

The effectiveness of the local management systems of rural water facilities for sustainable service delivery: a case study of the Sekyere East District, Ghana

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Abstract Involving communities in the operation and maintenance (O&M) of water facilities is expected to be a cost-effective means of ensuring sustainable provision of water to rural communities in Ghana. The purpose of this study was to examine the effectiveness of the community-based management strategy for the O&M of water facilities in the Sekyere East District of Ghana and to identify the best practices for replication. The data for the study were gathered from the District Water and Sanitation Team (DWST), Water and Sanitation (WATSAN) Committees and Water Boards (WBs) through direct interviews and focus group discussions. Analyses of the data revealed that the spirit of voluntarism that was expected to drive the local managers to be effective was fading away. Furthermore, the local managers were unable to mobilise adequate revenue to defray the cost of O&M partly due to households' reluctance to pay coupled with the general lack of accountability on the part of the managers. The authors concluded that for the local managers to be effective, they need to be effectively motivated so that they could in turn be accountable to the community members.

Keywords Rural water systems · Operation and maintenance · Orphan boreholes · Sustainability · Accountability

Introduction

Water according to the UN (2015) is at the core of sustainable development. The Millennium Development Goal (MDG) 7 which aims at ensuring environmental sustainability has a key target “to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015” (United Nations 2007). According to Howard and Bartram (2003), an estimated minimum of 7.5 l of water per person per day is needed in the house for domestic activities; preparing food, drinking, and other basic water requirements; whereas 50 l of water person per day is required to guarantee domestic cleaning, food and personal hygiene and washing needs. The range of services provided by water resources, therefore, underpins economic growth, poverty alleviation and reduction and sustainability of the environment (Carter and Danert 2003).

The aim of achieving the MDG water supply target in poorly served countries calls for scaling up water availability to meet domestic needs, improve water quality, and bring about changed water use and water management habits (Hunter et al. 2010). According to the UN (2015), the world need an average of USD 53 billion every year, for 5 years or requires USD 265 billion for 5 years (from 2010 to 2015) in an attempt to ensure that every household across the globe has access to water. There is need to sustain water services and quality in the wealthier countries in the years ahead, where there are available adequate quantities of domestic water. Nevertheless, there is a need to take account of the realities for frequent poor functionality levels.

Sub-Saharan Africa (SSA), which is one of the poorest regions in the world, was expected to scale up water supply coverage from 32 to 46 % within the decade (WHO 2000). As per urban–rural disparities concerning access to safe

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drinking water, out of the world population who lacked access to safe drinking water, about 84 % were living in rural areas (World Water Week 2010). Unfortunately, efforts aimed at expanding water and sanitation coverage has stagnated in Africa and more people are without adequate water and sanitation services today than in 1990 (WHO 2000). The WHO (2007) in explaining this condition posits that 88 % of the 4 billion annual cases of diarrhoea could be attributed to unsafe water and inadequate sanitation and hygiene while mortality due to diarrhoea was estimated at 1.8 million people each year. The WHO (2007) identified two factors that underpin the slow progress in ensuring sustained increase in access to water among the water-poor regions in SSA: investments in the water subsector lagged behind population increase; and the intended outcome of improved access to potable water in terms of improvements in health were not realised, partly due to the failure to maintain the facilities. Therefore, the best way to address these factors is to augment investments in the water and sanitation subsector to respond to the ever-increasing population in SSA. Secondly and equally important as the first, is the need to develop appropriate mechanisms to manage the water facilities to ensure sustained access to potable water.

The known responses to addressing the setbacks are contained in the Millennium Development Goals (MDGs) and the redefined operation and maintenance practices of water facilities. The importance of MDG7 (which seeks to halve the number of people without access to safe drinking water by 2015) is underlined by its linkage to other goals especially those focused on poverty, hunger, infant mortality and gender equity (Sevlo 2010). The MDG target has implications not only for increasing investments in water supply but also sustaining the investments through effective maintenance practices. In this regard, the Community-Based Management systems were introduced. These strategies were underpinned by the consensus that community members who are direct beneficiaries of the water facilities will endeavour to sustain them if they take charge of the management, operation and maintenance of the facilities. Unsustainable approaches or systems for managing water facilities lead to their breakdown (Mahmud et al. 2007; Carter and Danert 2003). Communities then relapse to the previous situation of using water from unsafe sources.

With the end of the MDGs fast approaching, the debates on its successor are intensifying. According to Muiderman (2013), two agenda are being pursued to the end of the MDGs: the Post-2015 development agenda (derived from the MDGs) and the sustainable development goals (SDGs). The UN aspires to integrate both agenda to achieve the ‘future we want’. The SDGs is the agreement that emanated from the United Nations Conference on Sustainable

Development held in Rio de Janeiro in June 2012 (Rio + 20). Adding to this, it was also identified from the United Nation Conference on Sustainable Development in 2012 that the SDGs could build on the success of the MDG framework. This therefore implies that, beyond the deadline for the MDGs, activities in the present study can live on within the SDGs framework. One of the critical focus areas of the SDGs is Water and Sanitation; hence the SDG 9 seeks to “Secure Ecosystem Services and Biodiversity, and Ensure Good Management of Water, Oceans, Forests and Natural Resources”. The third target of this goal—“All governments and businesses commit to the sustainable, integrated, and transparent management of water, agricultural land, forests, fisheries, mining, and hydrocarbon resources to support inclusive economic development and the achievement of all SDGs” is very significant to ensuring effective management of water resources and improving access of people to potable water sources. The United Nations Department of Economic and Social Affairs (UN DESA 2015) notes that there is a substantial gap between current institutional and human resource capacities, and the requirements for achieving the SDGs. The UN DESA (2015) further indicates that achieving the sustainable development goals will require major transformations in governance, policies, values and behaviour. This, thus, calls for the need to identify the management systems that exist to ensure regular functioning of water resources, eliminate water-related diseases and improve access to potable water sources.

In Ghana, the communities that are privileged to have access to water facilities cannot always boast of a thorough knowledge about events preceding the provision of the facilities as well as ensuring their sustainability (Dzisi and Obeng 2013). The implication here is that water supply process requires active involvement of the beneficiaries to ensure sustainability. In this regard, Ghana has committed itself not only to achieving the MDG target but also to sustaining the water facilities that are provided for communities. The Government of Ghana aims to achieve 85 % water coverage by 2015. This is seen to be 7 % more than the MDG target of 78 % by 2015 (Water Aid Ghana 2005). This provides an ample demonstration of the government’s (including the Development Partners’) commitment to scaling up access to safe drinking water. Following the launch of the National Community Water and Sanitation Programme (NCWSP) in 1994, the Community Water and Sanitation Agency (CWSA) was established in 1998 through Act 564. CWSA’s mandate is to facilitate the provision of safe drinking water and related sanitation services to rural communities and small towns in Ghana (CWSA 2007). The Act also transferred water and sanitation facility ownership and implementation responsibilities to districts and communities. The specific strategies

introduced to foster sustainability of the water facilities implemented under the NCWSP include: beneficiary districts and communities' contribution of 5 % towards the capital cost of water facilities, their responsibility for all operation and maintenance costs and their participation in planning, designs, siting, construction and management of facilities (Kleemeier 2002). Water and Sanitation (WAT-SAN) Committees, Local Management Teams (LMTs) and Water Boards (WBs) are established at the local level to be involved in the planning, implementation and post implementation management of the water and sanitation facilities. These arrangements exemplify Ghana's commitments not only to increasing access to safe drinking water but also sustaining them for the future generation. Hunter et al. (2010) assert that "It is relatively easy to increase coverage through construction of water supply systems, but it is much more difficult to ensure that such systems continue to provide service over the long term". This paper therefore argues that there should be conscious efforts and commitment by national and local partners to ensure adequate and sustainable water supply for everyone.

