THE IMPACT OF METERING AND BILLING REVENUE SYSTEMS ON REVENUE COLLECTION IN PUBLIC WATER COMPANIES

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ABSTRACT

The following specific objective guided the study: to evaluate the impact of the Metering and Billing Revenue Systems on Revenue Collection in Public Water Companies. The study was grounded in stakeholder theory and economic theory. The study adopted a mixed research design. A sample size of 500 was drawn from a target population of 1,000 respondents. A stratified sampling technique was applied. The study used questionnaires as the primary research instrument. Reliability and validity were tested using Cronbach's alpha and the Kaiser-Meyer-Olkin measure, respectively. Data were analyzed using descriptive and inferential statistics. The Statistical Package for Social Sciences (IBM SPSS version 20) was used for data analysis, and the results were presented in tables and graphical formats. Descriptive statistics had an average mean of 4.09 and a Standard Deviation of 0.960. Using frequency of agreement, 77.03% agreed that non-revenue water was a financial determinant of revenue collection. 6.7% of respondents were not sure. while 7.08% disagreed. Inferential statistics findings indicated a Coefficient of Determination of 0.587**, a significant level of 0.000, implying a strong positive correlation between metering and billing revenue systems and revenue collection in public water companies. A p-value of 0.000, which is less than 0.005, indicates that metering and billing revenue systems have an impact on revenue collection in public water companies. The study recommended that public water Companies should monitor and address metering and billing issues, especially meter installation, meter types, data input into the system, technological compatibility, data loggers at conversion of customer demand and supplies. The study suggests further investigations on connections of meters at service points, pressure measurements on transmission lines, and customer connection points to be done, and that the management teams should set the internal controls and risk management systems in relation to metering and billing revenue systems, and water management intensification for increased revenue collection in public water companies.

Key words: Unauthorized and Unmetered Consumption, Metering and Invoicing of Customers, Wrong Meter Readings, Control of Leakage, Revenue Growth, Reduced Bad Debts, Improved Liquidity.

INTRODUCTION

Globally, the shift toward smart metering is seen as a strategic investment in utility modernization. Countries are increasingly adopting digital solutions. Water companies have made notable strides, but disparities in the implementation of digital solutions and customer engagement remain significant. Smart metering and digital billing are game-changers for utility companies worldwide. By automating data collection and billing processes, these systems help

reduce human error, improve transparency, and ensure that revenue doesn't slip through the cracks. Walsh (2025) explained that utilities that adopt smart meters often see a noticeable boost in operational efficiency and financial performance, thanks to more accurate consumption tracking and streamlined billing. Smart metering has been recognized for its potential to enhance billing accuracy and improve financial performance (Orenstein, 2023; World Bank, 2020). However, the implementation of these technologies in developing contexts remains uneven. Utilities have made strides in digital billing revenue systems, yet infrastructural limitations, low technical literacy, and fragmented institutional support continue to hinder full adoption (Achieng, 2021; Muthoni, 2024).

Water service providers continue to struggle with revenue collection. Smart metering and digital billing platforms are beginning to change this picture by offering real-time monitoring, automated invoicing, and greater transparency between providers and customers. Companies like Mobi-Water and SchemeCloud supply meters that capture precise consumption data, helping utilities reduce billing errors and detect leaks early, while mobile money integration through M-Pesa makes it easier for households to pay on time. These innovations are reshaping the sector, but many regions still rely on old mechanical meters, leaving them vulnerable to inaccuracies and revenue losses.

The lack of standardized data protocols and the high cost of smart metering remain major barriers, especially in rural and low-income areas where affordability and accessibility are limited. Without uniform systems, utilities struggle to ensure fair billing and optimize water distribution, perpetuating inefficiencies and financial strain. Yet, when implemented effectively, accurate metering and transparent billing do more than cut costs—they strengthen financial sustainability, reduce fraud, and build customer trust. As Xylem "every drop you distribute is delivered and accounted for" is not just a technical goal but a foundation for reliable service, stronger infrastructure investment, and greater satisfaction among communities.

Outdated metering systems, a manual billing revenue system, and weak customer engagement have led to frequent errors, delayed payments, and declining trust in water companies. These challenges are compounded by poor regulatory enforcement and limited investment in metering infrastructure, leaving peri-urban areas particularly vulnerable. While mobile platforms like M-PESA, smart meters, and citizen-driven initiatives have improved billing accuracy and transparency in cities, rural and informal settlements continue to struggle with digital exclusion, weak infrastructure, and uneven policy enforcement. As K'Akumu noted, the unequal distribution of technological and institutional capacity undermines the inclusivity and sustainability of water sector reforms, often leaving marginalized communities behind.

This study aims to close that gap by examining how metering and billing systems directly affect revenue collection among peri-urban water providers. By blending institutional, technological, and behavioral perspectives, it seeks to uncover the root causes of revenue leakage and propose practical, context-specific solutions. The findings will not only strengthen financial sustainability but also empower utilities to improve service delivery, enhance liquidity, and

rebuild public confidence in the sector, making water governance more equitable and resilient for all.

Statement of the Problem

Globally, metering and billing revenue systems have been recognized as transformative tools for improving operational efficiency and billing accuracy (Orenstein, 2023; World Bank, 2020). Water reforms and interventions indicated that revenue collection and poor governance remain obstacles to accessing water in urban areas. Revenue collection in water companies faces challenges of inadequate bulk metering, insufficient control of unaccounted-for water, illegal connections, and billing problems.

