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The Complexities of Small Towns' Water Systems: Evidence from Two Selected Small Towns in the Middle Belt of Ghana

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Abstract
Most small towns in Ghana have been experiencing unsustainable water supply systems due myriad challenges. This paper focuses on the exploring the nature and extent of these complex challenges. The study was conducted in Kokofu and Parambo-Sawaba Water Supply Systems in the Ashanti and Brong Ahafo Regions of Ghana respectively. Focus group discussions and key informants' interviews were the techniques espoused for this study. In all, ninety-six participants, comprising of eighty community members and sixteen key informants were purposively selected for the study. Data was analysed by identifying gaps between theory and practice, taking into consideration the Guidelines of Small Town Water Sector of Ghana. The study identified the major challenges facing the water systems as: infrastructure inadequacies; the lack of preventive maintenance systems; weak institutional collaboration inter alia. The study concludes that although small town water systems provides an avenue for supplying safe and potable water to small towns in Ghana, the above-mentioned challenges pose a great threat to sustainable water services delivery.
Keywords: Complexities; Small Towns; Water System; Ghana

1. Introduction

Ghana and other sub-Saharan African countries face the challenge of achieving accessible and sustainable water service delivery [Stockholm International Water Institute (SIWI, 2005)]; UNICEF/WHO, 2015). The situation is even worse in rural and small towns where majority of the poor population resides (Ndaw, 2016). A report by WHO/UNICEF (2015) reveals that in rural and small towns, eight out of 10 people in sub- Saharan Africa lack access to improved drinking water sources. Similarly, water coverage for small towns and rural areas in Ghana is estimated at 61.74%. [Ministry of Water Resources, Works and Housing, Ghana (MWRWH), 2010]. This leaves close to 39% of the rural and small town populace without access to safe drinking water.

Small towns are settlements that are sufficiently large and dense to benefit from the economies of scale offered by piped systems, but too small and dispersed to be efficiently managed by a conventional urban water utility (David and Pilgrim 2000 cited in Ndaw, 2016). Dillion (2008) affirms that the management of small towns' water supply systems (STWS) in Ghana has been plagued with a multitude of problems impacting adversely on the efficiency and long-term sustainability of water services delivery. Besides, several studies have also proven that water systems provided in small towns are not operated and maintained in a sustainable manner. Nyarko (2007) for instance, revealed that four (4) out of the twelve (12) newly constructed small towns' water systems (STWS) in the Western Region of Ghana were not functioning due to factors ranging from technical, institutional and financial mismanagement. The International Water and Sanitation Centre and Aguaconsult (2011) report also confirms that between 30 percent to 35 percent of improved water services in small towns of Ghana are out of service at any given time, and the lack of maintenance procedures of the water systems have led to unsafe water usage. Furthermore, Dank (2013) work underscores that Twenty-Two (22) out of Seventy-Five (75) water systems in Thirty-One (31) communities across the North and South of Ghana are dysfunctional.

In view of the above challenges revealed, measuring functionality of service gives a more accurate picture of accessibility to potable water supply and sustainability of water services (MWRWH, 2010). Although many scholars on the topic of sustainable water supply systems have interrogated the issue of functionality, and have identified the major challenge as poor operation and maintenance procedures, there is a dearth of knowledge on the extent and nature of these challenges and most scholars often classify them under broad thematic areas. This paper seeks to bridge this gap in knowledge by investigating the factors accounting for the growing challenges of Small Town Water Systems (STWS) with reference to a study conducted in two selected small towns, Kokofu and Parambo-Sawaba of Ghana, as well as, supported by reviews of recent studies on small town water services in Ghana.

2. Methods

The study was conducted in Kokofu and Parambo-Sawaba. (Refer to Figure. 1). Parambo-Sawaba is in the Pru District in the Brong Ahafo Region whereas Kokofu is found in the Bekwai Municipal Assembly of the Ashanti Region.

