ASPECTS OF REVENUE GENERATION THAT INFLUENCE FINANCIAL SUSTAINABILITY OF PUBLIC-PRIVATE WATER UTILITIES: THE CASE OF LAKE VICTORIA SOUTH REGION, KENYA

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ABSTRACT

The study aimed at informing relevant policy discourses, management of water service delivery, and research in Kenya and other developing countries. Its design was founded on core tenets of positivist and constructivist schools of thought. It targeted 5 public-private water utilities, 184 water officers and water users. Data were collected in mid 2016 and the analysis techniques included cross-tabulation with Chi square statistic (χ^2), Spearman's Rank Correlation Coefficient, Relative Importance Index and Kendall's Coefficient of Concordance (W). The results show that non-revenue water was the most important aspect influencing financial sustainability of the utilities (relative weight = 0.837); followed by the type of billing system (relative weight = 0.803); formal payment methods (relative weight = 0.785); efficiency of the billing system (relative weight = 0.768); unaccounted-for water (relative weight = 0.758), as well as level of water tariff vis-à-vis cost recovery (relative weight = 0.744). The analysis revealed a strong and significant concordance of respondents' perceptions regarding the influence of each aspect on financial sustainability of the utilities (W= 0.892, χ^2 = 62.612, df = 4 & ρ-value = 0.000); implying that all the aspects analyzed deserve appropriate response interventions in order to enhance potential of the utilities to achieve financial sustainability, thereby, improve access to quality water services.

Keywords: Revenue generation, financial sustainability, public-private water utilities, perceptions.

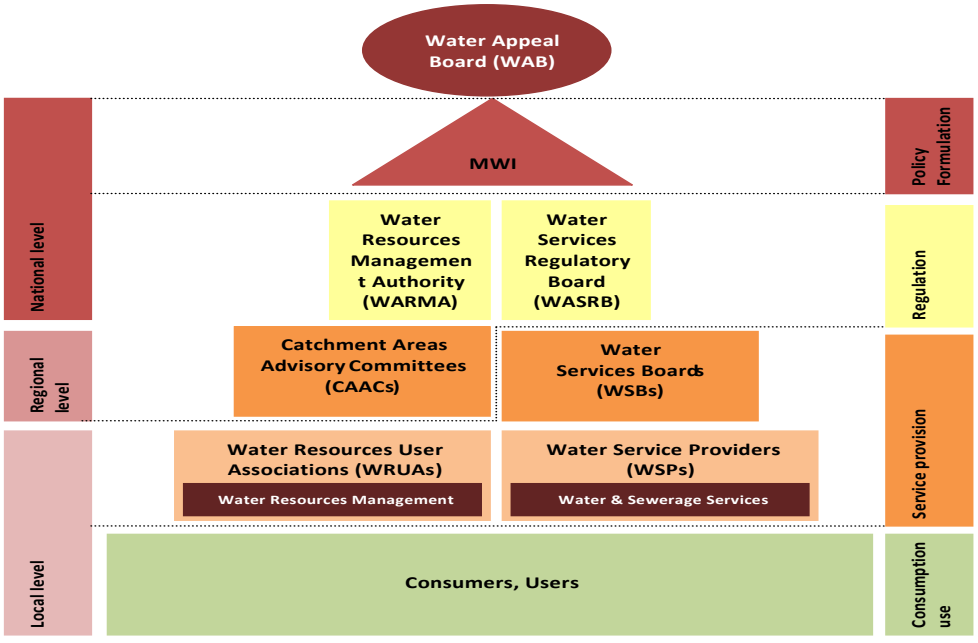
INTRODUCTION

Traditionally, water services have been provided by the public sector because access to safe drinking water is a fundamental element of human rights and a key indicator of socio-economic development (Gia & Fugelsnes, 2010; K'Akumu, 2006). However, in many developing countries, delivery of water services by the public sector has been constrained by challenges such as large amounts of non-revenue water, inefficient billing systems, ineffective revenue generation mechanisms, lack of accountable management of water revenues, as well as delayed maintenance of infrastructural facilities, among others (Gia & Fugelsnes, 2010; Whittington, Davis, Prokopy, Komives, Thorsten, Lukacs & Wakeman, 2009; K'Akumu, 2006). To address these challenges, water was among the sectors targeted by reforms proposed by the International Monetary Fund and the World Bank, under the Structural Adjustment Programs (SAPs). The purpose of SAPs was to enhance efficiency and sustainability of water services by reducing government participation in direct service delivery (United Nations, 2011). In Kenya, SAPs were introduced in the late 1980s; and in the water sector, the initiative required the government to delegate responsibility for operations, maintenance, financial management and service delivery to the private sector through Public-Private Partnership (PPP) initiatives (K'Akumu, 2006).

As explained by World Bank (1997), PPP initiatives describe a range of work relationships between public and private sector entities in developing facilities and delivering essential public services. The involvement of private sector entities in delivery of public services brings forth benefits such as expertise in commerce and management, capital investments, as well as a wide range of technological options (World Bank, 1997). The types of PPP initiatives range along a continuum: at the one end are those in which public entities retain full responsibility for operations, maintenance, capital investment and commercial risk; while at the other end, are those in which the private sector takes up much of such responsibility (World Bank, 1997). Based on this criterion, PPP initiatives fall under six broad categories, including service contracts, management contracts, leases, Build-Operate-Transfer (BOT), concessions and divestitures. Divestiture refers to complete privatization of public facilities by selling all assets and/or shares; or through a management buyout (World Bank, 1997). Divestitures give private service providers full responsibility for operations, maintenance, capital investment and commercial risks. The private service provider is contracted through a long-term agreement, which in some cases may be indefinite. Divestitures transfer full or partial ownership of assets to private service providers; while public authorities retain obligations such as quality monitoring, regulatory, as well as enforcement of health and environmental standards (World Bank, 1997).

In Kenya, privatization of public enterprises occurred in two phases. The first phase, which took place between late 1980s and early 1990s, targeted financial, communication, energy, water and manufacturing sectors (K'Akumu, 2006; Wambua, 2004). However, not much was achieved in the water sector because the country did not have clear policies and legislations on privatization (K'Akumu, 2006). The second phase of privatization came in the early 2000, this time round, guided by appropriate sectoral policy and legislative frameworks. In the water sector, the Sessional Paper No. 1 of 1999 on Water Resources Management and Development, and the Water Act of 2002 provided a crucial policy and legislative basis for privatization. The reforms process created various institutions to improve service delivery efficiency, such as illustrated in Figure 1.

Figure 1: Water sector institutional framework, Kenya



Rampa (2011)

Among the institutions established by the Water Act, 2002 were eight regional Water Services Boards (WSBs), including Lake Victoria South Water Services Board (LVSWSB),

which covers Kisumu, Siaya, Migori, Homa Bay, Bomet, Kericho, Nyamira and Kisii Counties, with a combined population of about 8.5 million people. The Gazette Notice No. 1714 of March 2004 specifies functions of WSBs, including asset development and ownership, as well as contracting and managing Water Service Providers (WSPs); thereby, ensuring efficient provision of water and sanitation services (K'Akumu, 2006).

The Act defines a WSP as a private or public company, a non-governmental organization, a community-based organization, or any entity that is contracted by a WSB to provide water and sanitation services in a particular geographical area. At the time of the study, LVSWSB had contracted 94 WSPs to deliver water and sanitation services within the region, of which 8 operated in urban settings and 86 served rural communities. Notably, the WSPs targeted by this study were termed as 'water utilities'. In order to cushion low-revenue earners, the Act emphasizes the need to establish utilities, in which public authorities hold shares and power to influence tariffs. This prompted the establishment of public-private limited companies (K'Akumu, 2006; Wambua, 2004). This study focused on five such companies that had been contracted by LVSWSB to deliver affordable water and sanitation services, namely: Kisumu Water and Sewerage Company Limited (KIWASCO); Migori Water and Sewerage Company Limited (MIWASCO); Gusii Water and Sewerage Company Limited (GWASCO); Kericho Water and Sewerage Company Limited (KEWASCO); as well as Bomet Water and Sewerage Company Limited (BOWASCO).

