Community-Based Management of Boreholes in the Talensi-Nabdam District, Upper East Region, Ghana: Problems and Solutions

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Abstract

The provision of boreholes is the best option for providing reliable and safe drinking water to rural populations in Ghana. Key to the success of these efforts is the proper management of the boreholes by the beneficiary communities. The Talensi-Nabdam District is a beneficiary of 161 boreholes and is currently confronted with problems relating to their management. A study was therefore undertaken to ascertain the problems facing the management of boreholes in the District and to make recommendations on how to deal with them.

The findings show that good Community-Based Management of Boreholes (CBMB) hinges on the adequacy and reliability of the boreholes, the use of good quality hand pumps for installation of boreholes and, readily available and affordable spare parts for the maintenance of the hand pumps. Additionally, a commitment of the beneficiaries to use the facility properly and contribute adequately towards its maintenance, the existence of a well-motivated Borehole Users Association equipped with what it takes to be efficient and effective. A good net-working of all stakeholders with political support at the local level is a plus for boreholes management. It is also recommended that Government institutes a policy to District Assemblies where CBMBs exist to set aside a proportion of their Common Fund annually to educate their communities in the areas of water, health and sanitation. Adequate training and periodic refresher workshops of members of the community borehole management committees with the assistance of the District Assemblies should also form part of the education.

1.0 Introduction

It is estimated that about 320 million people living in Sub-Sahara Africa have no access to clean reliable water supply and 85% of this number are in rural communities (MacDonald *et*

al., 2008). In Ghana, rural communities are those with populations fewer than 5 000 and make up 56.6% of the estimated 22 million people (Dapaah-Siakwan and Gyau-Boakye, 2000; Gyau-Boakye *et al.*, 2008). Government policy is to construct hand-dug wells for the provision of potable water to communities of up to 500 people and hand dug or boreholes fitted with pumps for populations between 500 and 2 000. Piped distribution systems are to be constructed for populations of 2 000 to 5 000 from either surface water or ground water sources. About 52% of rural communities have been provided with potable water mainly from groundwater resources (Gyau-Boakye *et al.*, 2008).

The provision of boreholes to rural communities has been found to be very suitable in Ghana because of favorable geological conditions, scattered and small settlement patterns and economic reasons (Dapaah-Siakwan and Gyau-Boakye, 2000; Amoah, 2001). The use of untreated surface water comes with it guinea worm and other water borne infectious diseases. The challenge to the provision of continuous access to safe drinking water by the provision of boreholes is to have in place an effective and efficient management system. It has been observed in recent times, that funding agencies require borehole beneficiaries to contribute a counterpart fund. This requirement is meant to ensure that the beneficiary communities have a keen interest in the water facility and will therefore manage it well when provided.

The purpose of this paper is to highlight the challenges facing rural communities in their bid to manage the water boreholes constructed for their use in the Talensi-Nabdam District of the Upper East Region in Ghana. Solutions are suggested and it is hoped that the study will help policy makers to be aware of the issues that require attention in the management of boreholes in the District and help direct the policies in other districts with similar systems.

2.0 The Study Area – Physiography and Hydrogeology

The Talensi-Nabdam District, hereafter called the District, is in the Upper East Region of Ghana. The District was inaugurated on 24th August, 2004 with Tongo as its capital. The national population and housing census of 2000 indicated that the District's population was 106,351. With a population growth rate of 1.1% per annum, the estimated current population of the district is 120,000. With a total land area of 912 km^2, the population density of the District is 132 people/km^2. The District is bordered to the north by Bongo, east by Bawku

West, west by Bolgatanga Municipality and south by Mamprusi West and East Districts (see Fig. 1).