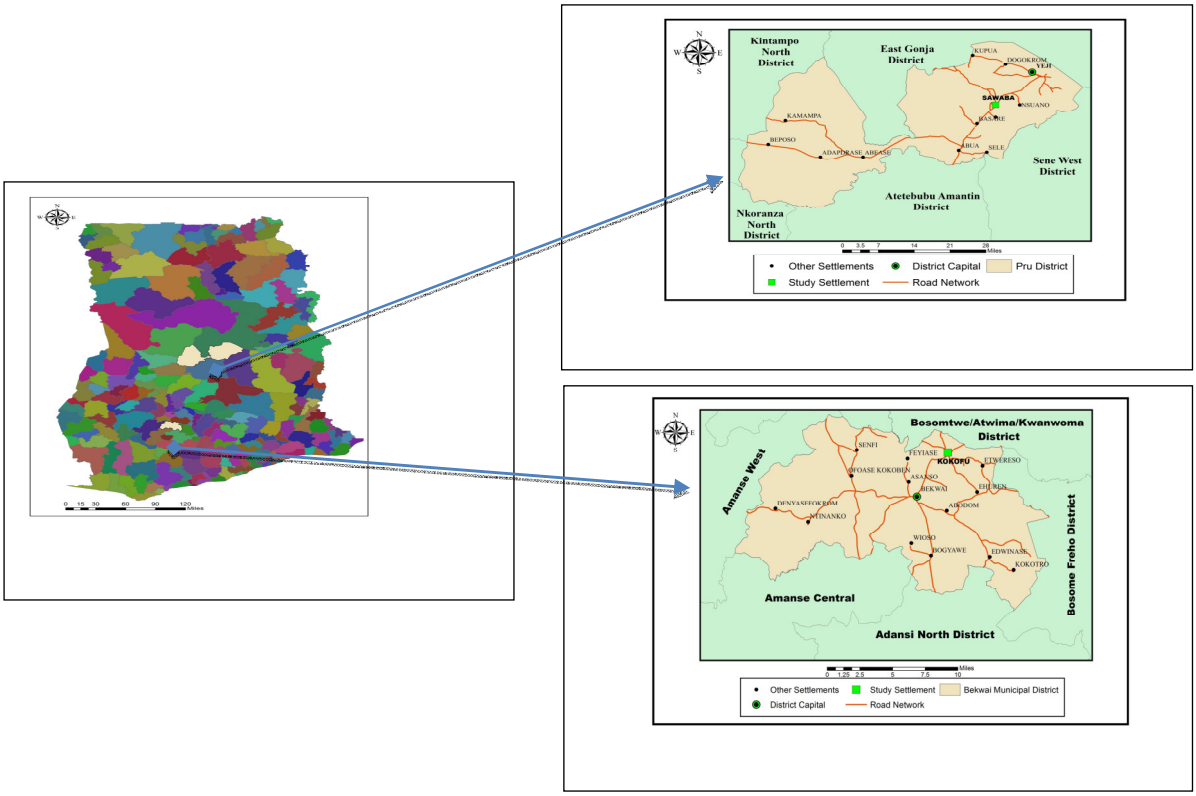

Figure. 1. Map of Study Areas shown from the National and District Perspectives
Source: Authors' Own Construct

The cross-sectional study design was adopted using Kokofu and Parambo -Sawaba Water Systems as case studies. Data were collected from both primary and secondary sources. Secondary data was reviewed from journal articles, institutional repository and internet sources. Data was collected with appropriate interview guides and using digital recording. Focus group discussion and key informant interviews were the two data gathering techniques applied to collect primary data. Stakeholders in the STWS were the units of analysis. In all, ninety-six people, comprising of eighty community members (forty each from the two communities) and sixteen key informants (eight each from the two communities) at the management level, were purposively selected for focus group discussions and key informants' interviews respectively. Focus group discussions focused on the different groupings of the communities including men, women, the youth and children, and each grouping were made of ten members. The key informants' interview centred on two representatives each from the DAs, DWST, WSDBs, and service operators. The study considered some broad ethical areas including voluntary participation, informed consent, confidentiality and anonymity.