According to Ban Ki-moon, the UN Secretary-General, access to water is deeply connected to virtually all aspects of sustainable development, in particular those involving the environment, education, gender equality and the reduction of child mortality and poverty. Dzisi and Obeng (2013) indicates that communities in Ghana that are having access to water facilities cannot always boast of a thorough knowledge about events preceding the provision of the facilities as well as ensuring their sustainability. Hence there is a need to promote and improve the capacities of the various existing systems in all stages of the project, to sustain the operation of the provided facilities. Understanding available systems in managing water resources leads to the avoidance of the dissipation of limited resources allocated to the water sector by both the public and private sector organizations and much improvement in the water sector within little time period. The foregoing underscores the importance of the study at hand.

A review of the Sekyere East District Water and Sanitation Plan (2008–2012) revealed that approximately 28 % of the water facilities (i.e., 41) implemented by the district were not functioning, despite the existence of WATSAN Committees and WBs in the beneficiary communities. This raises questions about the effectiveness of the systems established to ensure the sustainability of the water facilities. This study, therefore, sought to identify the factors that are responsible for the non-functioning of the water facilities. There exist sustainability problems in the O&M of rural water supply and this paper investigates this in district the management systems; taking into consideration the bodies (manager) responsible for managing water facilities, the practices adopted by the managers in

undertaking their respective activities and the challenges or otherwise of these practices to ensuring regular operation of water facilities. These suggest the need to put in place feasible measures to improve upon the activities of managers so as to achieve intended targets, ensure continuous functioning and supply of water to residents, improve access to potable water by using available resources in constructing new ones rather than fixing broken down facilities and in the long run attain the water-related target of the SDGs. Premised on this, the general objective of this study was to identify the factors that affect the effectiveness of existing local level organisations in managing water facilities for sustained access to potable water. The following were the specific objectives:

- To assess the effectiveness of the existing systems for managing water in the Sekyere East District.
- To identify the prospects and the challenges that the systems face in managing water facilities.
- To make recommendations to address the identified challenges.

Materials and methods

Research design and sources of data

The study adopted the mixed design which provides a mixture of quantitative and qualitative explanations to the study (Johnson and Onwuegbuzie 2004). The design was used to discuss and explain the responses from respondents on the management practices that are in place to ensure sustainability of provided water facilities. The quantitative technique was used basically to quantify responses on the type and frequency of maintenance activities by managers, the revenue generation capacity and the number of broken down and functioning water points. The results of these were therefore quantified and presented in simple frequencies and percentages. The qualitative techniques on the other hand were inductive, holistic, subjective and process-oriented method which was adopted to understand, interpret, and describe (Morse and Field 1996) systems for managing water facilities in the Sekyere East District. To ensure internal validity, the quantitative and qualitative techniques were applied to elicit responses from managers of water facilities in the selected communities. The data collected from the managers in the various communities were triangulated with those obtained from the District Water and Sanitation Team to render the research findings more accurate and valid and superior to mono-method.

The survey research approach was further used in obtaining relevant data for the study. This was undertaken by constructing a set of questions that were either asked by

means of a structured questionnaire or through an interview as indicated by Babbie (2010) to achieve the objectives of the study. The approach allowed the authors to quantify and generalise the research findings to an entire population, if the sample was appropriately determined and selected. Errors were minimised in the approach by using standardised structured questionnaires and guides. Primary data were obtained through direct interviews with members of the Sekyere East District Water and Sanitation Team (DWST), WATSAN Committees, Water Board (WB), Pump Maintenance Volunteers (PMVs) and Unit Committees. Focus Group Discussions (FGDs) were also held in seven communities namely, Naama, Anunya, Akotieso, Methodist, Mputuom, Oguaa and Akuakrom. The focus groups were the members of the WATSAN Committees, PMVs and Unit Committees. The units of enquiry were purposively selected due to the mandated roles they are expected to play in managing and sustaining water facilities in the communities.

Units of enquiry

Seventeen out of the forty communities in the Sekyere East District were purposively selected for the study (see

Table 1). The communities were selected on the premise that they had water facilities (either functioning or not) and managers to sustain their operations (see Table 1). The study ensured internal validity by selecting communities from each of the sub-district structures (that is, the Town and Area Councils) in the district as indicated in Table 1. The study communities were spread across the district. Three communities were selected from each of the three Area Councils namely, Akwamu Area Council, Asokore Area Council and Senchi-Nyamfa Area Council. Four communities were also selected from each of the Town Councils namely the Effiduase Town Council and Seniagya-Mponua Town Council (see Table 1). Seven out of the 17 study communities had orphan boreholes because the groups established to manage the facilities were not in existence. The said communities were Apemso, Akotieso, Asubonteng, Ntunkumso, Bouya, Ahwerewa and Senchi (see Table 1). In sum, the study communities were in two categories viz. communities with functional local management organisations and communities without functional local management organisations. The diversity helped to identify the factors that affect the effectiveness of the local management organisations in sustaining the water facilities.

Table 1 List of sampled communities

Town-area council	Community	Type of facility	Provider of water facility	Managers of water facility	No. of facility	No. func.	No. not func.
Akwamu	Naama	Borehole	WVI	WATSAN and PMV	2	2	0
	Apemso	Borehole	DA	WATSAN	2	1	1
	Anunya	Borehole	WVI	WATSAN and PMV	1	1	0
Asokore	Akotieso	Borehole	DA	WATSAN and LMT	3	2	1
	Methodist	Borehole	WVI	WATSAN and LMT	1	1	0
	Asubonteng	Borehole	DA	LMT	1	0	1
Effiduase	Okuasi/okuasi ext.	Pipe system	DA	Water board	5	5	0
	Ntunkumso	Borehole	DA	WATSAN	7	5	2
	Motokrodua	Hand-dug well	DA	WATSAN	1	1	0
Senchi-Nyamfa	Bouya	Borehole	DA	Unit committee	2	1	1
	Ahwerewa	Borehole	DA	WATSAN	2	1	1
		hand-dug well			1	1	0
Seniagya-Mponua	Mputuom	Borehole	WVI	WATSAN and PMV	1	1	0
	Senchi	Borehole	DA and WVI	Unit committee	7	3	4
	Seniagya	Pipe system	DA	Unit committee	2	2	0
		borehole	MIDA Project				
	Oguaa	Borehole	WVI	WATSAN and PMV	1	1	0
	Akuakrom	Borehole	WVI	WATSAN and PMV	2	2	0
	Anunso	Borehole	DA	Unit committee	1	1	0
Total					35	24	11