The annual mean temperature for the District is about 35^{o}C. Between November and February the area is characterised by cold, dry and dusty harmattan winds. Temperatures during this period could be as low as 14^{o}C at night but could go up to more than 35^{o}C during the day (Anon, 2005). The District is drained mainly by the Red and White Voltas, Kuldaga-Kulibuliga and Atamore Rivers. It experiences one short rainy season that often begins in May and ends in mid-October with heavy rains occurring between July and mid-September. This is followed by a prolonged dry season beginning from October to April. During the dry period most of the rivers, dams and dug-outs in the area dry up due to the resulting high evaporation rates. The annual rainfall figures from 1996 to 2009 vary between 855 mm and 1269 mm with a mean of 1 000 mm showing that there was enough precipitation to recharge ground water. Relative humidity from July to September is 91% and 15% from December to January respectively.

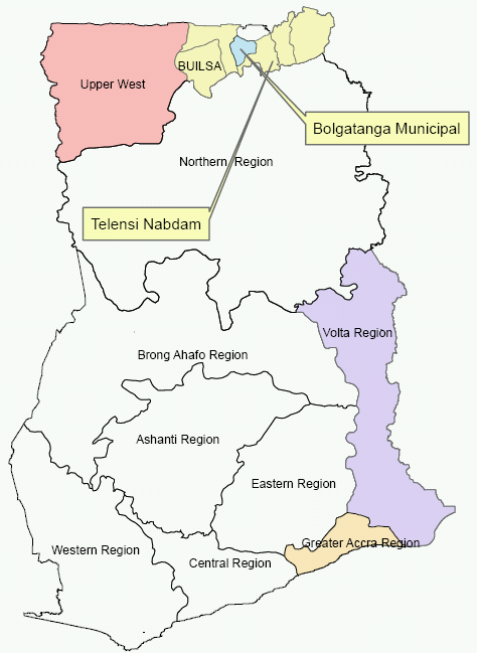

Fig. 1 Location Map of the Study Area (Anon, 2009)

Figure 2 shows the geology of the area. The District is underlain by Birimian metavolcanic and metasedimentary rocks that consist of andesitic and basaltic lavas, tuff, schist, amphibolite, phyllite, quartzite and metaconglomerate (Murray, 1960). These rocks are

intruded by granite. Groundwater storage and flow in the District are controlled by the thickness of the overburden, the degree of decomposition, and the type and intensity of fracturing (Apambire, 1996).

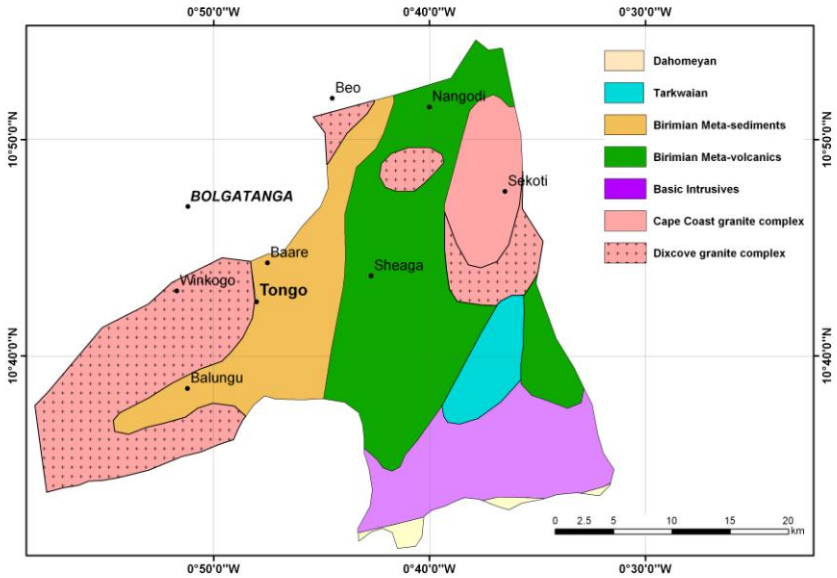

Fig. 2 Geology of the Study Area (Modified from Murray, 1960)

Using 191 wells logs in the Birimian in and around the District, it was found that the overburden thickness in the Birimian volcanics range from 17 to 33 m with a mean of 28 m and those in the metasediments are within 11 to 30 m with a mean of 19 m. About 95% of the wells in the Upper East Region and hence the study area are completed within the overburden (Apambire, 1996). The static water levels range from 0.98 to 17.67 m with an average of 6.39 m. The rise in ground water level during the rainy season measured over a three-year period average 1.8 m.

