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The Influence of Utility Efficiency on Financial Sustainability of Water Service Providers in Kenya

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ABSTRACT

The purpose of the study was to establish the influence of utility efficiency on financial sustainability among water service providers in Kenya. The study adopted the pragmatism research philosophy and explanatory sequential mixed design to provide empirical based solution to the financial sustainability concerns among the water service providers in Kenya. The target population constituted 616 senior managers from whom, a sample of 352 managers were selected. A structured questionnaire was then used to collect quantitative data from the sampled respondents. Additionally data was collected using interview schedule from key informants representing the ministry of Water, Sanitation and Irrigation, Water Services Regulatory Board, and the eight Water Works Development Agencies. Data collected, was coded, cleaned and analysed to obtain both descriptive and inferential statistics. These were in terms of mean, standard deviation, statistical tests, ANOVA and regression analyses. The study found that utility efficiency had a positive and statistically significant influence on the financial sustainability of WSPs in Kenya ($r=0.368$, $F= 10.719$ (1,250df), $\beta= 0.273$, $t(251)=3.274$, p-value=0.002). Based on this finding, there is need for each WSP in collaboration with the responsible county governments to undertake measures geared towards reduction of NRW and staff per 1000 connections while at the same time increasing billing and collection efficiencies.

Key words: Utility Efficiency, Financial Sustainability, Water Service Providers

I. INTRODUCTION

There is a universal acceptance that water is a source of life and a key ingredient in different sectors including transport, agriculture, energy, manufacturing and health among others (Aung et al., 2018; Martínez-fernández et al., 2020). The multifaceted use of water coupled with the limited and diminishing water sources called for increased efficiency, public participation, accountability and financial stewardship in the provision of water (Langford, 2005; Means et al., 2005). The United Nations definition of sustainability in water service provision as guided by the European Union Water Framework Directive (EWFD), places efficiency under the economic pillar and stresses on the need to track staff productivity and to track and reduce water losses among other inefficiencies (Bernard, 2003). It is against that background that under the Sustainable Development Goals (SDGs), economies identified and sought to track utility efficiency as a key contributor to sustainability in water service provision among other aspects (Ait-Kadi, 2016).

In water service provision, efficiency is categorized in to: technical, operational and management efficiencies (Murrar et al., 2017). Technical efficiency refers efficient extraction, treatment, distribution of quality water and waste water (Molinos-Senante et al., 2016). Technical efficiency parameters include: Non-Revenue Water (NRW), water quality, number of written complaints, number of connections per 1000 persons, percentage of revenue used on water, service coverage and service stability (Molinos-Senante et al., 2016; Gupta et al., 2012). Operational efficiency deals with the sectoral legal framework, maintenance of high service standards, investment planning, optimal tariffs, monitoring and evaluation, effective financial management and ensuring high performance levels (Storto, 2014). Management efficiency refers to the ability to acquire, use and maintain assets efficiently; the measures of management efficiency include: average operating revenue, operating cost ratio, collection efficiency, fixed assets per connection ratio and debt service ratio (Banerjee & Morella, 2011). Utility efficiency on the other hand, is the ability of a utility to accurately measure the production, customer consumption, to produce accurate and timely bills, to minimize water losses and to ensure a collection efficiency of 100% (WASREB, 2018). The key utility efficiency indicators in water service provision is NRW, collection efficiency, metering ratio and staff per one thousand connections (Murrar et al., 2017).

Financial sustainability on the other hand, is the ability of a WSP to attain full cost recovery with minimal revenue fluctuations (Pinto & Marques, 2016). Utility inefficiencies affect water service provider (WSP) financial sustainability by reducing revenue earned, unnecessarily increasing input costs or by increasing revenue variability. For instance, while nonrevenue water and metering inaccuracies translate to lost revenue, poor staff productivity unnecessarily increases operation and maintenance (O&M) costs, low revenue collection impairs liquidity and eventually solvency of water service providers (Murrar et al., 2017). Such inefficiencies have been found to be very costly to nations and water utilities across the world, they have been cited as the main cause of low levels of access to water (Frone, 2012; Estache & Kouass, 2002); they are a major cause of lost revenue for water utilities across the world (Chitonge, 2010). They have also made water unaffordable to the citizenry (Jiang et al., 2019). While raising adequate revenues to finance operation and investment costs is a priority in the water sector, efficiency in service delivery also determines financial sustainability of water utilities (Bohm et al., 1993; Akinyi & Odundo, 2018). Water service providers should ensure collection of revenue earned; so that they can be able to pay their liabilities as and when they fall due (Akinyi & Odundo, 2018). High collection efficiency ensures sufficient liquidity levels which in effect define the ability of the WSP to meet their obligations as and when they fall due (Vučijak et al., 2018).