Source: Field Survey, February 2013

Assessing the effectiveness of management practices

The sustainability of water facilities in rural districts in developing countries; particularly Ghana is ensured when there is enough revenue to cover expenses (and managers have sources of revenue generation) (Braimah and Jagri 2007); managers are prompt to maintaining broken down facilities; and managers undertake quarterly maintenance of water facilities (Sevlo 2010; Mazango and Munjeri 2009; Braimah and Fielmua 2011). These are geared towards ensuring the continuous and regular supply of water in communities. According to Schillinger (2010:2), effectiveness “is an intervention’s ability to do more good than harm for the target population in a real world setting”. It is also “a measure of how well the outputs of a programme or service achieve the desired outcomes of that programme or service” (Productivity Commission 2013). The information hence required to evaluate effectiveness are current situation, targets, factors that hinder or facilitate the realisation of targets. Also, there is the need to establish cause–effect relationship about the extent to which interventions produce the desired outcome (Cohen 2000; Schillinger 2010). Hence, effectiveness of an intervention is adequately understood by assessing the technical and cost/financial capacities (SCRGSP 2006).

The study, therefore, assessed the effectiveness of existing systems in sustaining water facilities by identifying their revenue mobilisation capacities, type and frequency of maintenance activities, promptness to maintenance needs of communities, and importantly the aim of having all water facilities functioning to serve the needs of users. The researchers identified the various means managers of facilities raised revenue to maintain water facilities, the amount realised and whether the means and amounts were adequate to ensure continuous operation of water facilities. Secondly, the specific types of maintenance activities practiced by the various managers in respective communities were examined. The frequency in undertaking such activities was also identified. Routine operation and maintenance play a significant role in ensuring the sustainability of water facilities. This aided in establishing a general cause–effect relationship between the activities and functioning of water facilities. The promptness of managers to repairing broken down or maintain facilities were also discussed. According to Mazango and Munjeri (2009) quick response to broken down facilities in Zimbabwe ensured continuous supply of water to residents in the Nkayi district. This has implication of reducing water-related diseases as residents would have continuous access to potable water and not rely on streams and other non-potable sources. The discussion of the research findings were done under these variables to understand the current situation (state of water facilities as

depicted in Table 1) and make recommendations to improve upon the systems, sustain facilities of water facilities and improve access to potable water sources.

Overview of the Sekyere east district

The Sekyere East District was established by the Legislative Instrument (LI) 1900 in November 2007 with Effiduase as the capital. The district is bounded to the north-east by the Sekyere-Afram Plains District, to the south-west by the Sekyere South District, to the south-east by the Asante-Akim North Municipality, and to the north by the Sekyere Central District (see Fig. 1). The Sekyere East District’s land area is about 730.5 square kilometres and has 40 settlements of varying sizes. Figure 1 shows the communities included in the study. The district had an estimated population of 92,455 in 2013. Water for domestic uses such as drinking, cooking and washing is obtained from pipe systems, boreholes, wells, rain harvesting systems, and streams/rivers. Notwithstanding the varied sources of water in the district, potable water coverage was only 43 % as indicated in Table 2, which is lower than the MDG7 and Government of Ghana’s targets of 78 and 85 %, respectively, by the year 2015 (Sekyere East District Assembly 2010). Table 2 reveals there are about 105 water facilities (69 boreholes, 20 dug wells, and 16 pipe systems) serving 39,643 people (43 % coverage) in the five town-area councils in the District. The facilities are managed by several management teams across the district (see Tables 1, 2).

State of water facilities in the Sekyere East District

Provision of water facilities in the Sekyere East District has not kept pace with the rapid population growth, particularly in the major settlements like Effiduase, Asokore, Seniagya, Senchi, Ahinsan and Nkwankwanua. The sources of water in the district include pipe-system, boreholes, wells, rain harvesting and streams and rivers (see Tables 1, 2). Water is mainly used for domestic purposes such as drinking, cooking and washing. The supply of potable water in the district is inadequate with coverage of 43 %. Some communities in the district which lack access to potable water depend on streams for drinking water. It is however disturbing to indicate that about 31 % of potable water facilities is non-functional (see Table 1). Facilities have broken down parts (e.g., pump, handle) which need replacement. This undermines the district’s aim of ensuring district-wide access to potable water.

The authors selected the district for the study not only because of the low potable water coverage but also because 11 out of 41 water facilities implemented in the district were not functioning. The water systems are ceasing to