3.0 Boreholes and their Yields

There are 161 boreholes in the District. The Community Water and Sanitation Agency's (CWSA) recommended ratio is one borehole to 300 people. With this ratio, the District has 41% of its requirement but needs a total of about 400 boreholes. Boreholes in the District are often found in fractures and faults mostly located within schist, phyllites, quartz veins and decomposed granites with their depths between 18 and 50 m. Water quality is fairly good, although there are reported cases of faecal coliforms in some wells. Pumping tests data

collected on the yields of boreholes in the District ranged from 4.54 to 340.50 l/min and average of 33.19 (l/min). However, 128 boreholes have yields of less than 30 l/min, 17 have yields between 40 and 119 l/min and 9 have yields greater than 120 l/min (Fig. 3). Except for one borehole the other eight with yields greater than 120 l/min are located on shears and faults (Anon., 2009a).

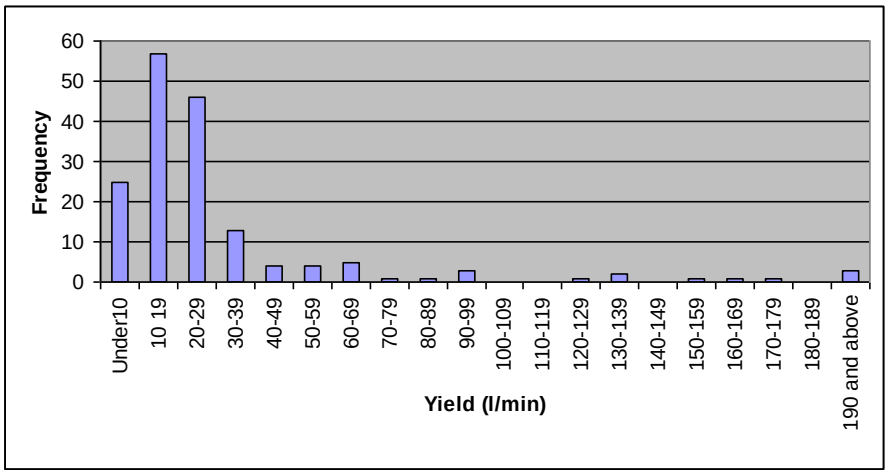

Fig. 3 Graph of Boreholes Yield versus Frequency

4.0 Reliability of Hand Pumps

A 102 Afridev and 59 Nira pumps were used in the installation of the boreholes. The Afridev pumps were used for the relatively deeper boreholes while the Nira pumps were used for shallower wells showing that there are fewer shallow wells in the District. The Afridev hand pumps have their plastic bearings, bobbins and plunger seals frequently replaced. Rust builds on the rod connection of the welded parts of the hook and eye. The Nira's stainless steel T-handles get worn and perforated generally after 4 years of use (Aduko, 1995). About 60% of the Afridev hand pumps broke down at least once, 27% broke down at least twice and 13% broke down at least three times in 2008. Only 10% of the Nira hand pumps broke down once in the same year.

5.0 Structure and Functions of Stakeholders

The stakeholders involved in the provision and management of boreholes in Ghana include the Ministry of Water Resources, Works and Housing (MWR and WH), Community Water and Sanitation Agency (CWSA), Regional Water and Sanitation Team (RWST), District

Assemblies (DA), District Water and Sanitation Teams (DWST), Community Water and Sanitation (WATSAN) Committees, the Communities and the Private Sector.

5.1 Ministry of Water Resources, Works and Housing (MWR and WH)

Water management function at the national level is performed by the MWR and WH. This Ministry is to ensure the efficient management of all water resources, increase access to potable water and provide adequate sewerage and drainage. The Ministry gets most of its funding for boreholes from donors.