II. THE PROBLEM STATEMENT

The implementation of the EU Water Framework Directive (EWFD) of 2000 was aimed at ensuring financial sustainability of the water sector (Bernard, 2003). Since its implementation however, the global cost recovery level has remained below the world benchmarks of between 130% to 200% depending on the reference geographical area Marson and Savin (2015) and it has been on a downward trend over the years (Van et al., 2017). For instance, the global O&M cost coverage declined from 111% in 2000 to 105% in 2008 (van et al., 2011); in Sub-Saharan Africa declined from 126% in 1995 to 116% in 2009 (Marson & Savin, 2015). The Kenyan full cost coverage benchmark is set at 150% O&M cost coverage WASREB (2020); and the number of WSPs attaining it has been quite low and on a declining trend since 2011 as shown by figure 1.

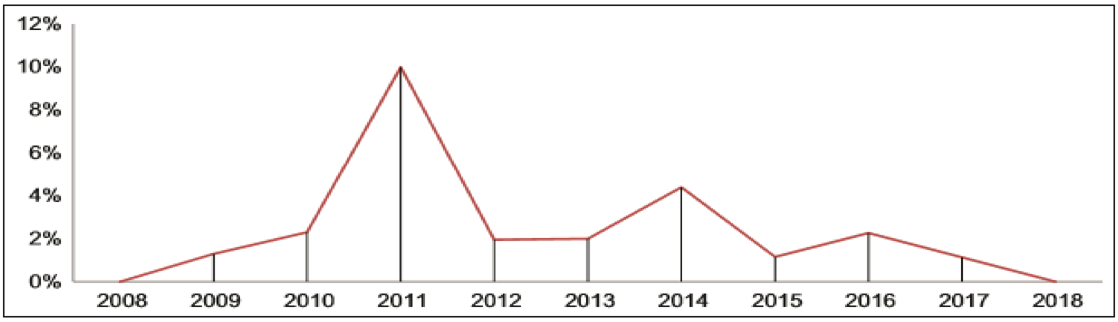

Figure1: Percentage of WSPs that Attained Full Cost Recovery in Kenya.

Source: Julius and Okech, 2021

Inability to attain full cost recovery lowers the WSP ability to finance efficiency related costs resulting to high levels of NRW and inability to attain other efficiency benchmarks (WASREB, 2019). In Kenya, the average NRW was reported to be 43% of the water production per year which is equivalent to a financial loss of Kshs 15.8 Billion or Kshs 8.9 billion when considering only the water loss above the acceptable sector benchmark of 20% (WASREB, 2020). Similarly, the metering and collection efficiencies are below the set benchmarks and on a declining trend while the average staff productivity has stagnated at 7 staff per 1000 connections (WASREB, 2020). Given the central role played by efficiency in the attainment of financial sustainability of WSPs, there was need to assess the influence of inefficiency costs on financial sustainability of WSPs in Kenya, as a key ingredient in the attainment of the Kenya's Vision 2030.

III. RESEARCH OBJECTIVE

The objective of this study was to assess the influence of utility efficiency on financial sustainability of water service providers in Kenya.

IV. LITERATURE REVIEW

Theoretical Framework

The study was anchored upon the sustainability oriented theory of the firm which was developed by Lozano, Carpenter and Huisingh in 2015. The theory is about the need to view business as part of a system that interacts with its environment with an aim of increasing the wealth of the stockholders (Lozano et al., 2015). According to the theory, businesses are able to ensure that the needs of the various stakeholders are taken care of, through a holistic view of the firm like part of a dynamic system. It explains how and why a firm should focus not just of the short term profits but should also aim to attain economic, environmental and social sustainability (Lozano et al., 2015). In water service provision, the theory is operationalized through the European Union Water Framework Directive (EWFD) as applied by the United Nations (UN) who defined sustainability in water to comprise of three interdependent pillars that impact on the optimality of the sector. These include economy, environment and ethics (Bernard, 2003) commonly referred to as 3Es as summarized in Figure 2.