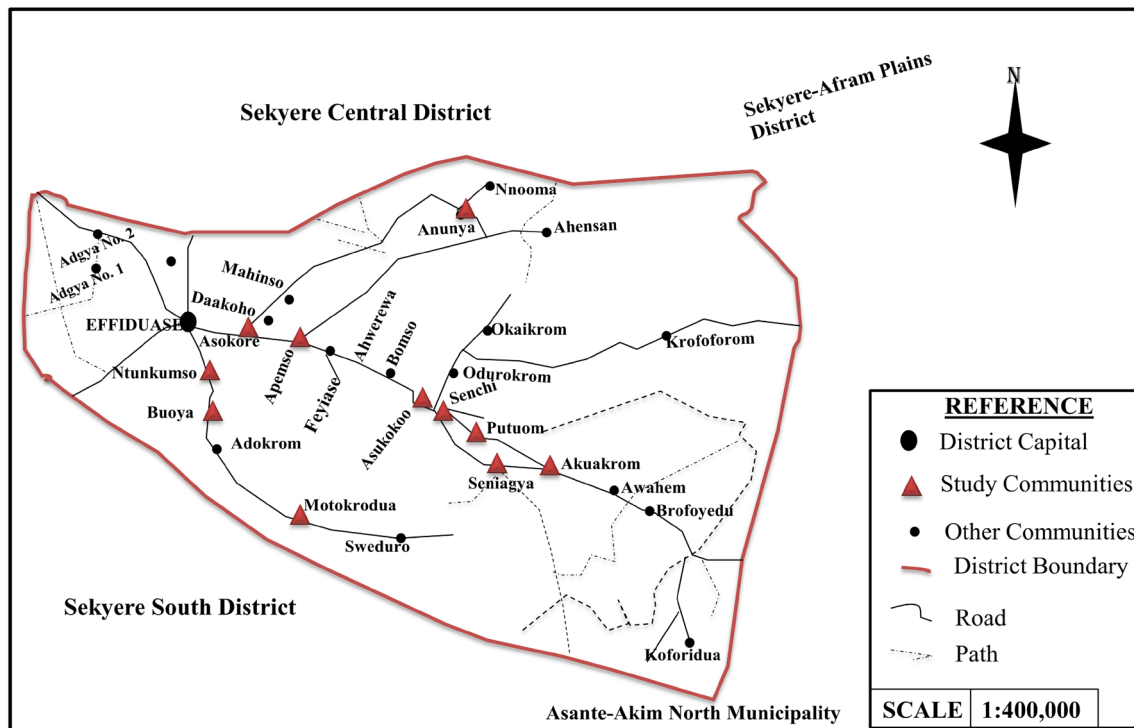


Fig. 1 Settlement map of Sekyere East District 2010

Table 2 Population served and coverage of potable water in the district

Town-area council	Pop (2013 est.)	Type of facility			Pop. Served	% Coverage	No. of WATSAN	No. of WB	No. of area mechanic
		Borehole with pump	Dug well with pump	Pipe system					
Akwamu	9145	14	1	0	5185	56.7	8	0	2
Asokore	15,870	10	4	6	8570	54.0	11	0	3
Effiduase	35,984	13	13	9	13,386	37.2	8	1	6
Senchi-Nyamfa	14,633	20	2	0	7506	51.3	7	0	8
Seniagya-Mponua	16,823	12	0	1	4996	29.7	6	1	2
District	92,455	69	20	16	39,643	42.9	40	2	21

Source: SEDWSP (2008)

function despite the existence of local management structures (i.e., WATSAN Committees, PMVs and WB), which have been specifically established to manage the facilities. Hence the need to assess the effectiveness of the local management structures in the district.

Analyses and discussions

Systems for managing water facilities in the district

The World Bank and other development partners in recent years have increased their focus on community participation and are supporting initiatives that would increase

access of the poor to basic social and economic infrastructure and services, and empower communities through participation in the selection, implementation, and operation and maintenance of development projects. Salim (2002) notes that in Ghana and many African countries, the central government and external support agencies were solely responsible for planning, constructing and maintaining rural water supplies. There was therefore little or no involvement of the beneficiary communities. Failures of the top-down/centralised planning and provision and maintenance of services shifted emphasis to a decentralised community-oriented approach (Osumanu 2013; Braimah and Fielmua 2011). The concept of community participation was thus embraced as one of the significant strategies

to ensure the planning, provision and maintenance of water facilities during the International Drinking Water and Sanitation Decade (IDWSD), which spanned 1981–1990 (McCommon et al. 1990). A study by Osumanu (2013) showed that planning, operation, maintenance and monitoring and evaluation of water facilities are the areas in which community involvement is likely to reap benefits in community–state–private sector partnerships in urban water and sanitation provision in Ghana.

The planners and implementers of the sampled water facilities were guided by the principles of community-based management discussed in the preceding section. The management and sustainability of rural water supply systems is possible if all stakeholders such as government or public bodies, non-governmental organisations, private sector agencies and communities (Tadesse et al. 2013, Kamruzzaman et al. 2013; Doe and Khan 2004; Davis 2005) play their respective significant roles. These bodies according to Carter (2010) are interdependent, interactive and crucial for achieving sustainable water services with a corresponding behaviour changes over time.

The principles demand that community members, who are the primary stakeholders of the water facilities, should be responsible for the management of the water facilities. This according to Tadesse et al. (2013) is that “full community participation promotes a proactive process in which the beneficiaries influence the development and management of development projects rather than merely receiving a share of project benefits”. This is because, “community participation provides the an enabling environment for sustainability by allowing users, as a group, to select the level of services for which they are willing to pay, to guide key investment and management decisions, and also to make choices and commit resources in support of these choices” (Sara and Katz 1997).

The community-based management bodies include the WATSAN Committees, Unit Committees, PMVs and WBs. The DWST has been established at the District Assembly and is mandated to plan, monitor and evaluate water and sanitation facilities with the beneficiary communities at the community levels. The community-based management structures are accountable to the DWST. Thus, the DWST plays a supervisory role over all the community-based management organisations. The Water, Engineering and Development Centre (WEDC 2003) posits that for rural water supply, the prominent model is community management service model. Mazango and Munjeri (2009) also argues that community-based management systems can improve efficiency, meet the target of the project within planned budget and enhance sustainability of rural water management. This thus underscores the significant roles of community-based management systems in promoting the sustainability of rural water supply systems.

Community-based management bodies and systems vary across nations. Thus, the identified stakeholders are “local” and apply to the setting of Ghana and the Sekyere East District. The WBs are responsible for the management of the pipe systems in the small towns while the WATSAN Committees manage the boreholes and hand-dug wells at the community level. The PMVs are specially trained members of the community who are required to restore the water systems when they break down.

The researchers observed that the management systems vary from one Development Partner/implementer to the other. For instance, WVI water systems had PMVs and WATSAN as managers of the water facilities at the community level. Prior to constructing the water systems, WVI tasked beneficiary community leaders to select some members of the community to be trained in the maintenance of the water systems. They are known as PMVs. WVI occasionally visits the project communities to take water samples for quality and safety analyses. The MIDA projects had WATSAN Committees as the managers of the water facilities. Private sector participation in rural water provision and management has been revealed to be very significant in improving access to potable water sources (Kleemeier 2010; Giné and Pérez-Foguet 2008; Harvey and Reed 2007a; Davis 2005; DFID 1998). The District Assembly projects had WATSAN Committees and/or Unit Committees managing them.

As set out by the study, managers of water facilities in the District varied. It was revealed that management of approximately 29 % of the facilities was done by the community WATSAN and PMV teams. The WBs which are mandated to manage facilities in peri-urban and urban centres managed 6 % of provided water facilities. The study emphasises that despite the differences in the names given to the local management structures, they were all mandated to collaborate to maintain the water systems in their respective communities. It was, however, observed that that approximately 31 % of the water systems in the District were non-functional as indicated in Table 1, despite the presence and management roles of WATSAN, PMV, WBs and Unit Committees (Table 1). The inability to sustain the water facilities provided has implications for the attainment of the water related SDG targets.

Systems for revenue mobilisation for operation and maintenance

Harvey and Reed (2007b) maintain that community financing strategies need to include appropriate mechanisms for revenue mobilisation towards the operation and maintenance (O&M) cost of water facilities. In this regard, the local management structures were trained on appropriate options for mobilising funds for O&M activities. The

study identified that approximately 55 % of the community-based management structures/bodies relied on payments from households and special levies (monthly contributions and deduction from funeral levies) to operate and maintain the water facilities. Households were levied GH¢1.00 (which was equivalent to 50 US Cents) for the operation and maintenance of the water facilities. This according to Lockwood et al. (2002) and Bohm et al. (1993) is a significant criterion and measure in ensuring the sustainability of projects in countries. This implies that the amount of water used by the households for a month did not have any effect on the levy paid for operation and maintenance. The study observed that the monthly levies were inadequate to ensure effective operation and maintenance. For instance, about 56 % of the broken down facilities were operated and maintained with funds from the monthly levies (see Table 3). Interviews with the WAT-SAN Committees revealed that funds to carry out required maintenance activities were sometimes lacking and hence there is disuse of the water facilities.