The implementation of such technologies remains uneven, with peri-urban and rural areas still relying on outdated manual systems (Kihumba, 2018; Mulewa & Kaplelach, 2024). These disparities contribute to billing errors, delayed payments, and limited financial planning among water service providers. Institutional barriers such as inadequate regulatory enforcement, limited technical capacity, and low consumer awareness further exacerbate the problem (Njoroge, 2023; Muthoni, 2024). While mobile payment platforms like M-PESA have improved convenience and reduced arrears, their integration with metering systems is often fragmented and lacks real-time feedback mechanisms (United States Agency for International Development, 2019; Achieng, 2021).

The existing literature has primarily focused on urban utilities and technological adoption, with limited empirical studies examining the direct relationship between metering accuracy, billing transparency, and revenue collection outcomes in peri-urban settings. There is a need for localized research that evaluates the effectiveness of current metering and billing practices and their impact on financial performance in water utilities. For this reason, the study investigated the extent to which metering and billing systems influence revenue collection among water service providers. The study examined the institutional, technological, and behavioral factors that contribute to the relationship development of a more integrated and sustainable revenue management framework.

Specific Objectives

To evaluate the impact of Metering and Billing Revenue Systems on Revenue Collection in Public Water Companies.

Hypotheses of the Study

H_{10}: Metering and Billing Revenue Systems have no significant impact on Revenue collection in Public Water Companies.

H_{02}: Moderating variables have no significant impact on Revenue Collection in Public Water Companies.

Significance of the Study

Public water companies face ongoing financial strain, much of it tied to outdated metering and billing Revenue Systems practices that weaken revenue collection and limit investment in

infrastructure. Studies highlight that financial health in utilities depends not only on external funding but also on internal efficiency, with improved billing systems, diversified revenue streams, and stronger controls proving effective in Water and Sewerage Companies. This research identifies metering and billing revenue systems as central levers for financial sustainability, showing how manual data entry, inaccurate records, and delayed invoicing have historically led to underbilling and revenue leakage. These inefficiencies erode trust, restrict service expansion, and undermine the resilience of Water Service Providers, making reform both urgent and necessary.

Smart metering and digital billing revenue systems platforms, such as those offered by Mobi-Water and SchemeCloud, present a promising path forward by enabling real-time monitoring, accurate consumption tracking, and seamless integration with mobile payment systems like M-PESA. These innovations not only streamline operations but also empower consumers with transparent, accessible tools, reinforcing accountability and trust. Yet, systemic barriers ranging from infrastructure gaps and high costs to limited digital literacy and uneven regulation continue to slow adoption, especially in rural and informal settlements. By advocating for targeted investments, stronger regulatory frameworks, and capacity building, this study contributes to shaping equitable, sustainable water governance, ensuring that every drop delivered is accounted for and that utilities can thrive financially while serving communities more reliably.

LITERATURE REVIEW

Introduction

The chapter represents an empirical review of literature relevant to the study alongside theoretical guidelines that discussed Stakeholder Theory, underscoring the need to engage all actors,government agencies, consumers, and regulators ,in shaping utility reforms. It posits that inclusive decision-making leads to more sustainable and socially accepted outcomes (Freeman, 1984). Economic theories of revenue collection, including the principles of price elasticity and marginal-cost pricing, provide insights into how tariff structures influence consumer behavior and utility income. These theories support the adoption of volumetric billing to better align consumption with cost recovery goals (Nauges & Whittington, 2010)

Theories serve as structured frameworks that explain relationships between variables and guide inquiry across disciplines. According to Kamayu, Namusonge, and Bichanga (2015), a theory is defined as a system of ideas formulated to explain phenomena, particularly when grounded in general principles that can be tested and applied. Their work emphasizes the role of theory in shaping research design and interpreting complex organizational dynamics. Beckett (2006) supports this view by highlighting that theories not only offer explanatory power but also serve as tools for integrating knowledge across contexts. Revenue collection in public water companies draws upon numerous financial, economic, and corporate management theories. The relevant theories explained the variables explored, indicating the existing studies and their conclusions.

Stakeholder Theory

The adoption of smart metering and digital billing systems in public water utilities is not merely a technical upgrade; it reflects a deeper interplay of organizational, economic, and social dynamics. Stakeholder Theory, as articulated by Freeman and Phillips (2023), utilities must consider the interests of all actors involved, including customers, regulators, and local communities. In terms of metering and billing, it means designing systems that are transparent, inclusive, and responsive to stakeholder needs. Engaging stakeholders in the rollout of digital billing platforms has been shown to increase trust, reduce resistance, and enhance compliance, ultimately improving revenue collection (Tse, 2011). Finally, Mitchell et al. (2022) and Emerson (2011) provide tools for identifying and prioritizing stakeholders based on their influence and urgency.

Applying these frameworks helps utilities navigate the complex social landscape of the water sector, ensuring that reforms are both effective and equitable. Their influence is crucial in shaping the public water company`s decisions and outcomes. In the water sector, applying this theory helps ensure inclusive service delivery. It promotes trust and accountability in operations such as billing and metering. Stakeholder theory thus provides a relevant lens for understanding water utility management. Its use supports long-term sustainability and operational success. In the public water sector, stakeholders play a pivotal role in shaping the effectiveness of metering and billing systems, which are essential for sustainable service delivery and revenue collection. Stakeholder Theory, as articulated by Freeman et al. (2023), emphasizes that organizations must consider the interests of all relevant parties, not just shareholders, to achieve long-term success.