Pertinent literature shows that KIWASCO was established in July 2003 under the Company's Act Cap 486, Laws of Kenya, following water sector reforms, to commercialize water and sewerage services; thereby, generate sufficient revenue to sustain operations in Kisumu County. MIWASCO was incorporated in June 2006 to run water supplies within Migori, Rongo, Kuria East, Kuria West, Nyatike and Uriri Sub-Counties, in line with provisions of the Water Act, 2002. The Company prioritized delivery of quality, reliable and sustainable services. GWASCO is also a limited company that was incorporated in June 2006 to deliver sustainable, efficient and affordable water and sewerage services in Kisii and Nyamira Counties. The Company is owned by eleven local authorities drawn from the area of jurisdiction through shares. KEWASCO was incorporated a little earlier in 1997 and contracted by LVSWSB to deliver water and sanitation services within Kericho County. Lastly, BOWASCO was established in 2013 to provide efficient, economical and sustainable water and sewerage services in Bomet County (LVSWSB, 2014)

Financial sustainability of water utilities is vital for ensuring continuous availability of quality and affordable services. A water utility is considered to be financially sustainable if it's able to generate adequate financial resources to meet its operations and maintenance (O&M) costs as well as invest in infrastructural facilities (McPhail, Locussol & Perry, 2012). Existing literature reveals that public-private water utilities in various countries have achieved varying levels of success in terms of revenue generation and financial sustainability. For instance, a study conducted by Whittington *et al.* (2009) reported that public-private water utilities had substantially improved service quality by reducing water rationing; while Andrés, Diop and Guasch (2008) found that public-private water utilities improved efficiency of water services by reducing water loss, improving billing and revenue generation, achieving financial stability, and delivering water services continuously. Similar findings were reported by Adank and Tuffuor (2013), Mimrose and Gunawardena (2011), Frauendorfer and Liemberger (2010), Fragano (2010) and World Bank (2006), among others.
In Kenya, public-private water utilities have experienced mixed results of success and failure since water sector reforms were initiated. Just two years after privatization of water services,

Wambua (2004) analyzed three public-private water utilities, namely, Nyeri Water and Sewerage Company, Eldoret Water and Sanitation Company, as well as Nairobi Water and Sewerage Company. The study revealed several common challenges among the utilities, including high proportions of non-revenue and unaccounted-for water, ineffective revenue generation system, inaccurate billing systems, as well as improper use of water revenues. As a result, none of the utilities had achieved financial sustainability (Wambua, 2004). Even though the theme of Wambua's study is similar to that of this study, a few fundamental differences are notable in terms of geographical setting, timing and methodological approaches.

A report compiled by the World Bank in 2012 applauded public-private water utilities for reducing water rationing and water loss through leakages, spillage and pilferage; improving revenue generation, providing a reliable stream of revenue for maintenance of water distribution system, as well as for sustenance and expansion of water services (World Bank, 2012). The report provided a blanket picture of achievements associated with water sector reforms, but did not delve into the influence of specific aspects of revenue generation on the financial sustainability of public-private water utilities (World Bank, 2012). The purpose of the study was to generate information to support relevant policy discourses and water service delivery decisions, as well as spur research activities, focusing on revenue generation and financial sustainability of public-private utilities, not only in Kenya but also in other developing countries. The objectives of this study were three-fold: determine bivariate relationship between various aspects (indicators) of revenue generation and financial sustainability of the of the selected public-private water utilities; examine the relative importance of revenue generation indicators based on the strength of correlation or statistical association with financial sustainability of the utilities; as well as determine the concordance of perceptions regarding the relationship between indicators of revenue generation and financial sustainability of the utilities.

LITERATURE REVIEW

All public utilities strive to achieve financial sustainability in order to deliver services consistently; thereby, ease pressure on national budgets and minimize dependency on donor funding (McPhail *et al.*, 2012). Achievement of financial sustainability requires such utilities to focus on developing four fundamental pillars, including strategic and financial planning, revenue diversification, sound administration and financial management, as well as revenue generation (McPhail *et al.*, 2012). As noted by McPhail *et al.* (2012), generating own revenue is a primary avenue through which utilities achieve financial sustainability. Own revenue enables utilities to cushion against shocks that may arise from sudden changes in funding from national budgets and/or from donors. The advantage of own revenue is that utilities have unrestricted authority on its utilization. There are many ways through which utilities can generate own revenue, and the ones adopted depend on a utility's core business, mission, vision and objectives. Whichever way is adopted, utilities must put in place appropriate measures for enhancing efficiency and optimizing opportunities (McPhail *et al.*, 2012).

In the context of water supply, own revenue is principally generated through delivery of water services to consumers. Various aspects require attention in order to enhance revenue generation by public-private water utilities, including billing systems, tariff levels, payment methods, non-revenue water, unaccounted-for water, connection coverage, as well as consumers' willingness to pay for services, among others. Existing literature suggests that water utilities in various countries have achieved varying levels of financial sustainability.

Studies such as Adank and Tuffuor (2013), Mimrose and Gunawardena (2011), Frauendorfer and Liemberger (2010), Fragano (2010) and World Bank (2006), among others, have assessed the relationship between financial sustainability of public, private and community water utilities and various aspects of revenue generation. For instance, Adank and Tuffuor (2013) reported significant association between financial stability of private water schemes in Ghana and factors such as non-revenue water, metering coverage and efficiency of general operations. The influence of revenue generation on financial sustainability of community water schemes was also reported in Sri Lanka by Mimrose and Gunawardena (2011). Revenue generation aspects covered by the study included billing and revenue collection, metering ratio, non-revenue water and unaccounted-for water.

The influence of non-revenue water and unaccounted-for water on financial sustainability of rural water schemes was also reported in a multi-county study commissioned by the World Bank. Non-revenue water is the difference between the volume of water put into the distribution system and the volume that is billed for authorized consumption. The difference between the input volume and the billed volume is caused by water losses, which are categorized into two, viz. real and apparent losses. Real losses include leakages in distribution mains and service connections, as well as leakage and spillage from storage tanks. Apparent losses include illegal connections and inaccurate metering. Non-revenue water also includes authorized, but unbilled consumption such as through community stand posts, as well as water used for fire fighting. Unaccounted-for water is the difference between the volume of water delivered into a network and the volume of water that can be accounted for by legitimate consumption, whether metered or not. Like non-revenue water, unaccounted-for water is attributable to leakage or theft of water from the distribution and storage systems. However, unlike non-revenue water, unaccounted-for water does not include unbilled authorized consumption, whether metered or not (Frauendorfer & Liemberger, 2010).

The study reported that water loss through leakages and unbilled consumption affected financial viability of water utilities in developing countries, particularly through revenue loss and high operation costs (World Bank, 2006). In Kenya, Kibuika and Wanyoike (2012) reported a strong negative correlation between financial sustainability of rural water schemes and the amount of unaccounted-for water ($r = -0.656$; $p < 0.01$). Unaccounted-for water was attributed to factors such as delayed maintenance of distribution lines, low operational efficiency, theft, inaccurate billing system, bad meters and low revenue generation. The influence of unaccounted-for water and non-revenue water were also reported in Paraguay by Fragano (2010). In this regard, study indicated that 67% of the projects examined were providing water continuously because they were financially stable, 54% were in a good state of maintenance, 29% had either expanded or were in the process of expanding their water supply infrastructure in response to growing demand. The achievements were attributed to factors such as near-universal metering, computerized billing systems, a high level of revenue generation, as well as favorable water tariff coupled with reliable services, which stimulated consumers to pay.