Qualitative tools were applied for analysis of the study and particularly, thematic data analysis was espoused to identify, analyse and report patterns within qualitative data which helped to organise the data in rich detail (Braun & Clark, 2006). A statistically representative sample size was not considered, however, findings from each source were triangulated to improve data quality and to validate findings. In addition, key subjective views of the participants were presented using direct quotations whenever possible and to contextualize the discussions.

3. Results and Discussion

The challenges of the water supply systems in the two study communities have been discussed under technical, managerial and administrative, social, as well as financial issues which are prerequisite to ensure sustainable water supply systems.

3.1Technical Challenges

3.1.1 Infrastructure Inadequacies

The inadequacy or the lack of a required infrastructure and equipment in a system reduces the efficiency and effectiveness of the system to function well (Brikke, 2000). In both study communities, the study revealed that the water systems lacked 'automatic cut-out device' to control the water pumps when the high level tank was full. Technical operators therefore handled this process manually at every pump hour and power interruptions. Due to this technical deficiency, operating the system was very tedious and energy sapping. The inadequate water

systems infrastructure is what Dillion (2008) described in his work as the non-practice of corrective maintenance. Because of these infrastructure inadequacies, high water losses averaging 30 to 32 percent were recorded in both study communities. In an interview with the Technical Manager at Parambo-Sawaba, he remarked as follows,

> *"There were several overflows of water at the high level tank over the years. This occurred because there is no device installed to automatically stop the pump when the tank is full, thereby resulting in high percentage value of waste".*

Parambo-Sawaba recorded water losses of 34 percent and 38 percent in 2006 and 2007 respectively. Alternatively, Kokofu recorded had comparatively lower rates of water losses. These were recorded as 20 percent and 30 percent for 2006 and 2007 respectively. These percentages are above the accepted limits of 10% and 20% for new and old system respectively as spelt out in the CWSA (2010) tariff guidelines. Using an average water tariff of GHS 1.1 per meter cube at Parambo Sawaba, an amount of GHS6000 and GHS 10125 in 2006 and 2007 respectively was arrived at as non-revenue water. The non-revenue water reflects the total revenue loss or monies unaccounted for which could have accrued as revenue obtained from water sold.

Similarly, in Kokofu, an amount of GHS 9945 and GHS 6053 was arrived for the same period using an average water tariff of 0.75 per cubic meter at Kokofu. This implies an average of GHS 8063 and GHS 8000 at Parambo Sawaba and Kokofu respectively per annum was lost as non-revenue water, because of high water losses recorded in the two water systems.

3.1.2 High Iron content in Water

Another technical challenge was the existence of high iron content in water supplied which contributed to the rusty nature of the high level tank at the Kokofu Water System. In an interview with the Technical Manager at Kokofu Water System, he narrated that because of iron content in underground water, a regular backwashing, as well as, flushing was carried out every quarterly to reduce the amount of iron content, which consequently led to increased water losses. The study revealed that because of this technical hitch, water quality was greatly affected, and the water had a metallic taste. It was also observed that the colour of water at Kokofu was yellowish-brown.

3.1.3 Lack of Preventive Maintenance

Preventive Maintenance refers to work that is planned and carried out on a regular basis to maintain and keep an infrastructure in good condition (Castro et al, 2009). The study revealed that none of the two water systems visited practiced routine preventive maintenance of equipment, and interventions only occurred when there was a complete breakdown. The lack of preventive maintenance explains why there was frequent break downs of the water pumps in the two water systems. Break down of water pumps at Parambo-Sawaba had occurred three consecutive times within a year, whereas Kokofu had experienced breakdown for once in a year, as revealed by the study. These higher frequencies of breakdowns imply water services delivery could not be described as reliable all year round. The Technical Manager at Kokofu recounted;

> *"In 2007, we experienced two pump breaks which costed several millions of Cedis. For about, 2 weeks we did not have water".*

Besides, the study also revealed that pipelines, valves and fixtures are fixed only when there is a burst or a noticeable leakage. This implies reactive maintenance systems which occurs because of failures and the malfunctioning are only practiced in the water systems. This finding also supports the views of Dillion (2008) & Sarpong Manu (2001) on the score that there are no systems for preventive maintenance of equipment of water systems in many small towns of Ghana.