The study noted that revenue generated through payment of the monthly levies by households was encouraging during the periods of harvest. The Sekyer East District is an agrarian economy and thus households are mostly able to pay these monthly contributions from the sale of their produce. Report by the District Planning Officer showed that households across the district averagely earned GH¢1200 (which was equivalent to US 600) during the harvest periods. This amount reduces by 87 % (i.e., households earn GH¢156

which was equivalent to US 78) during the dry seasons where households are unable to harvest and sell their produce. Payment of monthly levies, thus, becomes a daunting task during these seasons. A study by Herbertson and Tate (2001), however, revealed that in an attempt to assure managers of supply, a fixed amount was levied every month, forming the basis of the authority's pledge to provide water to every house as long as it is available.

Another means of mobilising funds for operation and maintenance was through the pay-as-you-fetch approach system. The study identified that approximately 45 % of the management structures practiced the pay-as-you-fetch system for the mobilisation of funds for operation and maintenance (see Table 3). The cost of a 25 l container of water attracted a fee of GH¢0.20 (equivalent to 1 US Cent) while the cost of a 10-litre container of water was GH¢0.10. A similar study by Bhandari and Grant (2007) on the operational sustainability of water supply systems in Nepal also concluded that satisfaction, trust worthiness of the water-user committee, affordability of user and willingness to pay are the most important operational sustainability factors. The means of mobilising the funds in the study communities were consistent with the findings of Braimah and Jagri (2007) and Yelbert (1999). The authors identified household levying, auctioning of donated farm harvest, voluntary contribution from the rich, cash crop deductions or “kilo kilo”, income generation ventures and funeral tax as the means of mobilising revenue for the O&M of water facilities at the community level.

Table 3 Revenue mobilisation and management

Town-area council	Community	Mode of collection	Safe keeping practice
Akwamu	Naama	Payment of levies (house to house collection)	Treasurer
	Apemso	Payment of levies	Treasurer
	Anunya	Payment of levies	Treasurer
Asokore	Akotieso	Pay-as you-fetch	Bank account
	Methodist	Pay-as-you-fetch	Bank account
	Asubonteng	Pay-as-you-fetch	Bank account
Effiduase	Okuasi/Okuasi Ext.	Pay-as-you-fetch contracts	Bank account
	Ntunkumso	Pay-as-you-fetch	Bank account
	Motokrodua	Payment of levies	Treasurer
	Bouya	Payment of levies	Treasurer
Senchi-Nyamfa	Ahwerewa	Payment of levies	Treasurer
	Mputuom	Payment of levies	Treasurer
	Senchi	Payment of levies	Bank account
Seniagya-Mponua	Seniagya	Pay-as-you-fetch	Treasurer
		Payment of levies	
	Oguaa	Payment of levies	Treasurer
	Akuakrom	Pay-as-you-fetch	Treasurer
	Anunso	Pay-as-you-fetch	Treasurer

Source: Field Survey, February 2013

The study further identified that 35 % of the community-based management structures operated bank accounts. These communities were Asokore Akotieso, Asokore Methodist, Asokore Asubonteng, Effiduase Okuasi, Ntunkumso and Senchi. Revenues mobilised from either the monthly levies or pay-as-you-fetch systems were lodged into the bank account. Approximately 65 % of the community-based management structures did not operate bank account, which was inconsistent with the position of the DWST that “every community is required to have a bank account for the O&M of the water facilities”. Further analyses revealed that approximately 18 % of the communities with broken down water systems had no bank account.

A key challenge to effective O&M of the water facilities was some households’ reluctance to contribute. Some argued that they contributed to the provision of the facility and thus think that they must be allowed to fetch water without paying any amount. This raises doubts about the effectiveness of community sensitisation/animation exercises held to make the community members aware of their responsibilities. This could also be as a result of a change in government policy suspending community contribution to counterpart funding for the provision of water facilities. With the coming into effect of this new policy those who had earlier on contributed towards the counterpart funding believe that they did not have to pay again for using the facilities. They do not consider regular payments like “pay as you fetch” as contribution towards O&M but rather payment for the use of the facility that they have already contributed to procure.

Typologies of maintenance activities carried out by the managers

The study revealed that all the community-based “managers” of water facilities undertook maintenance activities aimed at sustaining the water facility in their respective communities. The maintenance activities identified include routine cleaning and weeding around the water facilities often done through communal labour and repairs of broken down pumps carried out by the PMV with support from the WATSAN Committees.

Approximately 65 % of the communal activities were done weekly around water points. The remaining communal cleaning activities involved cleaning the stands and weeding around the facility, among others (see Table 4). The survey however identified that approximately 35 % of the communal cleaning activities around the water fetching point were unscheduled. The unscheduled communal cleaning activities around the water fetching points were consistent with the findings of Braimah and Fielmua (2011) in the Nadowli District. The authors found that communal activities aimed at maintaining the water facilities were done in the Nadowli District in Ghana as and when the place was perceived to be weedy or filthy. Children in school were also involved in planned communal cleaning activities as is the case in Addis Ababa (Yelbert 1999). Maintenance activities carried out on the piped systems in Seniaya and Effiduase were contracted out mainly because of the type of water facility in use (pipe system). Nevertheless, the routine cleaning was done by the community members with the active involvement of children in school.

Water could be obtained from the water facilities at all times, except at night when the pump caretakers close from work, in all but five of the sampled communities. These communities scheduled the supply of water because the water pumps break down often when they are used continuously for more than three hours a day. The scheduled times were from 6.00 a.m. and 9.00 a.m. and 3.00 p.m. and 5.00 p.m. The pipe system at Okuasi Extension was open for 12 h a day.

The relationship between meeting frequency and conditions of water facilities

Meetings of the local managers across the five Area/Town Councils were generally irregular (only scheduled meetings during emergencies or as and when the facilities breakdown). About 46 % of them held meetings once every month while 15 % of them met once every week. Approximately 39 % of the local managers met only during emergencies (when there were problems with the water facilities). The study further identified that 54 % of the local managers had no minutes of the meetings.

Table 4 Types of maintenance activities organised and their frequency

Kind of maintenance activity (%)		Frequency of maintenance activity (%)	
Communal labour	21.3	Daily	5.9
Both contribution and labour	45.1	Weekly	64.7
Local management team	14.7	Monthly	–
Contracts	11.1	Irregular	29.4
Others	7.8		
Total	100	Total	100

Source: Author’s Field Survey, February 2013

The Water Board met once every month and kept proper records of their meetings. The chairman of the WB explained that:

Managing pipe systems is a very difficult task. If records are not kept, we would not know what to operate on or maintain in case there is a fault with the laid pipes.