In their study, Sanders and Fitts (2011) found a significant relationship between cost recovery of water supply schemes and the amount of tariffs charged per unit of water consumed. The study further indicated that tariffs and user fees were crucial primary elements of cost recovery in water service schemes. Although in some communities charging user fees raises ethical concerns, balancing the amount of fees charged and parameters such as O&M costs as well as purchasing power of a community remains a delicate issue (Sanders & Fitts, 2011).

Still on community purchasing power, Check (2015) reported a significant correlation between financial sustainability of private water schemes in Uganda and the level of household revenue. In this regard, a water scheme located in communities with regular revenue was about thrice as likely to recover O&M costs as that located in communities with seasonal revenue. Besides, water schemes in communities with regular revenues were found to be more reliable in providing services than those in communities with seasonal revenue (Check, 2015); which suggests that a higher purchasing power is likely to influence willingness to pay for water services.

More still, willingness to pay for services is an indication of consumer satisfaction with quality of services. A study conducted by Abebe, Bosona and Gebresenbet (2013) in Central Ethiopia reported that about 55% of respondents were dissatisfied with the quality of services provided by public-private water schemes due to rationing. The authors concluded that when people are not satisfied with quality of services, the level of demand reduces and so is the amount of revenue generated and ability of water schemes to achieve financial sustainability. Lastly, the introduction of electronic payment methods using mobile phones is another aspect of revenue generation that has been linked to financial sustainability of rural water schemes. A study conducted in Kenya showed that introduction of mobile phone payment method, helped residents of Kiamumbi community in the outskirts of Nairobi to pay their bills without going to queue in banks, which in turn, improved revenue generation and cost recovery (Norman & Parker, 2011).

METHODOLOGY

The study was designed in line with core tenets of the positivist and constructivist schools of thought. Positivist scholars believe that information derived from observation of phenomena is an exclusive source of authoritative knowledge. Such information only qualifies to be authoritative knowledge when the observed phenomena are external and independent; as well as when the observation process is objective. A positivist investigator is keen on determining causality between two or more sets of phenomena, which necessitates formulation and testing of null hypotheses. Contrastingly, constructivist scholars believe that phenomena are socially constructed and are subjective, which implies that a constructivist investigator becomes part of the phenomena under investigation (Wong, 2014). Easterby-Smith, Thorpe and Lowe (1991) noted that a constructivist investigator focuses on the meaning of phenomena being observed, examines its totality and induces generalizations. The methods used under constructivist paradigm are numerous and are often combined to better understand phenomena (Wong, 2014).

Based on positivist thoughts, this study was designed to determine bivariate relationships between indicators of revenue generation and financial sustainability of public-private water utilities. Under the constructivist paradigm, requisite data were sourced using Key Informant Interviews (KIIs) and Focused Group Discussions (FGDs). The resultant information was used to examine the totality of relationship between indicators of revenue generation and financial sustainability of public-private utilities. Based on the positivist and constructivist thoughts, a mixed methods approach, with both quantitative and qualitative research methods, was applied (Sale, Lohfeld & Brazil, 2002). As noted by Hughes and Sharrock (1997), each method has its philosophical basis, including a patterned set of assumptions concerning reality (ontology), knowledge of reality (epistemology), and particular ways of knowing that reality (methodology). Whereas quantitative methods elicited information for descriptive and

inferential purposes, qualitative methods obtained in-depth information for validating quantitative results.

Lake Victoria South Water Services Board (LVSWSB) covers eight counties, including Kisumu, Siaya, Homa Bay, Migori, Kisii, Nyamira, Kericho and Bomet. Each county is served by one public-private water utility, except Kisii and Nyamira, which share a utility, as indicated in Table 1.

Table 1: Targeted counties and public-private water utilities

Counties	Public-private water utilities
Kisumu	Kisumu Water and Sewerage Company Limited (KIWASCO)
Siaya	Siaya-Bondo Water and Sewerage Company Limited (SIBOWASCO)
Homa Bay	Homa Bay Water and Sewerage Company Limited (HOMAWASCO)
Migori	Migori Water and Sewerage Company Limited (MIWASCO)
Kisii	Gusii Water and Sewerage Company Limited (GWASCO)
Nyamira	Gusii Water and Sewerage Company Limited (GWASCO)
Kericho	Kericho Water and Sewerage Company Limited (KEWASCO)
Bomet	Bomet and Sewerage Company Limited (BOWASCO)

The study targeted public-private water utilities in five of the counties, namely Kisumu, Migori, Kisii, Kericho and Bomet. In each utility, five categories of water officers, including managerial, operations, technical, commercial and finance were involved in the study. Also targeted were three groups of users, namely, commercial users such as guest houses, restaurants, fish processors, launders and car washers; government institutions, including health facilities, ministries and academic institutions; and domestic users, who were represented by household heads. A three-stage sampling process was applied to obtain units of analysis. Firstly, a random sampling process was applied to select five counties from the sampling frame indicated in Table 1. Secondly, the utilities were sampled purposively, based on their public-private ownership structure. In the process, KIWASCO, MIWASCO, GWASCO, KEWASCO and BOWASCO were sampled. Thirdly, five cadres of water officers, including managerial, operations, technical, commercial and finance were also identified and sampled purposively. Table 2 shows the distribution of sample sizes for each cadre of water officers.

Table 2: Population and sample size for water officers

Group	Specific cadre	Population (N_i)	Sample (n_i)	Selection/computation method
Managerial	Chief/deputy chief executive officers	5	5	Census
	Departmental heads	25	14	Fisher's formula
Operations	Scheme managers	16	9	,,
	Station in-charges	32	17	,,
Technical	Water engineers and technicians	148	64	,,
Commercial	Commercial officers	104	49	,,
Finance	Finance officers	50	26	,,
Total		**380**	**184**	,,

Fisher's formula for sample size determination from finite populations states that: $n_i = \left\{\frac{\delta(1-\delta)}{\left[\left(\frac{\alpha}{Z}\right)^2 + \delta(1-\delta)/N_i\right]}\right\} * \mu_i$

Where: n_i = sample size, N_i = population, δ = estimated population variance: 0.5, α = desired precision: 0.05, Z = confidence level: 1.96 for 95% on the normal distribution curve and μ_i =

design effect, default: 0.6 (Fink, 1995). Taking the example of commercial officers, whose population was 104, the computation obtains a sample size of 49 respondents.

Primary data were collected between May and July 2016, with permission from relevant authorities, including, National Commission for Science, Technology and Innovation; County administration, and management of each public-private utility. A standard self-administered survey questionnaire was applied to source quantitative data from water officers. The instrument was pre-tested on 20 respondents in Homa Bay County, about 10.9% of the targeted sample size, which according to Sheatsley (1983) is sufficient to discover flaws in data collection instruments. Content Validity Index (CVI) was computed for the survey questionnaire, and the process obtained a CVI of 58.3%, which suggests that the tool's contents were fairly valid (Polit & Beck, 2006). Reliability of data collection questionnaire was determined by computing Spearman-Brown Prophecy Coefficient. The process obtained a Coefficient of 0.88, which according to Garson (2009), suggested a 'good' level of reliability.