3.2 Financial Challenges

3.2.1 The Lack of Replacement Funds

The study findings revealed that "replacement fund" to pay for replacement of major system components was not provided in the preparation of budgets in both study areas. The situation has affected the maintenance of existing services, as well as the inability to extend services to serve new settlements. The study identified that in both study communities, monies were borrowed to maintain the water systems when they broke down. The lack of replacement funds increased the down time of the facility. The finding of this study is very much consistent with the view that prolonged lack of investment has led to an almost complete breakdown of water systems in many small towns of Ghana (Dillion, 2008).

3.2.2 High Operating Cost and Low Revenues

The study identified that service operators at Parambo-Sawaba and Kokofu Water Systems face high operating cost because of low demand of water services. The cost of producing one cubic metre of water was GH¢1.6 and GH¢1.1 at Parambo-Sawaba and Kokofu respectively as compared to the urban figures of GH ¢0.6. This finding is in consistent with Adank (2010) work which states that small town water services face the challenge of high operating costs and low revenues because actual water use is generally low, often lower than the design capacity resulting in low incomes. The study further identified that because of lower revenues obtained, the payments of WSDBs sitting allowance were long overdue. At Parambo-Sawaba, payment of salaries of workers had been in arrears for over 9 months as the time of the survey. The Lack of incentives and unpaid salaries for services

rendered has crippled the motivation to work efficiently and in the long run, the system could collapse.

3.3 Managerial and Administrative Challenges

3.3.1 Weak human and financial management capacity

The study identified that there was lack of adequate human resource capacity to manage the operations of the systems efficiently and effectively, as well as, lack of adequate oversight responsibility for the facilities. Even though service operators kept good records of financial statements, monthly internal auditing of accounts and financial reporting to community members were not done by WSDBs as specified as part of their responsibilities. This explains, as identified by the study, why community members were agitated and were reluctant in paying water tariffs. The study further identified that WSDBs and WATSAN were not functional in the two communities, and shirk their responsibilities to service operators. This finding support Brikke (2000) work which asserts that the capacity of WSDBs in most communities, to manage the technical and financial aspects of the water supply systems is weak. The study also revealed that in both study communities, the WSDBs and the DA lack the capacity to do water quality monitoring as specified as part of their roles. This finding confirms an earlier work by Sarpong Manu (2001) which revealed that water quality in most cases was questionable because of the absence water quality monitoring.

The study further revealed that there has not been any refresher courses or training to upgrade the skills of the WSDBs members since they took over the management of the systems. In addition, they do not receive any back-up support neither from CWSA nor the DA in the management of the water supply systems.

3.4 Institutional Challenges

3.4.1 Lack of Clear Roles and Responsibilities by Stakeholders

The study revealed that there was lack of clear roles and responsibilities among stakeholders' in their O &M functions. The roles of the District Assemblies (DAs) in small towns' water management are monitoring and supervisory roles, approval of water tariffs, financial support for major breakdowns and replacement, as well as, technical and advisory support. However, the study revealed that these roles were virtually absent in both study communities because of the lack of technical and financial capacity to carry out these functions. The study also revealed that the oversight responsibilities of WSDBs were not carried out. These boards were not proactive and shirks responsibilities to the service operators. It was observed that the WSDB were hijacked by only few members who were mostly the two chairmen in the study communities.

3.4.2 Institutional Collaboration

The study identified that there was poor institutional collaboration among the various stakeholders. The DAs did not collaborate with WSDBs and they only did so when they were called by the WSDBs. Communication could be described as one way in this circumstance. In responding to the question, what is the visiting schedule and plan of activities by DWST in respect to small towns' water systems, the Community Development Officer of the DWST at Kokofu said,

"We only visit as to when they call on us".