5.2 Community Water and Sanitation Agency (CWSA)

The CWSA was established by an Act of Parliament, (Act 564) in December 1998 with the mandate to facilitate the provision of safe drinking water and related sanitation services to rural communities and small towns in Ghana by determining the magnitude of investments required in such provision.

5.3 Regional Water and Sanitation (RWST)

RWST is the Regional Secretariat of the CWSA which gives technical assistance to the District Assemblies and develops the capacities of the private sector to perform the roles related to the improvement of community water and sanitation.

5.4 District Assembly (DA)

The DA is the highest political, executive, legislative, and administrative authority at the district level. It comprises elected representatives from Electoral Areas, Members of Parliament in the area as co-opted members, and appointed members by the President in accordance with Act 462 of 1993. By this Act, the Assembly is responsible for the overall development of the District. The Assembly has therefore established statutory committees to perform its functions. These committees include the Executive, Development Planning, Social Service, Justice and Security, Finance and Administration, and Works (Anon, 1996a).

5.5 District Water and Sanitation Team (DWST)

The DWST in the District comprise three seconded persons, one of whom is a female. They are trained in community development, environmental hygiene, water supply and sanitation related activities and charged with the management of water and sanitation activities of the

District. The DA budgets for the activities of the DWST and liaises between the Water and Sanitation Committees and the rest of the communities at the community level, the RWST, the private sector and the Assembly on all matters on community water and sanitation. The team is also in charge of baseline data collection on boreholes, promotional activities relating to water and sanitation, verification of water and sanitation issues in the communities, monitoring and follow-ups (Anon, 1996b).

5.6 Community Water and Sanitation (WATSAN) Committees

The WATSAN Committees in the District consist of a gender sensitive executive of at least seven and at most nine members for each borehole. Their functions include (Anon, 1997):

- Community mobilisation and consultation;
- Fund raising and Management;
- Operation and Maintenance management;
- Development of community proposals;
- Sanitation, hygiene, and other relevant educational programmes.

The Committees are also responsible for base data collection, supervision, monitoring, evaluating, promoting and writing reports on water and sanitation related issues.

5.7 Communities

The communities participate in the selection of the WATSAN Committees, planning facilities and systems for raising and managing funds, construction, maintaining old and new facilities, and hygiene/sanitation actions.

5.8 Private Sector

The private sector consists of the contractors, training institutions, mechanics, spare parts dealers, etc. who provide goods and services.

6.0 Challenges to Boreholes Management in the District

The challenges and management of boreholes in the study area are outlined in the following sections.

6.1 Government Institutions

Government's budget allocation to CWSA in terms of its running cost has been about 50% of what was required over the years (Anon, 2008). Since the RWST depend on the limited resources of the CWSA, some of its projects are also delayed. RWST involves the DWST and WATSAN Committees in the selection of borehole sites for drilling and in creating awareness of the community on the ownership and management of their boreholes. This is an indication that community participation is considered important in the success of boreholes development and management.

The DA in many instances is not able to provide the needed logistics and financial support for water and sanitation activities. Between 2005 and 2009, health, water and sanitation sectors were not adequately funded (Table 1). However, expenditure on administration was higher than the entire sector because it is a new district and needed to develop its offices. The DA depended on external funding from some Non-Governmental Organisations (NGOs) for its water and sanitation projects and programmes. In 2007 when there was no such funding for water and sanitation, there was no expenditure on the sector.

Table 1 Talensi-Nabdam District Assembly's Expenditure in the Various Sectors

Sector	2005	2006	2007	2008	2009	Average
Health	8.53%	1.73%	1.54%	19%	11%	8.36%
Education	20.63%	8.24%	4.41%	62%	42%	27.46%
Administration	68.89%	85.30%	94.05%	12%	40%	60.05%
Water and Sanitation	1.95%	4.73%	-	7%	7%	4.14%

Source: Anon (2009b).