Both quantitative and qualitative techniques were applied to process and analyze data. Quantitative techniques included cross-tabulation with Chi square statistic (χ^2) and Spearman's Rank Correlation Coefficient, to determine the strength of bivariate relationships between indicators of revenue generation and financial sustainability of public-private utilities. Besides, Relative Importance Index (RII) was applied to determine the relative importance of each indicator in relation to the financial sustainability of public-private water utilities. Kendall's Coefficient of Concordance (W) was applied to determine the concordance of respondents' perceptions regarding the relationship between indicators of revenue generation and financial sustainability of the utilities. The following publications expound the methodology that was applied in this study: Kometa, Oloimolaiye and Harris (1994), as well as Frimpong, Olowoye and Crawford (2003). All the quantitative analyses were performed using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel.

RESULTS

This section presents results of the study, which are organized under four thematic areas, including cross-tabulation analysis of respondents' background profile and financial sustainability of the public-private water utilities; cross-tabulation analysis of revenue generation indicators and financial sustainability of the public-private water utilities; relative importance analysis of the indicators, as well as concordance of respondents' perceptions regarding relationship between the indicators and financial sustainability of the public-private water utilities. Details are contained in the following sub-sections.

Cross-tabulation analysis of respondents' profile and financial sustainability of the water utilities

Results show that of the 184 targeted respondents, 161 (87.5%) employees of the public-private water utilities completed self-administered questionnaires. One important item in the questionnaires required respondents to indicate their perceptions regarding performance of their utilities in defraying Operation and Maintenance (O&M) costs on a four-point measurement scale, as 'very good', 'good', 'poor' or 'very poor'. In this regard, 9 (5.6%) respondents rated performance of their utilities as 'very good', while 57 (35.4%) indicated 'good'. Those who felt that their utilities had performed 'poorly' were 81 (50.4%)

respondents, while 14 (8.7%) alluded 'very poor' performance. In order to achieve objectives of this study, 'very good' or 'good' performance in defraying O&M costs were considered signs of financial sustainability, while 'poor' or 'very poor' performance indicated lack of financial sustainability. Based on this understanding, cumulative results show that up to 66 (41.0%) respondents expressed signs of financial sustainability in their utilities, while 95 (59.0%) hinted at lack of financial sustainability.

The study covered various background attributes of respondents, which were thought to have some influence on perceptions regarding performance of the public-private water utilities in defraying O&M costs. The attributes included affiliated utility, job category, gender, highest education level and highest professional training. The attributes were cross-tabulated against perceptions regarding financial sustainability. The results summarized in Table 3 show that 35 (21.7%) respondents were affiliated to BOWASCO, 33 (20.5%) were employees of GWASCO, while 32 (19.9%) worked for KEWASCO. Another 32 (19.9%) respondents were employed by MIWASCO, while KIWASCO was represented by 29 (18.0%) respondents. Cumulative results suggests that among those who indicated signs of financial sustainability (66), up to 21 (31.8%) were employed by MIWASCO, 15 (22.7%) worked for BOWASCO, while 11 (16.7%) were employees of GWASCO. Contrastingly, among those who stated signs of no financial sustainability (95), 23 (24.2%) worked for KEWASCO, 22 (23.2%) were employed by GWASCO, while 20 (21.1%) served at BOWASCO. Based on this, the analysis obtained a computed Chi square (χ^2) value of 20.708, with 12 degrees of freedom (df) and a 2-tailed ρ-value of 0.055, which suggests that respondents' utility of affiliation significantly associated with perceptions regarding financial sustainability of the utilities. Better still, the utilities varied significantly in terms of the extent of financial sustainability.

The respondents held various positions in their utilities, which were broadly grouped into five job categories, namely, managerial, 45 (28.0%); operations, 54 (33.5%); technical, 26 (16.1%); commercial, 21 (13.0%); and finance, 15 (9.3%). Again, cumulative results show that among those who indicated signs of financial sustainability (66), 21 (31.8%) belonged to operations job category, 20 (30.3%) held managerial positions, while 11 (16.7%) were commercial officers. However, among those who hinted at no financial sustainability, 33 (34.7%) held operational positions, 25 (26.3%) were managerial staff, while 16 (16.8%) served as technical officers. Nonetheless, the analysis revealed lack of a significant relationship between respondents' job category and perceptions regarding financial sustainability of the utilities (χ^2 = 8.108, df = 12 & ρ-value = 0.777). The results further suggest that all respondents were homogenous in terms of perceptions about financial sustainability of the utilities, irrespective of their job categories.

Table 3: Cross-tabulation of respondents' profile and financial sustainability of the utilities

Attributes	Very Good		Good		Poor		Very poor		Total	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Affiliated utility										
KIWASCO	0	0.0	10	17.5	16	19.8	3	21.4	29	18.0
MIWASCO	3	33.3	18	31.6	11	13.6	0	0.0	32	19.9
GWASCO	4	44.4	7	12.3	17	21.0	5	35.7	33	20.5
KEWASCO	0	0.0	9	15.8	19	23.5	4	28.6	32	19.9
BOWASCO	2	22.2	13	22.8	18	22.2	2	14.3	35	21.7
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Job category										
Managerial	3	33.3	17	29.8	22	27.2	3	21.4	45	28.0
Operations	2	22.2	19	33.3	27	33.3	6	42.9	54	33.5
Technical	1	11.1	9	15.8	15	18.5	1	7.1	26	16.1
Commercial	1	11.1	10	17.5	8	9.9	2	14.3	21	13.0
Finance	2	22.2	2	3.5	9	11.1	2	14.3	15	9.3
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Gender										

Male	4	44.4	42	73.7	48	59.3	11	78.6	105	65.2
Female	5	55.6	15	26.3	33	40.7	3	21.4	56	34.8
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Highest education level										
Secondary	1	11.1	7	12.3	8	9.9	1	7.1	17	10.6
College	5	55.6	33	57.9	45	55.6	9	64.3	92	57.1
University	3	33.3	17	29.8	28	34.6	4	28.6	52	32.3
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**

The results in Table 3 further show that the respondents included 105 (65.2%) men and 56 (34.8%) women. In relation to financial sustainability of the utilities, cumulative results show that those who indicated signs of financial sustainability (66), included 46 (69.7%) men and 20 (30.3%) women. Men also formed the majority of those whose perceptions suggested lack of financial sustainability, 59 (62.1%). Again, the analysis revealed no significant relationship between respondents' gender and perceptions regarding financial sustainability of the utilities ($\chi^2 = 5.882$, df = 3 & ρ-value = 0.118). The results suggest that there was no significant difference in the perceptions of male and female respondents concerning financial sustainability of the utilities.

Of the 161 respondents, 92 (57.1%) had attained college education, 52 (32.3%) indicated university education, while 17 (10.6%) had secondary level education. Cumulative results show that among those who indicated signs of financial sustainability (66), 38 (57.6%) had attained college education, 20 (30.3%) stated university education, while 8 (12.1%) mentioned secondary education. Among those who felt that their utilities had not attained financial sustainability, 54 (56.8%) were college graduates, while university graduates were 32 (33.7%). However, the analysis revealed lack of a significant relationship between respondents' educational attainment and financial sustainability of the utilities ($\chi^2 = 0.824$, df = 6 & ρ-value = 0.991). Again, the results suggest that there was no significant difference in perceptions of university, college and secondary education holders regarding financial sustainability of the public-private water utilities.

Cross-tabulation analysis of revenue generation and financial sustainability of the water utilities

The study covered eight aspects (indicators) of revenue generation, including the *type of billing system, efficiency of the billing system, type of payment methods* and *water tariff vis-à-vis community purchasing power*. Other indicators included *water tariff vis-à-vis cost recovery, non-revenue water, unaccounted-for water,* as well as *willingness of communities to pay for water services*. Whereas the type of billing system and type of payment methods were measured at nominal scale, the remaining indicators were captured at ordinal scale. The latter were used to formulate hypothetical test statements, against which respondents were requested to indicate their most accurate views.