The authors identified some level of relationship between the frequency of meetings and the conditions of the water facilities. Local managers who had irregular meetings were unable to attend to problems with the water facilities on time. Approximately 57 % of the community-based managers who had irregular (unscheduled) meetings had at least 55 % of their water facilities not functioning. For instance, the managers at Senchi failed to fix four broken down boreholes for well over 2 years. Water facilities at Apemso in the Akwamu Area Council and Seniagya in the Seniagya-Mponua Area Council had been broken down for the past year. The inability of the managers to repair the broken down facilities was mainly due to inadequate and unreliable source of revenue.

Management of “orphan” boreholes

The use of the term “orphan boreholes” depicts water facilities that do not have the appropriate managers, that is, the WATSAN Committees, managing them. There was therefore the need to identify those facilities and also find out how they were being managed. The study identified four communities with “orphan” boreholes/hand-dug wells. These communities were Senchi, Seniagya, Bouya and Anunso (see Table 5). Unit Committees managed the water facilities in these communities instead of WATSAN committees. The Unit Committees were charged with the responsibilities of managing the water facilities because they were established by law (Local Government Act, Act 462) to promote the development of their communities.

The study revealed that the Unit Committees were managing these facilities due to the collapse of the WATSAN committees. The researchers identified that members of the collapsed WATSAN committees complained of lack of motivation or incentive to carry out their duties. Some members accepted the fact it was a social responsibility to manage these facilities. They however had other responsibilities and assignments to attend to which they deemed more beneficial.

The study identified that the Unit Committees met irregularly and maintenance activities were also irregular. The irregularity in meeting was as a result of the “many other” tasks the Committees were mandated to perform, as stipulated by law. Their record keeping attitudes were also poor. The study identified that approximately 75 % of these communities had their water facilities broken down. The study thus concluded that WATSAN Committees were better managers of the water facilities at the community level than the Unit Committees. While Unit Committees performed other responsibilities including water facilities management, the WATSAN Committees were responsible for managing only water facilities.

The level of service provided by ‘orphan’ borehole communities and community-managed ones were similarly lower (see Tables 1, 5). However, it was observed that comparatively, the ‘orphan’ boreholes provided lower service levels due to the greater number (i.e., 75 %) of broken down facilities compared to 26 % of the community-managed broken down water facilities (see Table 1). It is, therefore, imperative to have in place the “right managers” and capacities to effectively maintain and manage facilities in the communities.

Factors that limit the activities of the local level water facility managers

From the study, three key factors were revealed to negatively affect the operations of local level water facility

Table 5 Management of orphan water facilities

Community	Managers	Provider of water facility	Mobilisation of revenue	Mode of revenue mobilisation	Revenue management practices	Frequency of meeting	Record keeping
Senchi	Unit committee Head	DA	Unit committee	Payment of levies	Bank Account	Irregular	Yes
Seniagya	Unit committee	DA (MIDA Project)	Unit committee	Payment of levies Pay-as-you-fetch	Treasurer	Irregular	No
Bouya	Unit committee	DA	Unit committee	Pay-as-you-fetch	Treasurer	Irregular	No
Anunso	Unit committee	DA	Unit committee	Pay-as-you-fetch	Treasurer	Irregular	No

Source: Author’s Field Survey, February 2013

managers. These were low revenue for O&M activities, low motivation of local level facility managers and the inability of the DWST to regularly supervise the activities of the local level water facility managers and water facilities across the district.

Several researchers argue that community (local) level water managers are confronted with several challenges, in their bid to undertaking their activities (Kleemeier 2010; Osumanu 2013; Bhandari and Grant 2007). The authors thus identified a myriad of factors that impinged upon the effectiveness of local level water facility managers. The first was the inability of the managers to mobilise adequate revenue for O&M of the water facilities. Kleemeier (2000, 2010) asserts that these managers and their systems are not successful because of the absence of right configuration of markets, government institutions and tradition. It emerged that some households expected to fetch water free because of the initial contributions they made to the capital cost. As earlier discussed, revenue generated through payment of the monthly levies by households was encouraging during the periods of harvest. Payment of monthly levies, therefore, becomes a daunting task during the dry seasons, where there are smaller harvests. Households were however willing to make contributions only when they had ‘enough’ money and water facilities break down. It could thus, be inferred that the period for revenue mobilisation (monthly contributions and levies) from households adversely affected the management and sustainability of facilities. This, as already indicated was due to the fact that the district was an agrarian economy and thus, households were unable to contribute during the off-farming seasons especially the dry seasons. It was also due to their reluctance to pay because they assumed that they had already contributed towards the procurement of the water facility. Sara and Katz (1997) are of the view that community involvement in contributing (financially) towards the maintenance of water facilities is key to ensuring sustainable rural water supply. Hence, irrespective of the season, households should contribute towards the management (repair and maintenance) of facilities.

Secondly, the DWST was unable to sustain its supervisory role because of limited funds and logistics. The Ghana National Water Policy and other water related plans and regulations mandates the DWST to regularly monitor water and sanitation facilities in communities within its jurisdiction. The DWST is however to be provided with funds and needed logistics by the District Planning body (District Assembly) to undertake its core mandate. The study however revealed that the DWST was unable to undertake its regular quarterly monitoring activities due to the delay in the release of funds (District Assemblies Common Fund which is to be given to every district in the country on quarterly by the national/central government to

aid development) from the District Budget/Finance office of the Assembly. The team (DWST) only had access to funds and needed logistics once in a year. At times, the team’s budgetary allocation was cut (reduced) to make room for other infrastructural (capital) and administrative expenses. This affected the ability of the team to police the managers of the water facilities. Laryea (1994) in describing this situation stated that external constraints that are beyond the control of rural communities include financial, time constraints and sectoral development plans by either the government or External Support Agencies.

Lastly, a serious challenge confronting local level water management is with the volunteer-based nature of management of rural water supply systems (Carter et al. 1999). By regulations, the activities of the local level water facility managers (largely by appointment) are voluntary: they do not get paid for their services. Membership of the local level water facility managers was largely voluntary with no direct financial returns to the members. They are only to be trained to manage communal water facilities: maintain, repair and report faulty facilities for repairs. The opportunity costs are the financial and other benefits members would forgo in order to participate in the activities of the committee. The apathy on the part of the WATSAN Committee members was a confirmation of the observation made by King et al. (2012) that the gradual monetisation of the rural economies in Ghana was impinging upon the effectiveness of voluntary groups formed to champion community development. Members’ unwillingness to invest their time into the works of the committees was partly because there was no incentive for them to participate in the Committees’ work. This is further confirmed by similar works by several authors (see Sevlo 2010; Osumanu 2013; Carter 2010; Kamruzzaman et al. 2013).