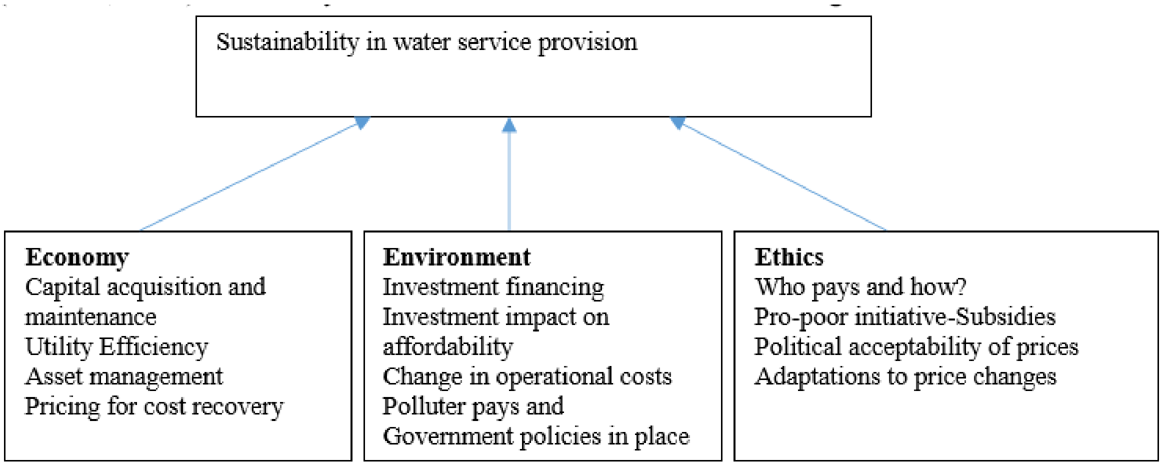

Figure 2: Sustainability in Water

Source: Bernard, 2003

The theory provides a clear linkage between efficiency as a key component in the economy pillar to financial sustainability (Bernard, 2003 & Hansmann et al., 2012).

Conceptual framework

The study was based on financial sustainability as the dependent variable while utility efficiency was the independent variable. The conceptual framework presupposed that optimal utility efficiency leads to financial sustainability of WSPs.

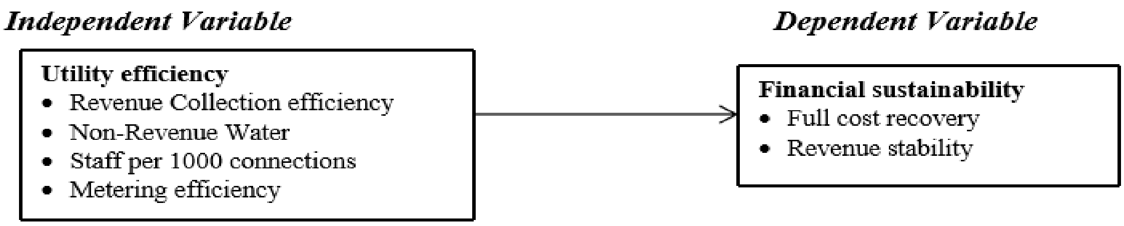

Figure 2: Conceptual Framework

Empirical Studies on Utility Efficiency and Financial Sustainability

Given the role of utility efficiency in the attainment of financial sustainability by WSPs, scholars have taken interest in the study of the various efficiency aspects, though there is limited research considering the four measures of efficiency together. Several studies have been done considering either one or two of the measures at one go. For instance, In Palestine, Murrar et al. (2017) found that high NRW and staff per 100 negatively influenced the water utility profitability. In another study covering the Palestinian water service providers it was established that collection efficiency positively impacted WSP profitability as measured by working ratio (Murrar et al., 2017). A study undertaken across the metro cities of India found out that the NRW averaged between 20% to 50% which represents a massive revenue loss to the utilities (Singh et al., 2005). A review of water pricing policies adopted by different countries across the globe established the need the need to pass key inefficiencies including NRW to customers for attainment of full cost recovery (Tsitsifli et al., 2017). In Japan, it was established that most WSPs were unable to recover their costs because of the high levels of non-revenue water; the country had an average NRW as high as 50% (Shibuya et al., 2014). The high non-revenue water was due to the aged infrastructure and low asset renewal financing occasioned by lack of financing given that on average the WSPs were not recovering the water supply cost (Shibuya et al., 2014). Similarly, low levels of asset renewal was cited as the main cause of the high NRW levels in Italy (Massarutto & Ermano, 2013). In Kenya, a case study meant to examine the factors influencing the financial viability of a Water Service Providers established that, a unit increase in non-revenue water leads to 19% decrease in financial viability of water service providers in Kenya (Onsomu et al., 2013).