Conceptual framework

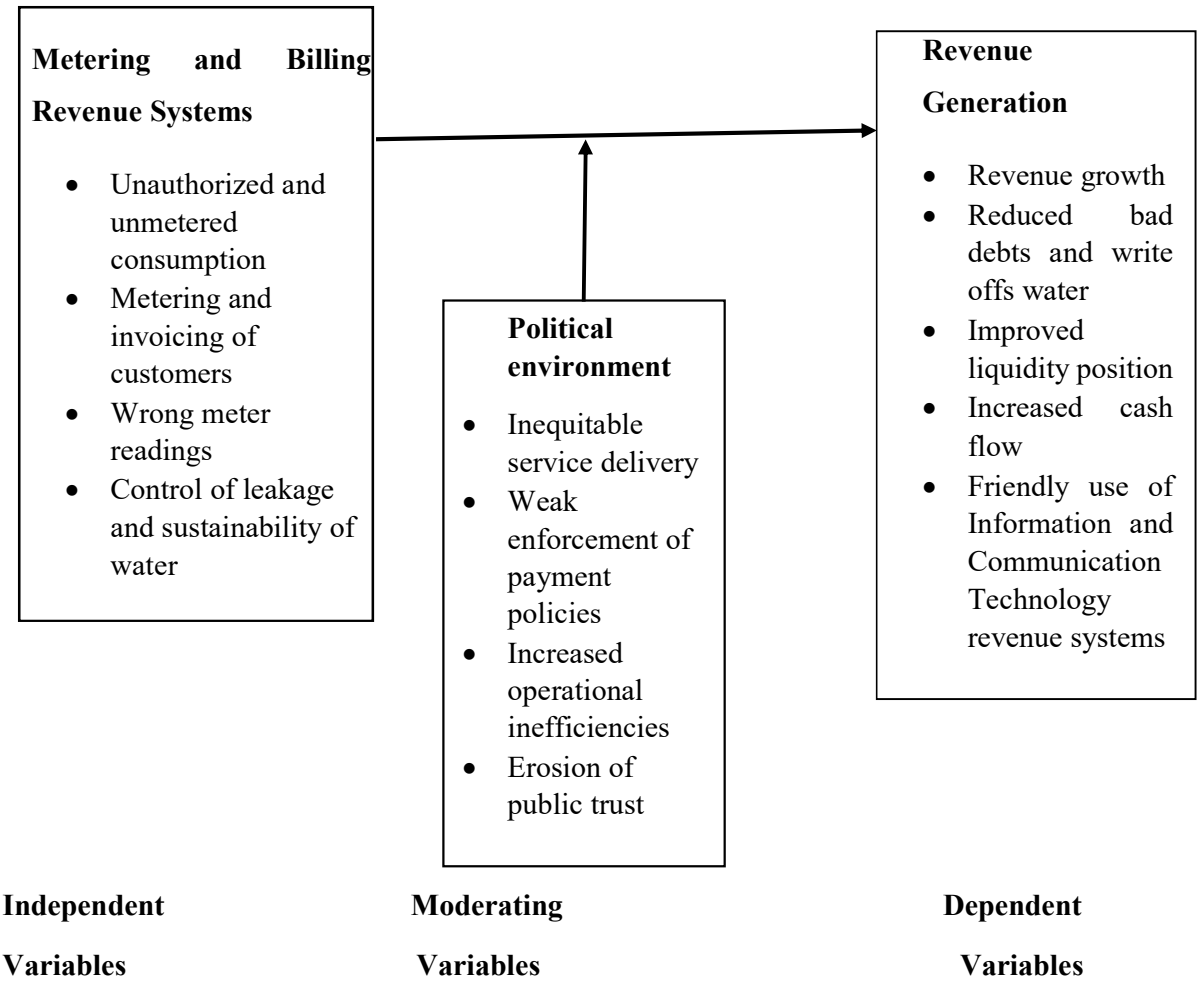
A conceptual framework serves as a structured lens through which researchers understand the relationships between variables. Guattari (1991) and Mwangi & Otieno (2023) define it as a network of interlinked concepts that collectively offer a comprehensive understanding of a phenomenon. These concepts reinforce one another, forming a coherent philosophical foundation for inquiry. Robson (2011) and Kamau Wambua (2024) emphasize that a conceptual framework also provides a diagrammatic representation of relationships among the study variables, clearly distinguishing independent variables (metering and billing) from the dependent variable (revenue collection). Empirical evidence from the water sector reveals significant financial strain among public utilities. For instance, a Water Company reportedly holds over USD 61.8 million in outstanding accounts receivable, which severely limits its ability to finance operational and capital expenditures (Water Services Regulatory Board, 2023; Karanja et al., 2024).

Mwangi & Mutiso (2024) highlight widespread complaints of overbilling and underbilling, which lead to customer dissatisfaction and payment refusal, directly harming revenue collection. Legal frameworks serve as key moderating factors in this situation. Kamau & Otieno (2023) point out that outdated legislation prevents water companies from writing off long-standing debts, even when buildings have been demolished or ownership has changed. Many of these debts are owed by county governments and public institutions, yet utilities lack

the legal power to enforce collection or adjust their records accordingly. Ndegwa & Mworia (2023) also identify county revenue bills as a consistent national issue. Although recent government measures have addressed the problem, it remains unresolved.