Conclusion and recommendations

Community management has achieved wide spread acceptance and majority of rural water supply projects all over Sub-Saharan Africa countries (IRC 2003). Adequate water supply is a form of development that every community, district or region needs. Improvements in rural water supply and management is key to the achievement of the SDGs and as well requires a multi-sectoral approach. Unfortunately, community initiatives in interventions to improve service delivery have not been given attention at both national and local government levels. The study revealed that there is a substantial gap between current institutional and human resource capacities and the requirements for achieving the SDGs. Achieving the sustainable development goals will therefore require major

transformations in governance, policies, values and behaviour. This, thus calls for the need to identify the management systems that exist to ensure regular functioning of water resources, eliminate water-related diseases and improve access to potable water sources. The study based on this, sought to identify and examine the factors that affect the effectiveness of existing local level organisations in managing water facilities for sustained access to potable water.

The study found that the supply of potable water in the district was inadequate with 43 percent water coverage. It was observed that communities that lack access to potable water; either as result of non-available sources or broken down facilities; depend on streams for water for domestic and other purposes. About 31 % of the water points (boreholes and hand-dug wells) were non-functional and thus reduced the number of facilities needed to serve the populace. The bodies mandated to ensure sustainable access to potable water (through provision and maintenance of provided facilities) ranged from community-based bodies like the WATSAN, PMV, Local Management Team and Unit Committees to district bodies, specifically the DWST. The DWST is mandated to quarterly monitor activities of local level water management teams. It was, however, found that the DWST was not well resourced to undertake monitoring of water facilities across the district. Systems adopted by community-based manager largely included revenue mobilisation from households, keeping records and undertaking communal labour to clean water points. The study revealed that that almost every community collected water rates but had its own way of maintaining their facilities. The amount obtained was however unsustainable and not enough to cover maintenance and repairs of (broken down) facilities due to the high cost of facility parts and repairs, and lower revenue obtained from households. It was revealed that managers that had frequent meetings and were able to keep records of meetings were quickly able to attend to broken down water facilities confirming similar findings of Braimah and Jagri (2007). Maintenance activities such as organising communal labour, outsourcing, payments from users of facilities and activities from local management teams were practiced in district. The major problem relating to the management of water facilities was on maintenance. This was attributed to the scarcity and high cost of spare parts. Most managers were thus unable to procure them on time whenever there was a break down in their water facilities. It was also revealed that the operations of the managers were ineffective due to the voluntary nature of their jobs. The membership of the local level water facility managers was largely voluntary with no direct financial returns to the members. Therefore, managers' unwillingness to invest their time and resources into the works of their various

committees was partly because there was no incentive for them to participate in the committees' work (Sevlo 2010; Osumanu 2013; Carter 2010; Kamruzzaman et al. 2013).

The study based on the revealed challenges recommends the need to ensure regular operation and maintenance of water facilities to ensure sustainable water supply through effectively adopting the appropriate systems in managing them. The recommendations seek to address the weaknesses of the various organisations and their management strategies to ensure the sustainability of the facilities. The study recommends community involvement to encourage and motivate members of local level water facility managers in their work. A study in the Nadowli District in Northern Ghana revealed that communities provided the managers with foodstuffs from their farms as well as contributing their labour to help the committee members on their farms. This aided in strengthening the interests of managers in seeking for support to provide and manage water facilities in the district. The District Planning Authority through the DWST should also initiate a comprehensive sensitisation programme to get communities to initiate actions to motivate the managers and also disabuse their minds that contribution towards capital cost of water facility procurement did not mean that one did not need to contribute for O&M. Secondly, since revenue mobilised from households is not enough to cover management costs, committee members should be encouraged to invest the little monthly revenue they mobilise from households in income generating activities (IGAs). The profits from these IGAs could augment the revenues of the managers to promptly attend to maintenance needs and also consider meeting the life cycle cost or replacement of facility costs (Braimah and Jagri 2007). The prospect of this proposal is, however, hinged on the level of accountability of the managers to the communities they serve. It must, therefore, be made mandatory that the managers account to the communities every year.

The study also calls for among others for quarterly training of local management teams (Bohm et al. 1993), identifying and adopting the appropriate revenue mobilisation strategies that will ensure effective maintenance and management of water facilities (Braimah and Fielmua 2011). Also, the active involvement of the community in what has traditionally been a public sector responsibility requires a more flexible approach. However, existing legal and regulatory frameworks need to change to reflect this. Osumanu (2013) suggests that mainstreaming community initiatives and realising their potential to act in full partnership with the state and utilities will require sustained effort, among others, in information sharing, capacity building and enabling communities to participate in the decision-making process will call for necessary institutional and legislative reforms. These are very important

areas in effectively managing provided water facilities in communities. The prospects of ensuring sustainable service delivery therefore look achievable provided the key challenges identified could be addressed and the most sustainable approach adopted in managing water facilities.