On collection efficiency, a study undertaken to establish the financial performance amongst water service providers in the West Balkan countries associated low staff productivity and low collection efficiency to low levels of financial sustainability by WSPs (Vučijak et al., 2018). These findings indicate that the two efficiency measures have a positive influence on WSP financial sustainability. Similarly the levels of metering and collection efficiencies were found to influence financial sustainability of WSPs in India (Aggarwal et al., 2013). According to the study that covered five municipalities including Ahmedabad, Raipur, Bangalore, Delhi and Chennai, lack of metering forced WSPs to use arbitrary water charging methodologies resulting to a disconnect between the water sold and revenue earned; high collection efficiency on the other hand enabled the WSPs to finance their operational exenditure (Akinyi & Odundo, 2018). In Kampala Uganda, a study undertaken recommended sub-metering as a solution to improve the accuracy of metering and accountability for water produced hence enhancing financial sustainability (Mutikanga et al., 2011). According to the study, metering efficiency tracks both meter installation, the accuracy of the meters and also the meter reading accuracy (Mutikanga et al., 2011).

In a study undertaken by the World Bank seeking to establish the effectiveness of non-revenue reduction programs, it was established that water losses negatively impacted financial sustainability of WSPs but only to a certain level beyond which it is difficult and expensive to reduce further (van den Berg, 2014). Most water regulatory bodies are cognizant of that fact and in effect they have set acceptable levels of NRW (Murrar et al., 2017). On collection efficiency, the World Bank established that high collection efficiency by WSPs improved their ability to attain 100% O&M cost coverage (Estache & Kouass, 2002). The study found that only countries with high collection efficiencies was able fully cover their costs (Estache & Kouass, 2002).

From the foregoing, utility efficiency plays a key role in the attainment of financial sustainability of water service providers. There is however limited current, localized and empirical research linking the four measures efficiency at a go to financial sustainability while covering all WSPs across the country. Thus there was need to undertake research to find out the influence of utility efficiency while considering NRW, staff productivity, collection and metering efficiencies on financial sustainability of WSPs in Kenya so as to inform policy, practice and academic discourse. This background informs the hypothesis of this study that:

H0: Water utility efficiency has no influence on financial sustainability of water service providers in Kenya

V. METHODOLOGY

This study adopted the pragmatism research philosophy and explanatory sequential mixed design whereby quantitative data was collected and analyzed, followed by qualitative data collection and analysis. The target population comprised of seven senior managers who are conversant with the financial sustainability status of the eighty-eight WSPs falling within the categories of small to very large (WASREB, 2020). For purposes of collecting quantitative data, multi-stage sampling was used whereby; census sampling was used to identify the participating WSPs while purposeful sampling was used to identify four senior managers from each WSP who are directly responsible for the specific aspects under study. The four respondents included managing directors, managers in charge of: finance and accounts, commercial and technical departments. Quantitative data was collected using a structured questionnaire that had five-point Likert scale, ranging from strongly disagree to strongly agree.

Data collected was cleaned, coded and analyzed using SPSS version 26. To establish the nature and the magnitude of hypothesized relationships, regression analysis was undertaken. In the regression analysis, $Y = \beta 0 + \beta_1 X + \varepsilon$ where, β_0 is the constant, β_1 is the regression coefficient for utility efficiency, ε is the error term, at a significance level of 0.05; diagnostic tests were done to confirm normality, linearity and to rule out heteroscedasticity and multicolliearity. For an in-depth understanding of the findings of the quantitative phase, interviews with the Water Secretary, Ministry of Water, Sanitation and Irrigation (MWSI), the CEOs water works development agencies (WWDAs) and the Water Services Regulatory Authority (WASREB) were undertaken. Three participants were selected through purposive sampling while ensuring representation from each organization category. Content analysis was used to analyse data collected in this phase and the results were used to explain the quantitative findings

VI. RESULTS

Response Rate

Out the sampled 352 participants, 252 filled and returned the questionnaires which translate to 71.59% response rate.

Descriptive Statistics for Utility Efficiency and Financial Sustainability

To determine the extent to which utility efficiency influenced financial sustainability of WSPs in Kenya, the respondents were required to rate several statements based on a five-point Likert scale, ranging from 1(strongly disagree) to 5 (strongly agree). Table 1 presents the results:

Table 1: Utility Efficiency and Financial Sustainability

Utility efficiency	**N**	**Mean**	**SD**
Company efficiency levels affects their ability to attain full cost recovery	252	4.52	.503
Non-revenue water is a major cause of lack of cost recovery	252	4.40	.773
Inaccurate data is a major hindrance to cost recovery of WSPs	252	3.83	1.100
Effective accounting systems are necessary for accurate cost determination	252	4.56	.590
Inability to accurately forecast expenses affects cost recovery of WSPs in future	252	4.13	.813
The company has staff with optimal skills mix	252	3.60	1.225
Public confidence on the accuracy of the billing enhances revenue collection	252	4.13	.813
Increased service hours enhance financial sustainability	252	3.89	1.079
There is a planned infrastructure replacement plan to reduce physical leakages	252	3.73	1.208
Inaccurate bills reduce collection efficiency	252	4.43	.588
Average	**252**	**4.08**	**0.907**

The results presented in Table 1 show an average mean was 4.08 with a standard deviation of 0.907, implying that majority of the respondents agree with the different constructs relating to utility efficiency and its influence on WSP financial sustainability.