Respondents were requested to indicate the *type of billing system* used by their utilities. The results in Table 4 show that 81 (50.3%) respondents mentioned manual billing systems, 28 (17.4%) said that the billing systems were partially computerized, while 15 (9.3%) indicated that the systems were fully computerized. Notably though, about one-fifth, 37 (23.0%), did not know the type of billing systems used by their utilities. Cumulative results show that among the respondents who indicated signs of financial sustainability (66), 28 (42.4%) said that their billing systems were manual, 13 (19.7%) mentioned partially computerized systems, while 8 (12.1%) affirmed that the systems were fully computerized. Among those who indicated signs of no financial sustainability (95), more than one-half, 53 (55.8%) stated that their utilities were using manual billing systems, 15 (15.8%) said the systems were

partially computerized, while 7 (7.4%) said that the systems were fully computerized. Based on this, the analysis obtained a computed Chi square (χ^2) value of 19.150, with 9 degrees of freedom (df) and a ρ-value of 0.024, which suggest up to 95% chance that the type of billing system used by the public-private water utilities significantly associated with their financial sustainability. Thus, upgrading the billing system is likely to influence financial sustainability of the utilities.

Respondents were also requested to indicate the extent to which they agreed or disagreed with the hypothetical test item, which stated that '*The billing system in my organization is efficient'*. The results in Table 4 show that 63 (39.1%) respondents agreed with the statement, while 2 (1.2%) agreed strongly. Contrastingly, 58 (36.0%) respondents disagreed, while 31 (19.3%) expressed strong disagreement. Cumulatively, up to 65 (40.4%) respondents indicated satisfaction with the efficiency of billing systems in their utilities, while 89 (55.3%) expressed dissatisfaction. Furthermore, cumulative results in Table 4 show that among the respondents who indicated signs of financial sustainability (66), 28 (42.4%) disagreed with the test statement, while 24 (36.4%) agreed. Among those who hinted signs of lack of financial sustainability (95), 39 (41.1%) agreed with the statement, 30 (31.6%) disagreed; while up to 22 (23.2%) disagreed strongly. Based on this, Table 5 shows that the analysis obtained a Spearman's rank correlation coefficient of 0.222, with a ρ-value of 0.005, which suggests up to 99% chance that efficiency of the billing systems used by public-private water utilities significantly correlated with their financial sustainability. Consequently, improving efficiency of the billing system is likely to influence significant changes on the degree of financial sustainability among the utilities.

Respondents were requested to indicate the types of payment methods that were formally adopted by their utilities. The results in Table 4 show that 87 (54.0%) respondents identified payment through bank, in form of cash or cheque deposits; followed by 55 (34.2%) who cited payment through mobile phones, and 15 (9.3%) who stated payment through cash. The results in Table 4 further show that among the respondents whose responses signaled financial sustainability (66), 41 (62.1%) mentioned payment through bank, 17 (25.8%) cited payment through mobile phones, while 6 (9.1%) stated cash payment. Among those who indicated signs of no financial sustainability, about one-half, 46 (48.4%), identified payment through bank, 38 (40.0%) mentioned payment through mobile phones, while 9 (9.5%) cited payment through cash. Based on this, the analysis obtained a computed χ^2 value of 19.774, with 9 degrees of freedom and a ρ-value of 0.019, which suggest up to 95% chance that the types of payment methods adopted by public-private water utilities significantly associated with their financial sustainability.

Respondents were also requested to indicate their views regarding the *'level of water tariff',* vis-à-vis purchasing power of communities served by their utilities. In this regard, the results in Table 4 indicate that 110 (68.3%) respondents described the level of water tariff as fair, 27 (16.8%) felt that water tariff was high, while 11 (6.8%) rated it as too high. Cumulatively, 123 (76.4%) respondents expressed satisfaction with the level of water tariff, while 38 (23.6%) indicated dissatisfaction. Among the respondents whose responses signaled financial sustainability (66), up to 52 (78.8%) affirmed that the level of water tariff was fair, while 9 (13.6%) felt that it was high. Among those whose responses signaled lack of financial sustainability (95), again, the majority, 58 (61.1%) rated the level of water tariff as fair, 18 (18.9%) thought it was high, while 9 (9.5%) indicated too high. As indicated in Table 5, the analysis obtained a correlation coefficient of -0.062 and a ρ-value of 0.432, which is not

significant; thus, suggesting that the level of water tariff and financial sustainability of public-private water utilities were not significantly correlated.

Table 4: Cross-tabulation of revenue generation indicators and financial sustainability of water utilities

Revenue generation indicators	Very Good		Good		Poor		Very poor		Total	
	Count	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*	*Count*	*Percent*
Type of billing system										
Fully computerized	3	33.3	5	8.8	4	4.9	3	21.4	15	9.3
Partially computerized	0	0.0	13	22.8	14	17.3	1	7.1	28	17.4
Manual	6	66.7	22	38.6	45	55.6	8	57.1	81	50.3
Don't know	0	0.0	17	29.8	18	22.2	2	14.3	37	23.0
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Efficiency of the billing system										
Agree strongly	1	11.1	1	1.8	0	0.0	0	0.0	2	1.2
Agree	7	77.8	17	29.8	30	37.0	9	64.3	63	39.1
Undecided	1	11.1	2	3.5	3	3.7	1	7.1	7	4.3
Disagree	0	0.0	28	49.1	26	32.1	4	28.6	58	36.0
Disagree strongly	0	0.0	9	15.8	22	27.2	0	0.0	31	19.3
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Type of payment methods adopted										
Cash	1	11.1	5	8.8	9	11.1	0	0.0	15	9.3
Bank	6	66.7	35	61.4	44	54.3	2	14.3	87	54.0
Mobile phone	2	22.2	15	26.3	26	32.1	12	85.7	55	34.2
Don't know	0	0.0	2	3.5	2	2.5	0	0.0	4	2.5
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Level of tariff vis-à-vis community purchasing power										
Too high	0	0.0	2	3.5	5	6.2	4	28.6	11	6.8
High	0	0.0	9	15.8	18	22.2	0	0.0	27	16.8
Fair	9	100.0	43	75.4	52	64.2	6	42.9	110	68.3
Low	0	0.0	1	1.8	2	2.5	4	28.6	7	4.3
Too low	0	0.0	2	3.5	4	4.9	0	0.0	6	3.7
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Water tariff is optimal for cost recovery										
Agree strongly	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Agree	9	100.0	43	75.4	52	64.2	6	42.9	110	68.3
Undecided	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Disagree	0	0.0	10	17.5	25	30.9	5	35.7	40	24.8
Disagree strongly	0	0.0	4	7.0	4	4.9	3	21.4	11	6.8
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Non-revenue water is within acceptable range										
Agree strongly	1	11.1	2	3.5	2	2.5	1	7.1	6	3.7
Agree	2	22.2	11	19.3	17	21.0	4	28.6	34	21.1
Undecided	0	0.0	2	3.5	3	3.7	0	0.0	5	3.1
Disagree	6	66.7	40	70.2	56	69.1	4	28.6	106	65.8
Disagree strongly	0	0.0	2	3.5	3	3.7	5	35.7	10	6.2
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Unaccounted-for water is within acceptable range										
Agree strongly	0	0.0	7	12.3	11	13.6	4	28.6	22	13.7
Agree	4	44.4	30	52.6	40	49.4	3	21.4	77	47.8
Undecided	1	11.1	6	10.5	9	11.1	2	14.3	18	11.2
Disagree	4	44.4	12	21.1	17	21.0	0	0.0	33	20.5
Disagree strongly	0	0.0	2	3.5	4	4.9	5	35.7	11	6.8
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**
Community is willing to pay										
Agree strongly	0	0.0	15	26.3	11	13.6	7	50.0	33	20.5
Agree	3	33.3	13	22.8	29	35.8	3	21.4	48	29.8
Undecided	0	0.0	5	8.8	4	4.9	1	7.1	10	6.2
Disagree	5	55.6	20	35.1	24	29.6	3	21.4	52	32.3
Disagree strongly	1	11.1	4	7.0	13	16.0	0	0.0	18	11.2
Total	**9**	**100.0**	**57**	**100.0**	**81**	**100.0**	**14**	**100.0**	**161**	**100.0**

*,**,*** show significance at $\rho<0.1$, $\rho<0.05$ and $\rho<0.01$ error margins, respectively

Still on water tariff, respondents were asked to indicate the extent to which they agreed or disagreed with the hypothetical test item stating that *'water tariff is optimal for full cost recovery'*. In this regard, the results in Table 4 show that 110 (68.3%) respondents agreed with the test statement, 40 (24.8%) disagreed, while 11 (6.8%) disagreed strongly.