Political interference threatens effective utility management. Owino & Wanjiku (2024) report that water company executives often face pressure and threats when enforcing billing policies that conflict with political interests. This undermines institutional autonomy and weakens accountability mechanisms. Additionally, the Water Services Regulatory Board (2024) highlights the limited national budget allocations to water utilities, noting that grants are negligible compared to the sector's infrastructure and service delivery needs. Consequently, public water companies are compelled to rely heavily on internally generated revenue, making efficient metering and billing systems not just operational needs but strategic requirements for financial sustainability.

Figure 2.1: Conceptual frame work.



Empirical Literature Review

According to Kothari (2004), an empirical literature review involves the systematic examination of prior research studies that are similar in scope to the proposed investigation.

This process enables the researcher to identify existing data, methodologies, and theoretical frameworks that inform the operational aspects of the current study. The empirical literature review focused on scholarly discussions surrounding the financial determinants of revenue collection in public water companies. Previous research has highlighted critical factors such as infrastructure financing, internal controls, billing systems, and operational efficiency as key influences on financial sustainability.

Julius (2024) emphasized that infrastructure financing and operational efficiency are central to the financial sustainability of the water service providers. His findings suggest that without strategic investment in infrastructure and streamlined operations, utilities struggle to maintain liquidity and deliver reliable services, particularly in peri-urban regions where demand often exceeds capacity. Mulewa (2024) explored the impact of internal financial controls and billing systems on revenue generation. His study revealed that improvements in billing accuracy, financial planning, and revenue diversification significantly enhance the financial performance of public utilities. These insights are especially relevant for water companies facing challenges in customer compliance and payment recovery.

Research Gaps

A research gap refers to an area in a field of study that has not yet been explored or fully understood. It represents a weakness or missing piece of knowledge within the scientific literature or a need to test new methods, such as studying a completely new organism (Cooper, 2001). The paper aimed to identify gaps related to the financial determinants and revenue collection of public water companies (Current Author, 2025). This was effectively demonstrated through both quantitative and qualitative approaches. Empirical research by Farouk (2021) also supports this approach. A review of existing literature shows that no previous studies have specifically examined the financial determinants of revenue collection in public water companies (Current Author, 2025). For example, research by Foster et al. (2017), Xuan (2015), Imene (2020), and David (2017) provides limited information on this topic. Although similar research has been conducted, significant gaps remain, as outlined above. This study aims to address those gaps by focusing on areas such as metering and billing, which have received minimal research attention and few recommendations.

RESEARCH METHODOLOGY

Introduction

This chapter comprises Research Design, Target Population, Sample Size, Sampling Frame, Data Collection, Pilot study, and finally, methods for analyzing data and interpretations. Data validity, reliability and correlation between the dependent and independent variables were done using the ANOVA regression model.

Research Design

The study applied a Mixed Research Design which enables the researcher to explain the relationship between variables. The design is useful for formulating investigation issues (Kothari, 2006). The Research Design ensures that the evidence is obtained to effectively

address the research problem logically and unambiguously (De, 2001). It provides a framework for data collection and analysis (Chepcheng, 2018; Ngugi, 2014), and, as Schwandt (2005) noted, it establishes procedures for obtaining cases for study and determining how scores will be obtained. Ngugi (2014) agreed with Newing (2021), who stated that research design is embedded in the overall process of research methodology and structure. Similarly, Cooper (2001) emphasized that research design constitutes the blueprint for the collection, measurement, and analysis of data, aiding scientists in allocating limited resources by posing crucial choices.

Target Population

A target population is described as an entire group of individuals, events or objects with common observable characteristics (Chumo, 2013). (Lumley, 1994) states that the population target is a group the research wants to use in the research study to form an opinion on the study's findings. (Kothari, Research Methodology:Methods and techniques, 2004), defines population as all items in any field of inquiry and is also known as the universe. A population is described as the set of sampling units or cases that the researcher is interested in (Newing, 2011).

The research study targeted a population of 1000 respondents, drawn from Water and Sewerage Company staff and management, the Ministry of Water and Sanitation, the Water Service Regulatory Board, and professionals from the County. The main focus was on seven regions. The reasons behind selection of the target population is that Ministry of Water is the overall government ministry responsible for water management, Water Service Regulatory Board is responsible for regulations and Athi Water Service Board for licensing Water Service Providers and water management and unionized staff being the implementers of water and sewerage services which currently stand at 101 licensed water companies by (Current Author, 2025). The table below indicates the respondent groups in three categories. Refer to Table 3.1.
The selected group includes water regulators who finance water projects, employees, and consumers who make decisions on water and sewerage operations.

Table 3. 1: Target Population under Study

Cadres of groups	Target
Management, staff and union	850
Ministry of water and sanitation	50
Water Services Regulatory Board, Non-Governmental Organization, and professionals from the City Water and Sewerage Company	100
Total	**1000**

Sampling Frame

According to Memba (2011), a Sampling frame is a list of sampling units selected from a sampling frame. (Chumo, 2013) stated that the sampling frame is a list of elements from which a sample is drawn. A sampling frame is a list of all items in a representative sample (Nachmias, 2008). The sample frame consists of executive members from the Ministry of Water and Irrigation, the Water Service Board, County officials, City Water and Sewerage Company

Limited management and staff. The choice was due to limited resources in accessing the required data from the target group.