This finding implies the regular routine monitoring exercises by the DWSTs as specified as their major role were not carried out.

3.4.3 Lack of Community Structures/Systems to Regulate Operation of the Water Systems

Another institutional challenge identified by the study was the lack of community bye-laws to regulate the operation of the water systems. In both communities, it was observed that there were no rules and regulations guiding the time of opening the communal stand pipes. Water vendors attended to stand pipes at their own convenience and as a result, some community members could not have access to water when they needed it. For this reason, some inhabitants were compelled to fetch water from the river side. The study also identified that water charges differed at different stand pipes and pricing depended on the vendors' criteria of measure of a bucket or pan which was very subjective. These issues raised a lot of concerns by the youth.

3.5 Socio-Cultural and Economic Challenges

3.5.1 Socio cultural factors

The study identified that social cultural factors also played a key role in ensuring effective operation and maintenance functions of the water systems. The social cultural factors considered issues of belief systems and perceptions prevailing in the study communities. For instance, issues such as broken-down water pumps were attributed to the failure to pacify the gods of the River Pru, located at the Parambo Sawaba community, which served as the main source of water for the water supply system. In a response to the question, why there was frequent break down of the water pump, the youth group at Parambo- Sawaba responded:

"We experience frequent break downs because since the operation of the water system in 2005, sacrifices made to pacify the gods of the River Pru have never been done. For this year, the pump has broken down for three consecutive times and for almost months we did not have water. We believe that the gods are annoyed with us for

drinking their water without performing the annual rituals to appease them".

The above assertion implies that social dimensions of maintenance must duly be considered to ensure effective operation and maintenance of water system. Gender issues also played a key role in ensuring effective operation of the water systems in the communities. The survey revealed that water selling was women dominated activity, and the elderly women were preferred to the young women. (See Fig. 2).

Figure. 2. An elderly woman at a water selling point & Some community members eagerly waiting to fetch water for free when there is an overflow

In response to the question, why water selling are women dominated activity; the board chairman at Kokofu responded that the men mostly shy away from selling water. Also, in a focus group discussion with the youth group at Parambo Sawaba, a male participant recounted:

> *"We are mostly busy at the farms and mostly return home late. The women are less busy and can be responsible for the taps. We propose that the elderly women are tasked to sell water at the communal stand pipes. They are more patient and can serve us better".*

3.5.2 Economic factors

Economic issues such as willingness and ability to pay for water services affected demand and therefore water production was considerably low particularly at Parambo Sawaba. Parambo-Sawaba had design water treatment plant capacity of 109,500m³ annually, however, an annual production of 26,462m³ of water was produced. Out of this total production figure, only 18,096m³ was consumed in 2006, where as in 2007, out of total production of 17,420m³, only 9,074m³ was consumed. The situation was comparatively better in Kokofu. At Kokofu water system, out of the total water production of 45,000m³ volume of water, 31,500m³ was consumed. In 2007, out of the total production of 40,000m³ volume of water, 36,000m³ was consumed. Impliedly, 13,500m³ and 8,000m³ of water were unaccounted for 2006 and 2007 respectively. Consequently, because of the situation hitherto described, water production was not all year round in both communities. The study revealed that the operational periods of water services were between four to six months at Parambo-Sawaba, which were normally between November to March, because of low demand during the rainy periods. In the case of Kokofu, the operational days were nearly year-round, but during certain times of the rainy periods, water sales attendants may decide to close taps when there is no patronage. Thus, water service reliability was estimated at 120: 365 days (which represent 33 percent of operational days annually) and 300:365 days (which represent 82 percent of operational days annually) for Parambo-Sawaba and Kokofu respectively.