Despite the many responsibilities of the DWST, the team had inadequate training, logistics and funds to carry out its work. Apart from this, it is not clear if in future their parent departments will withdraw their services. If this action is taken, it will greatly affect the work of the DWST. The DWST presents its routine reports to the Assembly's Secretariat. It also discusses the reports in quarterly meetings with the RWST, some key officials of the Assembly and other stakeholders. The outcomes of these meetings are addressed by the

Assembly. However, since the Assembly had not budgeted for the DWST's operations, it is not possible to spend from other budget lines without the approval of the General Assembly. This results in delays in implementation of agreed actions.

There are no private sector firms in the water and sanitation sector in the District and the few in the Region are located at Bolgatanga, the Regional Capital. These firms have limited capacity to cope with the ever-increasing demands from sector stakeholders and beneficiaries.

6.2 The Communities - Ownership and Contributions towards Boreholes Maintenance

Each borehole has a WATSAN Committees (hereafter called the Committees) in place but some of the boreholes do not have the full complement of members and this poses extra burden on the few members. The inclusion of women in the membership of the Committees' work is good and encouraging. This is because out of a total of 966 members, 485 are women. The Committees have difficulties holding successful community meetings to discuss matters relating to the management of their boreholes (e.g. mobilising funds for the maintenance of the boreholes). The various Committees in the District neither have a common forum to share ideas relating to their work nor to present their problems to the DA and other stakeholders for assistance. Committees formed after 1996 did not have their members trained and are therefore performing below expectation resulting in the members of such communities having low confidence in them.

Although there is the Small Towns Mechanised Water System in the District located at Kongo, most of the beneficiaries of that system did not pay their tariffs and were therefore disconnected. Consequently, the whole population depends on the boreholes resulting in pressure and over use of the hand pumps fitted to those boreholes leading to their frequent break downs. Children are often sent to fetch water from the boreholes for the family. Some of them are so young that they cannot pump out the water from the boreholes in a standing position. As a result, they have to jump and hang onto the handle of the hand pump to operate them (Fig. 4). These actions cause damage to some of the parts of hand pumps.

Fig. 4 Children Pumping Water from a Borehole

All the communities prefer to own and manage their boreholes despite the problems they are facing. Their reasons are that, if an external body takes over the management of the boreholes, it may sell water to them at a higher price and many people will not be able to pay for it. Some are also of the view that the water from the boreholes is free. It is therefore not justifiable to sell the water to community members. Besides, owners of land where the boreholes are located would ask for exemption from payment, claim ownership of the boreholes, ask for compensation for their land or demand for the removal of the boreholes from their farmlands if they would not benefit from the water. Selling water from the boreholes would also bring about land litigation issues, disagreement over how prices should be fixed, and the control and usage of revenue accruing from the sale. The problems that would arise from all these may derail the present management system. It was learnt that land litigation are common in communities with irrigation dams because of the economic activities around them. Unlike irrigation dams, land tenure is not a problem to the provision of boreholes in the area because the size of land used for a borehole is small and the water from them is not for sale.

The trained hand pump caretakers do not carry out maintenance work on the hand pumps; not only because spare parts are not readily available but it is also not easy to convince the communities to pay for maintenance when a hand pump has not broken down. Until a hand pump breaks down, they do not find it necessary to contribute money for its preventive maintenance. Contributions towards the repair of broken down hand pumps are done either on the basis of the number of houses in the area or the number of kitchens in a house. This arrangement was decided by the boreholes users. The contributions vary with the cost of spare parts purchased and repair of the hand pumps. The communities' response to requests to contribute money for the repair of broken down hand pumps is generally slow. In order to

repair a broken down hand pump quickly, some of the Committees borrow from individuals to pay for repairs before all the money is collected from the borehole users to pay back the loan. In cases where it is not possible to obtain money for repairs in this way, it leads to delays in the repair of the hand pumps.