Cumulatively, 110 (68.3%) respondents affirmed that water tariff level was optimal for cost recovery, while 51 (31.7%) felt that it was sub-optimal. Among the respondents whose views signaled financial sustainability (66), 52 (78.8%) agreed with the test statement, while 10 (15.2%) disagreed. Among those whose responses suggested lack of financial sustainability (95), up to 58 (61.1%) agreed that water tariff was optimal for full cost recovery, while 30 (31.6%) disagreed. Based on this, Table 5 shows that the analysis obtained a correlation coefficient of 0.230, with a ρ-value of 0.003, which suggest up to 99% chance that the level of water tariff vis-à-vis full cost recovery significantly correlated with financial sustainability of the public-private water utilities.

Table 5: Correlation between revenue generation indicators and financial sustainability of water utilities

		Utility's performance in defraying O&M costs	Utility's billing system is efficient
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	0.222
	Sig. (2-tailed)	.	0.005***
	N	161	161
Utility's billing system is efficient	Correlation Coefficient	0.222	1.000
	Sig. (2-tailed)	0.005***	.
	N	161	161
		Utility's performance in defraying O&M costs	Level of water tariff, vis-à-vis community purchasing power?
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	-0.062
	Sig. (2-tailed)	.	0.432
	N	161	161
Level of water tariff, vis-à-vis community purchasing power?	Correlation Coefficient	-0.062	1.000
	Sig. (2-tailed)	0.432	.
	N	161	161
		Utility's performance in defraying O&M costs	Level of water tariff is optimal for full cost recovery
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	0.230
	Sig. (2-tailed)	.	0.003***
	N	161	161
Level of water tariff is optimal for full cost recovery	Correlation Coefficient	0.230	1.000
	Sig. (2-tailed)	0.003***	.
	N	161	161
		Utility's performance in defraying O&M costs	Non-revenue water is within the acceptable bench mark
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	0.250
	Sig. (2-tailed)	.	0.001***
	N	161	161
Non-revenue water is within the acceptable bench mark	Correlation Coefficient	0.250	1.000
	Sig. (2-tailed)	0.001***	.
	N	161	161
		Utility's performance in defraying O&M costs	Unaccounted-for water is within the acceptable limits
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	0.169
	Sig. (2-tailed)	.	0.032**
	N	161	161
Unaccounted-for water is within the acceptable limits	Correlation Coefficient	0.169	1.000
	Sig. (2-tailed)	0.032**	.
	N	161	161
		Utility's performance in defraying O&M costs	Communities served are willing to pay for services
Utility's performance in defraying O&M costs	Correlation Coefficient	1.000	-0.074
	Sig. (2-tailed)	.	0.351
	N	161	161
Communities served are willing to pay for services	Correlation Coefficient	-0.074	1.000
	Sig. (2-tailed)	0.351	.
	N	161	161

*,**,*** show significance at ρ<0.1, ρ<0.05 and ρ<0.01 error margins, respectively

The study also captured respondents' degree of agreement or disagreement with the hypothetical test item, stating that *'Non-revenue water is within the acceptable range'*. In this regard, Table 4 shows that 34 (21.1%) respondents agreed with the test statement, while 6

(3.7%) agreed strongly. Contrastingly, up to 106 (65.8%) respondents disagreed with the statement, while 10 (6.2%) disagreed strongly. Cumulatively, 40 (24.8%) respondents indicated satisfaction with non-revenue water, while 116 (72.0%) expressed dissatisfaction. Furthermore, cumulative results show that among the respondents whose views signaled financial sustainability (66), 16 (24.2%) affirmed the test statement on non-revenue water; while up to 48 (72.7%) indicated contrary thoughts. Among those whose responses signaled lack of financial sustainability (95), 24 (25.3%) affirmed that non-revenue water was within the acceptable range, while 68 (71.6%) stated contrary views. Based on this, the results in Table 5 show that non-revenue water significantly correlated with financial sustainability of the public-private water utilities (Spearman's rho = 0.250 & ρ-value = 0.001). The results imply that non-revenue water was likely to influence financial sustainability of the public-private water utilities.

Respondents were further requested to indicate the extent to which they agreed or disagreed with the hypothetical test item, stating that '*Unaccounted-for water is within the acceptable range'*. In this regard Table 4 shows that 77 (47.8%) respondents agreed with the test statement, while 22 (13.7%) agreed strongly. Those who disagreed with the statement were 33 (20.5%), while 11 (6.8%) disagreed strongly. Cumulatively, 99 (61.5%) respondents indicated satisfaction with the statement, while 44 (27.3%) expressed dissatisfaction; thus, suggesting that unaccounted-for water was either higher or lower than the acceptable range. In relation to financial sustainability, among those whose responses suggested that the utilities were financially sustainable (66), 41 (62.1%) affirmed that unaccounted-for water was within the acceptable range, while 18 (27.3%) contradicted the hypothetical test statement. Among those whose views suggested that the utilities were not financially sustainable, 58 (61.1%) affirmed the test statement, while 26 (27.4%) negated it. Based on this, the results in Table 5 show that the analysis obtained a correlation coefficient of 0.169 and a ρ-value of 0.032, which suggest up to 95% chance that unaccounted-for water significantly correlated with financial sustainability of public-private water utilities.

The study also required respondents to indicate the extent to which they agreed or disagreed with the hypothetical test item, which stated that *'Community members are willing to pay for water services'*. in this regard, the results presented in Table 4 show that 48 (29.8%) respondents agreed with the statement, while 33 (20.5%) agreed strongly. Those who disagreed with the statement were 52 (32.3%), while 18 (11.2%) disagreed strongly. Cumulatively, 81 (50.3%) respondents affirmed that community members were willing to pay for water services, while 70 (43.5%) negated the hypothetical statement. Among the respondents whose views suggested that the utilities were financially sustainable (66), 31 (47.0%) expressed agreement with the hypothetical test statement, while 30 (45.5%) negated it. Among those whose responses suggested lack of financial sustainability (95), 50 (52.6%) affirmed that community members were willing to pay for water services, while 40 (42.1%) expressed contrary views. As indicated in Table 5, the analysis obtained a correlation coefficient of -0.074 and a ρ-value of 0.351, which is not significant. The results suggest that willingness of community members to pay for water services had no significant relationship with financial sustainability of the public-private water utilities.