The study attributes the problem of low patronage of water services to low income levels of the populace particularly at Parambo Sawaba. The average household annual income at Parambo Sawaba is Gh¢195.6 which is thrice less than the regional average household annual income of Gh¢ 1170 (Pru District Assembly, 2015). Besides, the comparatively high prices of water, also deterred community members from the patronising water services. The study revealed that the prices per bucket were comparatively higher in the two study areas as compared to other urban areas outside the study settlements. Price per bucket was Three (3) Ghana Pesewas per 18 litres bucket at Parambo-Sawaba and Two (2) Ghana Pesewas per same bucket at Kokofu. However, the price of water at the urban areas were One (1) Ghana Pesewa per same litres, 18 litres (34 bucket) or Six (6) Ghana Pesewas per metre cube. As a result, most community members' preferred fetching only few buckets of water from stand pipes and supplementing their water with other available traditional sources such as hand dug wells and rivers which are non-potable water sources. In an interview with the Station Manager at Parambo-Sawaba, he remarked,

> *"Most community members feel reluctant to pay for water services. They prefer fetching the water free when there is an overflow or resort to other traditional sources of water".*

Accordingly, it can be deduced that low demand of water services was influenced by differential price of water in small towns as against the urban towns, and because of alternative traditional water sources in the small towns. The lower consumption levels and therefore lower production for water in the study areas attest to Smet

and Wikj (2002) argument that small towns usually have limited demand for water services. This finding is also in consistent with Adank (2013) and the World Bank Group (2015) studies which put forward that traditional water sources such as hand dug wells and collected rain water often supply water services at lower prices than piped schemes, but tend to provide less reliable services, especially in the dry season.

4. Conclusion

The study critically examined the nature and extent of the challenges confronting Small Towns Water Systems (STWS) in Ghana. The challenges identified includes infrastructure inadequacies; the lack of preventive maintenance systems: high iron content in water sources: high operating cost as against low revenues obtained from water sales, weak collaboration among major stakeholders, weak human & financial capacity of institutions responsible for managing water supply; sociocultural, as well as, economic factors pertaining in small towns. The study confirmed that these challenges accounted for high water losses averaging between 30 to 32 percent per annum, coupled with frequent break downs of water pumps and consequently abysmal functionality of small town water systems. The study concludes that although small town water systems provides an avenue for supplying safe and potable water to serve the populace of small towns in Ghana, the above-mentioned operation and maintenance challenges pose a great threat to sustainable water services delivery. It is therefore proposed that a system of preventive maintenance for pumping plant, as well as, other water infrastructure needs are instituted in STWS to ensure sustainable water service delivery. The study further suggests that measures should be put in place to reduce the amount of non-revenue water wasted through leakage and wastage. This can be achieved by developing a comprehensive corrective maintenance of infrastructure such as providing adequate automatic cut device systems. Besides, to ensure regular maintenance and to reduce time of water pumps of STWS, the WSDBs at the community levels must set up maintenance budget for replacement purposes. Impliedly, some monies need to be set aside by the WSDB as savings in a “capital fund” which could be used to pay for new items required for expansion of the water systems. In addition, the study proposed that institutional collaborations are strengthened to curtail the challenges among the various stakeholders responsible for managing the water systems in small towns. This can be achieved through the District Assemblies, by redefining the roles of all stakeholders, DWSTs, WSDBs, and the WATSAN committees in the management of STWS. This will help curb the issue of conflicting roles and revive dormant stakeholders. Finally, the study suggests that the District Assemblies (DA) must enforce the implementation of the proposed interventions under appropriate bye laws to ensure effective operation and maintenance of STWS to achieve accessible and sustainable water service delivery. This research has provided a tool to guide communities, as well as governments on ensuring appropriate interventions for small towns. Ultimately, the outcome of the research will contribute to the body of knowledge available on effective operation and maintenance of small towns’ water management as well as generate further research studies. Some accruing benefits will include increased access to safe water in small towns as well as contribute to meeting the sustainable development goal 6 which seeks to ensure water and sanitation services for all.

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