6.3 Breakdown of Hand Pumps

The causes of breakdown of hand pumps in the area are due to lack of preventive maintenance and replacement of old parts, overuse and misuse of some of the hand pumps. The depth of the boreholes also contribute to their breakdown since one needs to pump a number of times before water starts flowing and this leads to some of the pump parts wearing faster compared to shallow boreholes.

7.0 Water Quality and Sanitation Challenges

Tests on the water quality of the boreholes were carried out in the year the borehole(s) were drilled. However, the results of these tests were not disclosed to the beneficiary communities or the DA. Boreholes in the District were drilled between 1973 and 2009. According to Apambire (1996), water samples taken from boreholes in the District and analysed for zinc, copper and manganese found their concentrations to be within acceptable limits. Iron was not analysed.

Fluoride concentrations in ground water in the metavolcanics and metasediments ranged from 0.29 ppm to 0.49 ppm but those analysed from the Bongo granite in Sekoti and Tongo were as high as 1728 ppm (Apambire, 1996). Because fluorite is reactive, it forms many complexes with several other elements and makes its removal difficult using physical treatment methods. The most affected parts of high fluoride concentration in Ghana are the Upper East, Upper West and Northern regions (Gyau-Boakye, 2008). Human populations consuming fluoride above the maximum acceptable limit in drinking water suffer from dental fluorosis and increased bone fracture in children. Long-term consumption of fluoridated water results in increased hip fracture in the elderly (Danielson, 1992).

According to the World Health Organisation (WHO), "sanitation is safe management of human excreta and includes the provision of latrines and the promotion of personal hygiene. Environmental sanitation is a broader term, encompassing excreta disposal, solid waste

management, waste water disposal, vector control, and drainage. Personal hygiene includes practices such as washing hands with soap after defecation and before contact with food, and in a broader sense, extends to the collection, storage and handling of safe water" (Asha, 2003). Poor health is a direct consequence of poor sanitation. That is why it is one of the major requirements for the management of boreholes. CWSA's approach to sanitation promotion is simply a process which aims at promoting conditions and practices that help to prevent water and sanitation related diseases. The focal areas of this promotion include: safe water, environmental cleanliness, disposal of faecal matter, hand washing, food handling, water-borne, water related and excreta related diseases.

With a concrete floor around each borehole, surface water is prevented from entering the boreholes and contaminating the water. Each borehole has a pad which collects spilt water on the concrete floor. Apart from the fact that this provides water for animals to drink, it prevents the spilt water from making the surroundings of the borehole muddy. However, most of the boreholes in the District are sited on farms and in the rainy season food crops are always grown close to boreholes. People hide in the crops near the boreholes to attend to nature's call. Washing of clothes and household utensils around the boreholes is also common. In the dry season, stocks of food crops and grasses are left around the boreholes. Animals on free range in the dry season drink water from the pads of the boreholes and leave behind their droppings soaked in water. Boreholes located near market areas are also surrounded by waste generated from the markets.

In terms of sanitary facilities, the District has a total of 55 water closets and 7 Kumasi Ventilated Improved Pits (KVIPs). There are 148 households with toilet facilities. Out of 145 schools in the District, only 3 have toilets. The District has no solid and liquid waste disposal site. Thus, sanitary facilities in the District are woefully inadequate. Open defecation is therefore widespread and is found in open fields, bushes, and drains. This may generate viruses, bacteria and parasites which may be transferred to human beings through the eating and drinking of contaminated food and water respectively. The District is therefore prone to diseases related to poor sanitation. Information from the Out Patient Department (OPD) of the Tongo Health Centre indicate that there is high incidence of water and sanitation related diseases in the District (Table 2).