Sample Size and Technique

(Gerstman, 2003), states that a requirement for an appropriate sample size is first to declare an acceptable margin of error (€). The Cochran formula allows you to calculate an ideal sample size given a desired level of precision, desired confidence level, and the estimated proportion of the attribute present in the population. Cochran's formula is considered appropriate for large populations. It was established by William G. Cochran (Cochran, 1977) and presented as the following formula for a definite population target. The sample size (n) for a finite population for the study with a confidence of 95% at a maximum proportion of 50% Z= 1.96, while acceptable within an error margin of 0.0438 of the target population of 1000. As indicated in Table 3.2.

Cochran's formula for sample calculation

Cochran W, G, (1977) $n = \frac{Z^2 * P * (1-p)}{e\hat{}2}$

Where:

n- The sample size

Z- Z-score associated with the desired confidence level

P- The expected proportion or prevalence of the outcome or characteristic of interest in the population.

e- The margin of error, i.e., the maximum distance between the true population parameter and the sample size.

Table 3. 2: Sampling Frame

Cadres of staff	Target population	Sample size
Management, staff and union	850	425
Ministry of Water and Irrigation	50	25
Water Services Regulatory Board, and the Professionals of City Water and Sewerage Company	100	50
Total	**1000**	**500**

RESEARCH, FINDINGS AND DISCUSSIONS

Introduction

The study used descriptive statistics: frequency, mean, mode and standard deviation and measures of dispersion such as correlation coefficient, and presented in tabular form. Both qualitative and quantitative analyses were used to compile the findings. The Statistical Package for Social Statistics program was applied. The chapter also covers the inferential analysis of the study model called the logistic linear regression model.

Pilot Study Results

Below are the results for the pilot study tests on research instruments for both dependent and independent variables in determining reliability and validity. A logistic linear regression model

was run. Cronbach's alpha was used to determine the reliability of the questionnaires, and the Kaiser-Meyer Olkin test was used to test the validity of the research tools.
Additionally, the output of the diagnostic tests on Linearity, Normality, Multicollinearity, Autocorrelation, and Homoscedasticity for both dependent and independent variables. The independent variables, Kaiser–Meyer–Olkin test, Kolmogorov -Smirnov and Shapiro- Wilk tests, and Durbin-Watson were done as indicated in the tables;

Response Rate

The questionnaires were administered to 500 respondents. Only 487 respondents returned the questionnaires. The response rate was 97.4 percent, while 2.6 % did not return the questionnaire. The study was conducted in the following three cadres of staff in the Water and Sewerage/Sanitation management, staff and union, Ministry of Water and Irrigation and sanitation, Water Services Regulatory Board, World Bank and Professionals, from a population target of 1000 respondents, and a sample size of 500.

According to (Kahn, 2007) a response rate of 50 percent is considered adequate, 60 percent good and above 70 percent very good. The respondent rate of 97.4 was considered very good as it exceeded the threshold postulated by Kahn (2007).

Descriptive Analysis

The section deals with descriptive analysis of the study variables. It begins with the independent variable, Metering and Billing Revenue System, and moderating variables, Legal Framework and Political Environment. The measures of central tendency and dispersion were used to present data.

Respondents on Metering and Billing Revenue Systems

The study sought to examine the impact of Metering and Billing revenue systems on Revenue Collection in Public Water Companies. The respondents were asked to indicate their level of agreement/disagreement with Metering and Billing revenue systems. A Likert scale was used as follows: Strongly Disagree =1, Disagree =2, Not sure =3, Agree =4, and Strongly Agree=5. Below is the outcome as indicated in Table 4.15.

Table 4.15 below indicates that 83.1% of respondents agreed that unauthorized and unmetered consumption leads to financial loss or revenue. Additionally, 79.7% of respondents agreed that the government plays a role. 86.0% of water service boards and water companies have a significant role in metering, invoicing customers, and revenue collection. Furthermore, 77.2% of respondents agreed that wrong meter readings result in misrepresentations of accounts receivable in the company's financial statement. 74.5% of respondents agreed that managing customer security deposits is key to enhancing revenue collection. Also, 72.9% agreed that the water company has accurate data for customer security deposit accounts. Lastly, 74.8% agreed that de-enrolled security deposits constitute unclaimed assets, which lead to government penalties.

Table 4. 15: Respondents on Metering and Billing by Frequency Distribution

Statement	Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree
Unauthorized and unmetered consumption results in financial loss or revenue	3.1%	2.7%	8.0%	36.1%	47.0%
The Government, the Counties, the Water Service Board, and Water Companies play a big role in metering and invoicing of customers and revenue generation.	3.3%	4.3%	9.7 %	39.2%	40.5%
Wrong meter readings result in misrepresentations of accounts receivable in the financial statements.	1.4%	4.7%	13.6%	37.8%	39.4%
Customer security deposit management is key to Revenue collection in Public Water Companies.	1.0%	6.8%	14.6 %	42.1%	32.4%
The water company has accurate data on the customer's security deposit account.	2.9%	5.7%	15.4%	41.3%	31.6%
De-enrolled security deposit constitutes unclaimed assets that attract a government penalty.	2.7%	3.9%	15.6%	37.4%	37.4%

Table 4.16 indicated the output on sampled respondents as follows: agreed (Mean of 4.09; Standard Deviation 0f 0.960) that Metering and Billing Revenue Systems level of agreement has an impact on Revenue collections. However, the respondents agreed (Mean of 4.24; Standard Deviation 0f 0.951) that Unauthorized and unmetered consumption results in financial loss of revenue. The respondents agree that Metering and Billing Revenue Systems are financial determinants of Revenue Collection in Public Water Companies.

