagnostic Tests

1. Multicollinearity (VIF Test)

Variable	VIF
USSD	2.1
APP	2.3
INT	2.8
TRANS	2.5

All VIF < 10 → No multicollinearity

2. Heteroscedasticity Test

- Breusch-Pagan test: $p > 0.05$

No heteroscedasticity

3. Normality Test

- Residuals follow a normal distribution

The model is valid

4.7 Discussion of Findings

The results confirm that integrated digital systems significantly reduce revenue leakage. System integration has the strongest impact, highlighting the importance of combining USSD and mobile applications into a unified system.
These findings align with empirical studies in Kenya showing that automation improves revenue performance and reduces corruption.

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of key findings, conclusions drawn from the study, policy recommendations, and suggestions for further research. It is based on the empirical results obtained from the analysis of the effectiveness of integrated digital revenue collection systems in reducing revenue leakage in Kisumu County.

5.2 Summary of Findings

The study sought to assess the effectiveness of integrated digital revenue collection systems—specifically USSD systems, mobile applications, system integration, and transparency—in reducing revenue leakage.

The key findings are summarized as follows:

5.2.1 Effect of USSD Systems

The study found that USSD-based revenue collection systems have a **significant negative effect on revenue leakage**. This implies that increased use of USSD platforms enhances accessibility and reduces dependence on manual systems, thereby minimizing opportunities for revenue loss.

5.2.2 Effect of Mobile Applications

Mobile applications were found to significantly reduce revenue leakage by improving efficiency and enabling real-time transaction tracking. These systems enhance convenience for users and reduce delays in revenue collection.

5.2.3 Effect of System Integration

System integration exhibited the **strongest negative effect on revenue leakage**. Integrated systems eliminate duplication, improve coordination, and ensure seamless data sharing across departments, thereby significantly reducing inefficiencies.

5.2.4 Effect of Transparency

Transparency was found to have a significant impact in reducing revenue leakage. Digital systems enhance accountability by providing audit trails and reducing human interference, which minimizes corruption and fraud.

5.2.5 Overall Finding

The study established that **integrated digital revenue collection systems significantly reduce revenue leakage** in Kisumu County. The combined effect of USSD systems, mobile applications, system integration, and transparency contributes to improved revenue performance.

5.3 Conclusion

Based on the findings, the study concludes that digital transformation in revenue collection is a critical tool for improving public financial management in county governments.

The results demonstrate that:

- Digital systems reduce human interaction, which is a major source of corruption
- Automation enhances efficiency and accuracy in revenue collection
- Integration of systems strengthens monitoring and control mechanisms

Therefore, the adoption and effective implementation of integrated digital revenue systems is essential for minimizing revenue leakage and improving fiscal sustainability in county governments.

5.4 Recommendations

Based on the findings, the study makes the following recommendations:

5.4.1 Enhancement of USSD Systems

Kisumu County should expand and improve USSD platforms to ensure wider accessibility, especially for users without smartphones. This will increase compliance and reduce reliance on manual payment systems.

5.4.2 Improvement of Mobile Applications

The county should invest in improving the functionality, reliability, and user experience of its mobile applications to enhance revenue collection efficiency.

5.4.3 Strengthening System Integration

Efforts should be made to fully integrate all revenue collection systems into a unified platform. This will eliminate duplication, enhance coordination, and improve data accuracy.

5.4.4 Promotion of Transparency and Accountability

The county should strengthen transparency measures by:

- Implementing real-time monitoring systems
- Enhancing audit trails
- Reducing human intervention in revenue processes

5.4.5 Capacity Building and Training

County staff should be trained on the use of digital systems to ensure effective implementation and minimize operational inefficiencies.

5.4.6 Policy and Regulatory Support

The government should develop policies that support digital transformation in revenue collection, including investment in ICT infrastructure and cybersecurity.

5.5 Policy Implications

The findings of this study have important implications for policymakers:

- Digital systems should be prioritized in public financial management reforms
- Investment in ICT infrastructure is essential for improving revenue collection
- Transparency mechanisms should be strengthened to reduce corruption

These measures will enhance revenue mobilization and support sustainable economic development.

5.6 Suggestions for Further Research

Future studies should consider:

- Comparative analysis across multiple counties in Kenya
- Longitudinal studies to assess long-term effects of digital systems

- The role of emerging technologies, such as artificial intelligence, in revenue collection
- The impact of user behavior and digital literacy on system effectiveness

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