Table 2 Top Recorded Diseases in the Tongo Health Centre

Disease	**2005**	**2006**	**2007**	**2008**	**2009**
Malaria	23,957	19,900	22,275	34,955	42,156
Acute Respiratory Infections	3,074	2,156	3,598	4,473	5,660
Skin diseases	3,224	2,161	3,218	3,944	4,418
Diarrhea	2,466	1,153	1,143	1,637	2,454
Pneumonia	973	841	863	1,620	1,238
Malaria in pregnancy	718	592	594	307	696
Anemia	530	-	561	736	753
Intestinal worm	351	354	335	347	585
Typhoid / Enteric Fevers	-	-	307	303	628
Acute eye infection	419	309	303	343	819
Rheumatism/Joint pains	-	370	717	1,447	1,054

Source: (Anon, 2009c)

8.0 Solution and Conclusion

The number of boreholes constructed in the District is inadequate and needs to be increased from 161 to 400. There should be a well-planned and implemented reforestation and rain water harvesting scheme in the District to improve the quantity of ground water. The study has established that the hand pumps used for the installation of boreholes are reliable but the level of reliability is however threatened by maintenance problems such as unavailability of spare parts, poor hand pump caretaker performance, and unavailability of hand pump mechanics in the District. There are only 4 hand pump mechanics in the Upper East Region and these are the ones who also own shops that sell the spare parts. Unfortunately, they have limited capacity. The problem of spare parts is in two-fold; there is no spare parts dealer in the District and the only one in the Bolgatanga Municipality does not stock enough parts because of the low profit margins.

To resolve this problem, communities need to identify interested people living in the District to be trained as area mechanics to repair the hand pumps, deal in hand pump spare parts and other spares such as bicycles and motor bikes. The DA may have to screen and select those interested in dealing with the spare parts and supporting them by assisting them to get loans

from financial institutions at concessionary rates. The Committees and pump caretakers formed after 1996 need to be trained and refresher courses regularly organised for them in addition to those trained earlier on.

Many families send children to fetch water from the boreholes for them. The children do not use the hand pump properly and this leads to frequent breakdown of hand pumps. Thus children should always go to the borehole in the company of adults to assist them to fetch water from the boreholes.

The study showed that most of the communities were not contributing enough money towards the maintenance and motivation of the Committee members. Routine maintenance ensures good performance and durability of the hand pumps. The study established that if people in the 18 to 64 years bracket paid Twenty Ghana Pesewas (GH¢0.20) per month towards the maintenance of boreholes in the District, the money collected will be adequate to maintain the hand pumps and motivate the Committee members.

The study also showed that the CWSA, RWST, DA and DWST rely on dwindling and delayed Government funds for their work. The private sector and the boreholes beneficiary communities do not depend on Government funding for the management of boreholes. As Carter and Bevan (2008) suggested, there is the need to reduce the cost of borehole drilling and construction, promoting low cost drilling technologies and ensuring functional sustainability of groundwater abstraction points. The third point is best accomplished by empowering communities through education and training.

The study also established that the Committees in different communities do not have a forum where they discuss their challenges and solutions. It is suggested that a Boreholes Users Association (BUA) should be formed in the District and they should meet at least once a year. The BUA will bring all the Committees together to discuss their problems and plan on how to solve them. They will also hold meetings with the Assembly Members, Area Councils, District Assemblies and other stakeholders to discuss the problems they are facing in managing the boreholes. The body will be able to bring about uniformity in solving common problems in the area. However, the Committees should be left to continue to hold their separate community meetings to discuss their peculiar problems.

The study further revealed that the Committees related directly only with the DWST and sometimes the RWST staff. It is important that they are in contact with the Community Development Department, Ghana Education Service, Environmental Protection Agency and Non-Governmental Organisations in the water and income generation sectors for educational programmes. The community members need more interactions with different organisations to widen their horizon of thinking. Some of these organisations may provide funding in the future for their educational programmes. Community participation in boreholes management could be improved through such programmes.

It was also established in this study that the DA did not budget adequately for water and sanitation issues. The problems of water, sanitation and health issues should be taken seriously by the District Assemblies by setting aside a proportion of the Common Fund annually for education in the areas of water health and sanitation. The central Government should make it a policy to all districts with CBMB to set aside a proportion of their Common Fund annually for education in water health and sanitation.

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