Diagnostic Test Results

The data was subjected to diagnostic tests to confirm the suitability of undertaking regression analysis. The diagnostic test results ruled out multicollinearity and heteroscedasticity problems with a VIF=1.104 and the test Glesjer p-value of 0.940>0.05. The results confirmed normality of the data whereby the Shapiro-Wilk statistic was 0.750 at P=0.000. Additionally, the data was found to be linear with the ANOVA test yielding a non-significant deviation from linearity at a P-value of 0.197>0.05.

Regression Analysis of the Influence of Utility Efficiency on Financial Sustainability

The results of the regression analysis are presented in table 3.

Table 3: Influence of Utility Efficiency on Financial Sustainability of WSPs in Kenya

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.395[a]	.156	.141	3.18474

a. Predictors: (Constant), Utility efficiency

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	108.713	1	108.713	10.719	.002[b]
	Residual	588.270	250	10.143		
	Total	696.983	251			

a. Dependent Variable: Financial Sustainability
b. Predictors: (Constant), Utility efficiency

Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	33.209	3.468		9.575	.000
	Utility efficiency	.273	.083	.395	3.274	.002

a. Dependent Variable: Financial Sustainability

The results presented in table 3 indicate a positive and statistically significant relationship between utility efficiency and financial sustainability of WSPs in Kenya (R=0.395, R2=0.156), implying that utility efficiency explains 15.6% of financial sustainability variability. The F-statistic was 10.719 (1,250 df), at p-value of $0.002<0.05$ against calculated F-critical (1,250df) of 3.8789. The regression coefficient was 0.273, with a p-value of $0.002<0.05$. Given the results, the study rejects the null hypothesis that, utility efficiency has no influence on financial sustainability of water service provider in Kenya.

These results could be attributed to the fact that high inefficiency levels result in lost revenue which disables financial sustainability and the converse is true. Although there are limited empirical studies undertaken considering all the four measures of efficiency jointly, different studies have sought to establish the influence of either one or a number of the efficiency measures on financial sustainability of WSPs yielding similar results as the current one. In Palestine for example, studies undertaken considering NRW, staff productivity and collection efficiency established that the three measures of efficiency were positively correlated with O&M cost coverage (Murrar et al., 2017; Murrar et al., 2017); the same was established in India while considering metering and collection efficiencies (Aggarwal et al., 2013); in Japan and in Greece while considering NRW (Shibuya et al., 2014; Vasilis et al., 2014). In Zambia, while considering NRW and metering efficiency (Chitonge, 2010) and globally while NRW and collection efficiency (Tsitsifli et al., 2017; Vučijak et al., 2018; van, 2014).

Interview Analysis Results on Influence of Utility Efficiency on Financial Sustainability

The interviewees agreed that efficiency levels were a major contributor to the lack of financial sustainability among WSPs in Kenya with the main inefficiencies being: NRW and low staff productivity. Experts attributed the large percentage of NRW to physical and commercial losses in the form of illegal connections and bill manipulation. Experts opined that in order to address the inefficiencies, there was need to confirm staff capabilities and competence at the point of hire; to continuously train staff on new developments and technologies in their areas of specialization; inculcate a culture of integrity among WSP staff. Additionally, experts identified inefficient utilization of infrastructure development funds as a possible contributor to the ever-increasing infrastructure financing gap, low asset renewal and rehabilitation hence high NRW.

VII. CONCLUSION

Based on the finding, the study concludes that utility efficiency positively influences financial sustainability among WSPs in Kenya. Thus implying that increasing utility efficiency through reduction in NRW, increased staff productivity, increased metering and collection efficiency would lead to improved financial sustainability by utilities across the country.

VIII. RECOMMENDATION

The study recommends the need for WSPs to: reduce NRW, improve staff productivity through embracing the right technology and training staff on their areas of specialization; to confirm staff qualification, competence and efficiency at the point of hire, to undertake frequent staff sensitizations on integrity in order to reduce commercial malpractices and to institutionalize high levels of integrity in the operations of the WSPs.

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