Table 4. 16: Respondents on Metering and Billing Revenue Systems using Measure of Dispersion

Statement	n	M	e	SD
Unauthorized and unmetered consumption results in financial loss or revenue	487	4.24	.043	.951
Accurate data collection by water companies` staff aids the government and the water works service board in policy formulation and monitoring.	487	4.12	.045	.990
Wrong readings of meters result in misrepresentations of accounts receivable in the financial statements of the company	487	4.13	.042	.925
Water meters provide accurate data for qualitative and quantitative data analysis and projection in water demand and supply	487	4.02	.043	.945
The water company has accurate data on customer security deposit accounts	487	3.97	.045	.991
There are technological challenges between dilapidated infrastructure and smart metering technology in integrating the System Geographical Information System	487	4.05	0.045	0.987
Valid N (list-wise)	**487**	**4.09**	**0.04**	**0.960**

Respondents on Moderating Variables as a Political Environment

The study sought to evaluate the influence of the political environment on Revenue Collection in public water companies. The respondents were asked to indicate their level of agreement/disagreement with the political environment as presented in the questionnaires. A Likert scale was used which indicated Strongly Disagree =1, Disagree =2, Not sure =3, Agree =4, and Strongly Agree=5. Below is the outcome as indicated in Table 4.21.

Table 4.21 indicated the output on sampled respondents as; agreed (Mean of 4.35; Standard Deviation 0f 0.78) that political environment level of agreement was above the average mean for two statements; Politically appointed board members often lower accountability in enforcing payments with a mean of (Mean of 4.43,, Standard Deviation 0f 0.720) and Elections politicize water access, leading to temporary waivers that hurt revenue level of agreement with mean of Mean of 4.45; Standard Deviation 0f 0.711 However, the respondents of agrrment on the statement that political interference in water operations affects revenue collection negatively with (Mean of 4.20 Standard Deviation 0f 0.934) whose mean was below the average mean and finally, there is weak policy or legislation of company contracting agencies on contracting of revenue collection. had a mean of (Mean of 4.32; Standard Deviation of 0.764), which implies that the mean of the two variables' level of agreement is below the aggregated mean, with a high standard deviation of 0.934 and 0.764. The higher the standard deviation, the poorer the performance. However, on average, the political Environment influences revenue collection in public water companies.

Table 4.21: Respondents of Political Environment

Statement	N Statistic	Mean	std error	Std. Deviation Statistic
Political interference in water operations affects revenue collection negatively	487	4.20	.042	.934
Governance changes disrupt billing systems and reduce collection efficiency.	487	4.32	.035	.764
Politically appointed board members often lower accountability in enforcing payments	487	4.43	.033	.720
There is a weak policy or legislation of the company's contracting agencies on the contracting of revenue collection	487	4.45	.032	.711
Valid N (list-wise)	**487**	**4.35**	**0.04**	**0.78**

Inferential Statistics.

Pearson Correlation objective: The study aimed to determine the strength of the relationship between independent variables and revenue collection. On Methodology, Pearson Correlation Coefficient was adopted to measure the level of relation between linearly related variables and the Confidence Interval of the coefficient was calculated at a 95 percent confidence level with an error margin of 0.05. Coefficient of Correlation. The coefficient of correlation, denoted as "r," quantifies the strength and direction of the relationship between two variables. It ranges between -1.0 (perfect negative correlation) and 1.0 (perfect positive correlation). The study examined the following independent factors: Metering and Billing Correlation Matrix findings were presented in Table 4.22. which indicated how the independent variable related to revenue collection in public water companies as follows.

Table 4. 22: Correlation Matrix Metering And Billing Revenue Systems And Revenue Collection

Variable		Revenue Collection "r" value	Remarks
Metering and Billing Revenue Systems	Pearson Correlation	587**	Average positive correlation
	Sig. (2-tailed)	000	
	N	487	

The p-value for Meter and Billing system was found to be 0.000 which is less than the significance level of 0.05 ($p<0.05$). The result indicated that the Pearson Correlation coefficient (r-value) of 0.587** represented a strong, positive relationship between metering and billing systems and revenue collection of public water companies. The use of Pearson's (r) correlation helps water companies determine the nature and direction of the relationship between the Metering and Billing revenue system and Revenue collection. Refer to Table 4.23 below.

Table 4.23: The Correlation Matrix between Metering and Billing Revenue System and Revenue Collection

Variables		Revenue Generation	Metering and Billing
Revenue Generation	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	487	
Metering and Billing	Pearson Correlation	.587**	1
	Sig. (2-tailed)	0.01	
	N	487	487

Multiple Linear Regression

Multiple linear regressions were computed at a 95 percent confidence interval with a 0.05 margin of error. This shows that there is a multiple linear relationship between the independent and dependent variables of the study.

Coefficient of Determination (R2)

The coefficient of determination, R^2, is used to analyze how differences in one variable can be explained by differences in a second variable. The correlation coefficient formula will tell you how strong a linear relationship is between two variables, as indicated in Table 4.25 below.