Relative importance analysis of revenue generation and financial sustainability of water utilities

The cross-tabulation analysis in the previous sub-section revealed significant relationships between financial sustainability of the public-private water utilities and various indicators of

revenue generation, including type of billing system, which for the purpose of further analysis, was coded as *TBSystem*; efficiency of the billing system *(EBSystem)*, formal payment methods *(FPMethods)*, non-revenue water *(NRWater)*, water tariff vis-à-vis cost recovery *(TCRecovery)*, as well as unaccounted-for water *(UAWater)*. The indicators of revenue generation were coded to facilitate relative importance analysis, which generated three outputs; viz. correlation co-efficients (β), general dominance weights and relative weights, as presented in Table 6. Relative weights were used to express the importance of each indicator of revenue generation in relation to financial sustainability of the public-private water utilities.

Table 6: Relative importance of revenue generation and financial sustainability of water utilities

	INTER-ITEM CORRELATION MATRIX						RELATIVE IMPORTANCE		
Revenue generation indicators	*FPMethods*	*EBSystem*	*UAWater*	*TCRecovery*	*TBSystem*	*NRWater*	β	General dominance weights	Relative weights
FPMethods	1.000	0.386	0.457	0.460	0.455	0.528	0.512	0.799	0.785
EBSystem	0.386	1.000	0.414	0.409	0.290	0.434	0.495	0.782	0.768
UAWater	0.457	0.414	1.000	0.383	0.200	0.527	0.484	0.771	0.758
TCRecovery	0.460	0.409	0.383	1.000	0.357	0.236	0.471	0.758	0.744
TBSystem	0.455	0.290	0.200	0.357	1.000	0.158	0.528	0.815	0.803
NRWater	0.528	0.434	0.527	0.236	0.158	1.000	0.566	0.853	0.837

The results in Table 6 suggest that non-revenue water *(NRWater)* was the most important indicator of revenue generation that influenced financial sustainability of the public-private water utilities, with a relative weight of 0.837. Notably, up to 116 (72.0%) respondents felt that non-revenue water was not within the acceptable range. Some respondents estimated non-revenue water to range between 30% and 45%, for the most and the least efficient utility, respectively; which is higher than the acceptable average of 20%. Respondents linked the high proportion of non-revenue water to losses through physical leakages in distribution systems, particularly due to lack of routine maintenance, as well as illegal connections. Regardless of underlying factors, respondents concurred that the high proportion of non-revenue water affected revenue targets, which in turn, undermined potential of the water utilities to achieve financial sustainability. The resulting imbalance between revenues and financial obligations, often led to financial constraints, which affected timely and routine maintenance of equipment, remuneration of workers and delivery of water services.

The type of billing system *(TBSystem)* was the second most important factor influencing financial sustainability of the public-private water utilities (relative weight = 0.803). The type of systems used to compile meter data, as well as compute and distribute water bills, is crucial for revenue generation and the potential of water utilities to achieve financial sustainability. Notably, about one-half of the respondents, 81 (50.3%), indicated that the type of billing system used by their utilities was purely manual. Only 43 (26.7%) respondents hinted that their utilities had initiated computerization of the billing systems. Respondents linked the dominance of manual billing systems to lack of appropriate Information and Communication Technology (ICT) equipment, including computers and software programs. Where such equipment existed, consistent utilization in billing activities was constrained by lack of technical skills among water officers. The dominance of manual billing systems was also linked to erroneous compilation of meter data; thereby, leading to under-valuation, and

in a few instances, over-valuation of water services. Whereas under-valuation of water services directly reduced revenues, over-valuation was linked to dissatisfaction among customers, unwillingness to pay, disconnections and bad debts, which indirectly deprived the utilities of revenues. By reducing revenues, there is no doubt that the dominance of manual billing systems undermined the potential of the water utilities to achieve financial sustainability.

The third factor in the order of relative importance was formal payment methods adopted by the water utilities *(FPMethods)*, which generated a relative weight of 0.785. Notably, more than one-half of respondents, 87 (54.0%), mentioned payment through bank as the dominant method, 55 (34.2%) cited payment through mobile phones, while 15 (9.3%) stated cash. Even though payment through bank was the most common, its dominance was gradually fading away, particularly among household consumers, because of inconveniences such as long distance to bank facilities, tedious paperwork, which requires competent literacy skills, as well as long queuing time. Nonetheless, payment through banks was still common among institutional and corporate consumers because the paperwork involved provided documentary evidence for accounting purposes. In addition, respondents noted that mobile phone payment was increasingly becoming a favorite method among household consumers because of its convenience and flexibility, as consumers were able to pay bills from anywhere, without necessarily going to banks or revenue collection offices. Reportedly, challenges such as default rate, delayed payments and number of disconnections were relatively higher among consumers paying through banks than those paying through mobile phones. Thus, the findings suggest that adoption of mobile phone payment method enabled the water utilities to improve revenues and achieve financial sustainability.

Efficiency of the billing system *(EBSystem)* came out as the fourth important factor influencing financial sustainability of the public-private water utilities (relative weight = 0.768). In this regard, up to 89 (55.3%) respondents felt that the billing system was inefficient. Even though the manual billing system was the most dominant, respondents associated it with challenges such as tedious paperwork, delayed completion of the billing process, as well as human error in computations, which manifested through under-costing or over-costing of water services. Whereas under-costing of services sub-optimized revenues, over-costing was linked to delayed payments, disconnections and bad debts, which also reduced revenues and delayed achievement of financial sustainability. Moreover, some respondents noted that under the manual billing system, a number of water consumers were often never billed either erroneously or through collusion; thus, no revenues were obtained from such consumers. High prevalence of non-payment on the part of government institutions, whose disconnection follows a long procedure, also amplified revenue generation challenges. In this regard, upgrading the billing system by computerizing billing operations is likely to enhance efficiency through accurate computation of meter data, timely completion of billing processes and casting the net wider to cover all water users; thereby, improve achievement of revenue targets and financial sustainability.

Unaccounted-for water *(UAWater)* was fifth in the order of relative importance, among aspects of revenue generation that influenced financial sustainability of the public-private water utilities (relative weight = 0.758). In this regard, about one-third of respondents, 44 (27.3%), believed that unaccounted-for water was above the acceptable range of 20%. Respondents acknowledged that unaccounted-for water was high due to deterioration of the piped distribution system, lack of appropriate ICT equipment and budgeted monitoring plans, for timely detection of leakages and illegal connections; low operational efficiency, as well as

poor quality water meters. These challenges affected the amount of revenue generated, which in turn, delayed achievement of financial sustainability by the utilities.

The level of water tariff vis-à-vis cost recovery *(TCRecovery)* was sixth in the order of relative importance (relative weight = 0.744). Even though up to 110 (68.3%) respondents felt that water tariff was optimal for cost recovery, a significant one-third, 51 (31.6%), felt that the level of tariff applied by their utilities was inadequate for cost recovery. Notably, the inadequacy of water tariff was evidenced by perennial financial constraints, which delayed repairs and maintenance of water distribution system, payment of workers, acquisition of necessary supplies, as well as over-dependence on national budgetary allocations. Nonetheless, the analysis revealed that perceptions regarding the adequacy or inadequacy of water tariff were not backed by accurate data, particularly because the real cost of producing and delivering water was either inadequately recorded or completely unknown. The challenge was exacerbated by lack of reliable data about O&M costs; as well as lack of sound M&E mechanisms for collecting and compiling such data in standard formats. Without such data, it's difficult to tell whether applicable water tariff is accurate or not. Consequently, efforts to improve the potential of water utilities to achieve financial sustainability need to consider appropriate monitoring and data capture systems to enhance tariff-setting decisions.

Concordance of perceptions on revenue generation and financial sustainability of water utilities

The results in Table 7 show the mean rank for each indicator of revenue generation, which were obtained on the basis of perceived strength of their influence on the financial sustainability of public-private water utilities. In this regard, non-revenue water was first with a mean rank of 3.72; followed by type of billing system applied by the water utilities (mean rank = 3.26); formal payment methods adopted by the water utilities (mean rank = 3.14); and efficiency of the billing system used by the water utilities (mean rank = 2.93). Ranking fifth was unaccounted-for water with a mean rank of 2.87, while level of water tariff in relation to cost recovery ranked last (mean rank = 2.82).