References

- Babbie ER (2010) The practice of social research, 12th edn. Wadsworth Cengage, Belmont
- Bhandari B, Grant M (2007) User satisfaction and sustainability of drinking water schemes in rural communities of Nepal. *Sustain Sci Pract Policy* 3(1):12–20
- Bohm RA, Essenburg TJ, Fox WF (1993) Sustainability of potable water services in the Philippines. *Water Resour Res* 29(7):1955–1963. doi:10.1029/92WR02997
- Braimah I, Fielmua N (2011) Community ownership and management of water and sanitation facilities: issues and prospects in the Nadowli district of the upper west region of Ghana. *J Sustain Dev Africa* 13(2):74–87
- Braimah I, Jagri EM (2007) Institutionalizing Water and Sanitation Committees (WATSAN) for sustainable service delivery in Ghana: the case of Nantumba North District in the Northern Region of Ghana. *J Sci Technol* 27(1):90–101
- Carter RC (2010) Study of sustainability of water supply services in Madagascar. Water Aid, London
- Carter RC, Danert K (2003) The private sector and water and sanitation services—policy and poverty issues. *J Int Dev* 15:1067–1072
- Carter RC, Tyrrel SF, Howsam P (1999) Impact and sustainability of community water supply and sanitation programmes in developing countries. *Chart Ins Water Environ Manag* 13:292–296. doi:10.1111/j.1747-6593.1999.tb01050.x
- Cohen SJ (2000) Efficacy, effectiveness, and sustainability: translating research into improvements in health care. *Med Care* 38(5):449–450
- CWSA (2007) Community water and sanitation agency, corporate brochure. CWSA, Accra
- Davis J (2005) Private-sector participation in the water and sanitation sector. *Annu Rev Environ Res* 30:145–183
- DFID (1998) Better water services in developing countries: public–private partnership; the way ahead. London
- Doe SR, Khan MS (2004) The boundaries and limits of community management: lessons from the water sector in Ghana. *Commun Dev J* 39(4):360–371. doi:10.1093/cdj/bsh032
- Dzisi S, Obeng F (2013) Microfinance and the socio-economic wellbeing of women entrepreneurs in Ghana. *Int J Bus Soc Res (IJBSR)* 3(11):45–62. <http://www.thejournalofbusiness.org/index.php/site/article/viewFile/313/313>. Accessed 23 Aug 2014
- Giné R, Pérez-Foguet A (2008) Sustainability assessment of national rural water supply program in Tanzania. https://upcommons.upc.edu/bitstream/handle/2117/8151/gine_sustainability_2008.pdf?sequence=1&isAllowed=y. Accessed 24 Aug 2014
- Harvey PA, Reed RA (2007a) Sustainable supply chains for rural water supplies in Africa. Oxford University Press, United Kingdom
- Harvey PA, Reed RA (2007b) Community-managed water supplies in Africa: sustainable or dispensable? *Commun Dev J* 42(3):365
- Herbertson PWE, Tate EL (2001) Tools for water use and demand management in South Africa. Secretariat of the World Meteorological Organization—Geneva—Switzerland WMO/TD—No. 1095; 2001
- Howard G, Bartram J (2003) Domestic Water Quantity, Service Level and Health. Geneva: World Health Organisation. Available: http://whqlibdoc.who.int/hq/2003/WHO_SDE_WSH_03_02.pdf. Accessed Sept 2015
- Hunter PR, MacDonald AM, Carter RC (2010) Water supply and health. *PLoS Med* 7(11):e1000361. doi:10.1371/journal.pmed.1000361
- Johnson B, Onwuegbuzie A (2004) Mixed methods research: a research paradigm whose time has come. *Educ Res* 33(7):14–26
- Kamruzzaman AKM, Said I, Osman O (2013) Overview on management patterns in community, private and hybrid management in rural water supply. *J Sustain Dev* 6(5):26
- King R, Braimah I, Amponsah O (2012) UNDP/NADMO recovery programming support for northern Ghana: terminal evaluation draft report. United Nations Development Programme, Accra
- Kleemeier E (2000) The impact of participation on sustainability: an analysis of the Malawi rural piped scheme program. *World Dev* 28(5):929–944. doi:10.1016/S0305-750X(99)00155-2
- Kleemeier E (2002) Rural water sector reform in Ghana: a major challenge in policy and structure, Fiedl Note 2, Vandena Mehra, www.wsp.org/publication/af_bg_ghana.pdf. Accessed 23 Oct 2013
- Kleemeier E (2010) Private operators and rural water supplies, a desk review of experience. The World Bank
- Laryea NO (1994) Challenges and prospects of community management in Ghana. In *Affordable Water Supply and Sanitation*. Paper presented at the 20th WEDC conference, Colombo, Sri Lanka
- Lockwood H, Bakalian A, Wakeman W (2002) Assessing sustainability in rural water supply: the role of follow up support to communities: literature and desk review of water supply and sanitation project documents. The World Bank, Washington, DC
- Mahmud SG, Shamsuddin SkAJ, Feroze AM, Davison A, Deere D, Howard G (2007) Development and implementation of water safety plans for small water supplies in Bangladesh: benefits and lessons learned. *J Water Health* 5:585–597
- Mazango N, Munjeri C (2009) Water management in a hyperinflationary environment: case study of Nkayi district in Zimbabwe. *Phys Chem Earth Parts A/B/C* 34(1–2):28–35. doi:10.1016/j.pce.2008.07.004
- McCommon C, Warner D, Yohalen D (1990) Community management of rural water supply and sanitation services. UNDP-World Bank, Washington DC
- Morse JM, Field PA (1996) Nursing research: the application of qualitative approaches. Macmillan, Basingstoke
- Muiderman K (2013) Post-2015: SDGs or Post-MDGs? Running up to the end of the MDG term. <http://www.thebrokeronline.eu/Articles/Post-2015-SDGs-or-Post-MDGs>. Accessed 24 May 2015
- Osumanu IK (2013) Community involvement in urban water and sanitation provision: the missing link in partnerships for improved service delivery in Ghana. *J Afr Stud Dev* 2(8):208–215
- Productivity Commission (2013). On efficiency and effectiveness: some definitions, Staff Research Note, Canberra: Commonwealth Commission of Australia
- Salim AS (2002) Rural water sector reform in Ghana: a major change in policy and structure, water and sanitation program-Africa region (WSP-AF) Nairobi, Kenya
- Sara J, Katz T (1997) Making rural water supply sustainable: report on the impact of project rules. UNDP World Bank Water and Sanitation Program, http://www.wsp.org/sites/wsp.org/files/publications/global_ruralreport.pdf. Accessed 7 Mar 2014
- Schillinger D (2010) An introduction to effectiveness, dissemination and implementation research. In: Fleisher P, Goldstein E (eds) *From the Series: UCSF Clinical and Translational Science*

- Institute (CTSI) Resource Manuals and Guides to Community-Engaged Research, P. Fleisher, ed. Published by Clinical Translational Science Institute Community Engagement Program, University of California San Francisco. http://ctsi.ucsf.edu/files/CE/edi_introguide.pdf. Accessed 23 Sept 2013
- SCRGSP (2006) Report on government services 2006, productivity commission, Canberra: Steering Committee for the Review of Government Service Provision (SCRGSP)
- Sekyere East District Assembly (2010) District medium-term development plan (2010–2013), Effiduase, Planning Department Office
- Sevlo G (2010) Community participation in the operation and maintenance of water and sanitation facilities. Unpublished B.Sc. (Planning) Special Study Submitted to the Department of Planning, University of Science and Technology, Kumasi
- Tadesse A, Bosona T, Gebresenbet G (2013) Rural water supply management and sustainability: the case of adama area, Ethiopia. *J Water Res Prot* 2013(5):208–221
- United Nations (2007) The millennium development goals report. New York: United Nations. <http://www.un.org/millenniumgoals/pdf/mdg2007.pdf>. Accessed Sept 2015
- United Nations (UN) (2015). Water for a sustainable world. The United Nations World Water Development Report 2015, UNESCO (United Nations Educational, Scientific and Cultural Organization), France
- United Nations Department of Economic and Social Affairs (UN DESA) (2015). The Critical Role of Water in Achieving the Sustainable Development Goals: Synthesis of Knowledge and Recommendations for Effective Framing, Monitoring, and Capacity Development
- Water-Aid Ghana (2005) Assessment of national sanitation policies: Ghana case. Final report, Accra, p. 9. http://wedc.lboro.ac.uk/projects/proj_. Accessed 26 Mar 2008
- WEDC (2003) Community and management, a WEDC postgraduate module: WEDC. Loughborough University, UK
- WHO (2007) Combating Waterborne disease at the household level. The International Network to Promote Household Water Treatment and Safe Storage. Oxford Press, Geneva, Switzerland
- World Health Organisation (2000) Primary health care; from Alma-Ata to the year 2000, reflections at the mid-point. Oxford Press, Geneva
- World Water Week (2010) Presentation from the 2010 World Water Week in Stockholm. http://www.worldwaterweek.org/documents/WWW_PDF/2010/Thursday/T5/2_JMP_latest.pdf. Accessed 4 Sept 2013
- Yelbert JE (1999) Community management practices. Integrated development for water and sanitation. Addis Ababa, Ethiopia: Water, Engineering and Development (WEDC) Publications