Table 4.25: Regression of Independent Variables and Dependent Variable

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.191[a]	.037	.035	.775

Table 4.29 indicates that Metering and Billing have a significant positive effect on Revenue Collection in Public Water Companies. It has a β coefficient of 0.471 and a p-value of 0.000. According to this model, when the independent variable's value is zero, then the y-intercept will be equal to 42.192 as a constant.

Table 4.29 Regression Coefficients of Variation

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	**42.192**	**3.882**		**59.420**	**.000**
Meter and Billing	**.471**	**.130**	**.345**	**3.310**	**.000**

Testing of Hypothesis

The hypothesis tested the direction of the relationship between the dependent and the independent variable. Pearson's correlation analysis was run to assess the strength and

direction of the relationship. The alternative hypothesis concluded that Metering and Billing impact Revenue collection in Public Water Companies.

Hypothesis 1: Metering and Billing Revenue Systems

H_O: Null Hypothesis,

H_1: Alternative Hypothesis which is also called the Research Hypothesis which is to be investigated.

Where the level of confidence is at 95% and the significance level is 5% $t \leq 1.96$

$H_{O:} \geq$ 0.05 Not reject

H_1: < 0.05 Reject

H_O: Metering and Billing Revenue Systems does not have a significant impact on Revenue Collection.

H_1: Metering and Billing revenue systems have a significant impact on Revenue Collection.

The objective of the hypothesis is to determine the relationship between Metering and Billing revenue systems and Revenue Collection through a logistic linear regression model, as indicated in Table 4.30 and as represented by the linear equation as follows;

$Y2= \beta_0+\beta_1 X_{2+} \epsilon$

Where $Y2= 4.104 +0.01 X_1$

Table 4.34 below, Metering and Billing ($\beta = 0.112$), was found to have a positive impact on Revenue Collection in Public Water companies. From the t-test analysis, the t -value was found to be 4,104 and the ρ -value 0.000. This null hypothesis, H_0: was rejected because $\rho<0.05$. The study accepted the alternative hypothesis and it concluded that Metering and Billing impact Revenue Collection in Public Water Companies.

Table 4.34: Coefficient variation of Metering on Billing Revenue Systems on Revenue Collection

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.104	.137		29.970	.000
Customer security deposit management is key to towards in enhancement of Revenue Collection	.082	.033	.112	2.466	.014

a.Dependent Variable: Sound management of accounts receivable will improve the liquidity position of the water company, which brings about revenue growth.

b.Predictors: (Constant), Customer security deposit management is key to the enhancement of Revenue Collection.

Table 4.34 indicates the direction of the relationship between Metering and Billing revenue systems and Revenue Collection. The analysis further reveals that the determinant coefficient of 0.112, implying that metering and billing revenue systems have a weak positive direction,

indicating that metering and Billing revenue systems have a positive influence of 1.2 (%) percent improvement on the Revenue Collection of Public Water Companies.

a. Dependent Variable: Sound management of accounts receivable will improve the liquid position of your water company, hence bringing about revenue growth.

b. Predictors in the Model: (Constant), Customer security deposit management is key to Revenue Collection.

Table 4.35 shows the output of logistic linear regression between Metering and Billing revenue systems, and Revenue Collection variables. The statement that stated that unauthorized and an unmetered consumption result to financial loss or Revenue revealed beta of β= -0.221 indicating a weak negative correlation with Revenue Collection (β = -0.221 sig=œ = 0.653) unauthorized and unmetered consumption result to financial loss that for every one-unit increase in unauthorized and unmetered consumption of water, there is -0.221 decrease of Revenue Collection in Public Water Companies. The direction of the relationship between unauthorized and an unmetered consumption and Revenue Collection has a Partial Negative Correlation of- 0.0 21, which means that there is a weak negative relationship between Unauthorized and an unmetered consumption and Revenue Collection in Public Water Companies.

The government, Counties, Water Service Board and Water Companies play a big role in Metering and Invoicing of customers and Revenue Collection. The output of Regression Analysis indicated a (β) beta of - 0.014, which implies that there was a weak negative correlation between the Government, Counties, Water Service Board and Water Companies` roles in Metering and Invoicing of customers and Revenue Collection. (β =- 0.014 œ = 0.69). The output of the logistic regression indicated that inaccurate meter readings result in misrepresentation of accounts receivable in the financial statements. This results in underestimated or overestimated bills in Revenue Collection. Wrong readings of meters resulting in misrepresentations of accounts receivable in the financial statement of the Company as a result of underestimated or overestimated bills of β= 0.004, indicating a weak positive correlation with Revenue Collection (β = 0.004 sig=œ = 0.653).

Wrong readings of meters resulting in misrepresentations of accounts receivable in the financial statement of the Company as a result of underestimated or overestimated bills implies that for every one-unit improvement in Wrong readings of meters resulting in misrepresentations of accounts receivable in the financial statement of the Company as a result of under or overestimated bills, there was a β 0.004 decrease in Revenue Collection of Public Water Companies. The direction of the relationship between Wrong readings of meters resulting to misrepresentations accounts receivables in financial statement of the Company as a result of under or overestimated bills of Revenue Collection has a partial negative Correlation of -0.021 which means that there is a weak negative relationship between Wrong readings of meters resulting to misrepresentations accounts receivables in financial statement of the Company as a result of under or overestimated bills of Revenue Collection of Public Water Companies.