Table 7: Concordance of perceptions regarding indicators of revenue generation

Ranks		**Test Statistics**	
Revenue generation indicators	Mean Rank	N	161
Type of billing system	3.26		
Efficiency of billing system	2.93	Kendall's W	0.892
Formal payment methods	3.14	Chi-Square	62.612
Non-revenue water	3.72	df	4
Water tariff optimal for cost recovery	2.82	ρ-value	0.000
Unaccounted-for water	2.87		

The analysis obtained a coefficient of concordance (Kendall's W) of 0.892, which suggests a strong concordance of respondents' perceptions regarding the relationship between the indicators of revenue generation and financial sustainability of the public-private water utilities. The analysis also obtained a computed Chi square (χ^2) of 62.612, with 4 degrees of freedom (df) and a significance value (ρ-value) of 0.000, which suggest up to 99% chance that respondents' perceptions regarding the relationship between indicators of revenue generation and financial sustainability of the utilities were concordant. The results suggest that all the indicators included in the study had a significant influence on the financial

sustainability of the public-private water utilities. Consequently, none should be overlooked when planning and financing appropriate response interventions.

CONCLUSIONS AND IMPLICATIONS

The purpose of the study was to generate empirical evidence to support relevant policy discourses and management of water service delivery, as well as spur further research on the subject, not only in Kenya but also in other developing countries. More specifically, the study was expected to determine bivariate relationship between indicators of revenue generation and financial sustainability of the public-private water utilities; examine the relative importance of revenue generation indicators based on the strength of correlation or statistical association with financial sustainability of the public-private water utilities; as well as determine the concordance of perceptions regarding the relationship between indicators of revenue generation and financial sustainability of the public-private water utilities.

The results show that non-revenue water emerged as the most important indicator of revenue generation influencing financial sustainability of the water utilities, with a relative weight of 0.837. Second in the order of relative importance was the type of billing system used by the utilities (relative weight = 0.803), followed by formal payment methods, which generated a relative weight of 0.785; efficiency of the billing system (relative weight = 0.768); unaccounted-for water (relative weight = 0.758), as well as level of water tariff vis-à-vis cost recovery (relative weight = 0.744). The study also revealed a strong and significant concordance of respondents' perceptions regarding the relationship between each indicator of revenue generation and financial sustainability of the water utilities (Kendall's W= 0.892, χ^2 = 62.612, df = 4 & ρ-value = 0.000); implying that all the indicators deserve appropriate response interventions in order to enhance potential of the utilities to achieve financial sustainability, thereby, improve access to quality water services.

A high proportion of non-revenue and unaccounted-for water signals loss from the distribution system through leakage, spillage and pilferage. Loss of water from the distribution system means loss of revenue, which inevitably undermines potential of the utilities to achieve financial sustainability. Reducing non-revenue and unaccounted-for water is an indispensable precursor to achievement of financial sustainability by water utilities. Financially sustainable utilities are better placed to: expand access to water services in under-served areas without further investments in infrastructural facilities, ensure customer satisfaction as well as create employment opportunities, in line with sectoral and national development goals. Notably though, reducing non-revenue and unaccounted-for water is a daunting challenge, particularly in contexts where utilities lack appropriate technology and technical skills for monitoring and detecting leakages, as well as sufficient budgetary resources. In Kenya, the water sector is constrained by perennial budgetary deficits, which makes it difficult for the public-private water utilities to acquire necessary technology and build the capacity of workers, in order to tackle high proportions of non-revenue and unaccounted-for water. Consequently, there is no doubt that the twin challenges will continue militating against ability of the public-private water utilities in the study area to achieve financial sustainability and realize their full potential. Nonetheless, initiating and/or strengthening less demanding programming options, such as partnership with communities, is likely to go a long way in containing non-revenue and unaccounted-for water. For instance, partnership with community members and relevant structures is likely to improve information sharing as well as early reporting of physical leakages, spillage and illegal connections for timely action by the utilities. Equally important is the need for continuous

engagement with multilateral and bilateral development partners, with a view to mobilizing fiscal resources to supplement annual budgetary allocations, as well as acquiring equipment and technical support for managing non-revenue and unaccounted-for water.

The type of billing system adopted by water utility, whether manual or computerized, determines the accuracy of water bills and the efficiency with which such are produced. Whereas manual systems are prone to inaccuracy and inefficiency, computerized systems are likely to generate more accurate bills at less cost and time. Regardless of the type of billing systems adopted by a utility, the accuracy of bills and efficiency of the billing process are paramount pillars for the achievement of financial sustainability. Water bills are inaccurate when they are either under-valuated or over-valuated. Whereas under-valuated bills translate into direct loss of revenues, over-valuated bills may cause indirect loss of revenues by triggering dissatisfaction, unwillingness to pay, disconnections and bad debts. Either way, inaccurate bills and inefficient billing processes are not appropriate for the financial health of water utilities. The findings of this study suggest that manual billing systems are a common feature in the Kenyan water sector, which raises concern about the quality of water bills generated by the public-private water utilities. In order to improve revenue generation and achievement of financial sustainability, transition from manual billing systems to computerized systems is an inevitable necessity. Notably though, the transition process is a capital-intensive undertaking, as it requires appropriate ICT hardware facilities and software programs, as well as technical support in building the capacity of workers. In Kenya, delivery of water services is a devolved function that is primarily funded and overseen by county governments. Even though some utilities have integrated computers in their billing systems, this study amplifies the need for county governments and management of public-private water utilities to prioritize upgrading of billing systems through their annual investment plans.

An effective payment method is one that motivates customers to pay their bills in time by reducing inconveniences such as opportunity costs, transport costs, transaction costs, queuing time and 'complicated' paperwork. Early payment of water bills is crucial for utilities to obtain revenues for defraying O&M costs and investing in infrastructural facilities. Early payment of bills also prevents disconnections and bad debts, which indirectly deprive utilities of the much needed revenues. Therefore, any attempt to enhance financial sustainability of water utilities should not overlook the need to improve payment methods, particularly in terms of versatility, convenience, transaction costs, travel time, queuing time, as well as necessary paperwork, among other aspects. The fundamental point is that payment methods and processes should be made as easy as possible to motivate early payment of bills. In Kenya, the advent of mobile phone payment methods provides an important option, which enables consumers to overcome challenges inherent in payment through banks and cash. Even though the introduction of mobile phone payment methods by some public-private water utilities continues to reduce incidences of delayed payments and non-payment of bills, this study resounds the need for payment methods that are responsive to the needs and circumstances of all consumers. Scaling-up mobile phone payment method is one option that should improve revenues further and enable public-private water utilities achieve financial sustainability.

The level of water tariff in relation to cost recovery is also crucial for the financial sustainability of water utilities. Water tariff is optimal when it can generate sufficient revenue to cover O&M costs, as well as provide incentives for continuous uptake of, and willingness to pay for water services. Setting water tariff for public-private water utilities is a critical process which should ensure that low revenue-earners are not over-charged and water utilities

are not under-paid for their services. The challenge is greater in developing countries, where most households live below the poverty line and leaders use access to water services to advance political interests. Optimal tariff is an indispensable antecedent for the achievement of financial sustainability by water utilities. Setting optimal water tariff requires accurate and complete data on production and distribution costs, which however, was lacking among the public-private water utilities involved in this study. Thus, initiating appropriate monitoring and data capture systems remains a crucial intervention, which will enable the utilities set and manage tariff levels in the best way possible in order to improve revenues and achieve financial sustainability.

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