The water company has accurate data on customer security deposit accounts, which had a weak negative correlation with Revenue Collection. (β = 0.026, œ = 0.609). The water company has accurate data on customer security deposit accounts. The water company has accurate data that the null hypothesis is not rejected since œ 0.0609 is greater than 0.05. The partial negative correlation of -0.023 decreases with the Revenue Collection of Public Water Companies. The direction of the relationship between the water company has accurate data of customer security deposit accounts and the Revenue Collection, which has a Partial Correlation of -0.023, which means that there is a low negative correlation between the water company has accurate data of customer security deposit accounts and the Revenue Collection in Public Water Companies.

De-enrolled security deposit constitutes unclaimed assets that could lead to a penalty by the Government. The table shows a relationship between De-enrolled security deposits and unclaimed assets that could lead to a penalty by the Government ts of Revenue Collection in Public Water Companies. De-enrolled security deposit constitutes unclaimed assets that could lead to a penalty by the Government, which is -.025, which implies that for every unit change in the De-enrolled security deposit, which constitutes unclaimed assets that could lead to a penalty by the Government, there is β.-0.25-unit decrease in Revenue Collection of Public Water Companies.

There is a significant effect since Alpha œ > 0.05, the null hypothesis was not rejected (β=. -0.25, p=0.609). The direction of the relationship between the De-enrolled security deposit, which constitutes unclaimed assets that could lead to a penalty by the Government and Revenue Collection, has a Partial Correlation of -0.023, which means that there is a low negative correlation between De-enrolled security deposit, which constitutes to unclaimed assets that could lead to penalty by the Government for Revenue Collection in Public Water Companies.

Table 4.35: logistic Linear Regression between Metering and Billing Revenue Systems and Revenue Collection

Model	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics Tolerance
Unauthorized and unmetered consumption results in financial loss or revenue	-.021[b]	-.449	.653	-.021	.940
The Government, Counties, the Water Service Boards, and water companies play a big role in metering and invoicing customers.	-.014[b]	-.288	.773	-.013	.886
Wrong readings of meters result in misrepresentations of accounts receivable in the financial statement of the company as a result of	.004[b]	.080	.936	.004	.810

underestimated or overestimated bills.					
There is a wrong installation of meters by the company	-.026[b]	-.512	.609	-.023	.779
The company presents Inflated bills with the payment meters to customers.	-.025[b]	-.502	.616	-.023	.812

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The chapter summary covers the theoretical framework, which includes various economic, finance, and corporate theories. Among corporate theories, agency theory, stakeholder theory, and stewardship theory are discussed. The chapter also explores the conceptual framework, which defines the dependent, independent, and intervening variables. The main independent factor identified in the research was metering and billing. This was recognized as the key independent factor in the study. The dependent variable is revenue collection, with key indicators under review. The intervening factors included income, meter reading inaccuracies, water pressure, technological changes, and system failures.

Impacts of Metering and Billing Revenue System on Revenue Collection

The objective of the study was to evaluate the impact of Metering and Billing Revenue Systems on Revenue Collection in Public Water Companies. The study showed that the Metering and Billing Revenue System positively impacted revenue collection in Public Water Companies (Mwangi, 2025). David *et al* (2017) indicated that Metering and Billing Revenue Systems have a positive impact on Revenue Collection.

The findings also agreed with Xuan *et al* (2015) who indicated that Revenue management had a positive impact on Revenue collection. The p-value for Meter and Billing Revenue system was found to be 0.000 which is less than the significance level of 0.05. The result indicated that the Pearson Correlation coefficient (r-value) of 0.587**, which was a strong, positive relationship between Metering and Billing revenue system and the Financial Determinants of Revenue Collection of Public Water Companies.

Conclusion of the Study

The specific objective of the study was to evaluate the impact of metering and billing revenue systems on revenue collection in public water companies. The study found that the metering and billing system positively impacts revenue collection in Public Water Companies (Mwangi, 2025), and emphasized the importance of management in ensuring precise and efficient customer metering and billing processes.

Recommendations

The study recommends that the metering and billing revenue systems be managed effectively to enhance revenue collection and ensure there is sufficient water and sanitation services. Many companies face challenges such as outstanding water bills and accounts not integrated into the revenue system, which encourages customers to consume water without payment. To address these issues, management must also strengthen installation procedures to prevent unauthorized connections and safeguard company resources (Mwangi, 2025).

Based on the analysis of water company management practices, leaders must prioritize government-issued guidelines while applying systems theory, which underscores the interconnectedness of organizational components working collectively toward shared goals. In addition, effective monitoring of water activities along transmission lines, strict adherence to the installation of water meters, and compliance with financial policies are essential measures for ensuring sustainable and efficient operations (Mwangi, 2025).

Areas for Further Research

Metering and billing systems support accountability and motivate customers to pay water bills on time, as stated in the financial policy and debt management policy. This, in turn, leads to sound financial management (Mwangi & Otieno, 2024; Njoroge & Kamau, 2023).
Other beneficiaries include scholars, financiers, government bodies, trade unions, competitors, lenders, creditors, policymakers, researchers, and water customers. The study will help water companies achieve sound financial management. By addressing these empirical gaps, the study contributes to a more comprehensive understanding of how metering and billing systems affect revenue collection in water utilities.

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