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AN EVALUATION OF THE SUSTAINABILITY OF A WATER SUPPLY PROJECT IN MT DARWIN DISTRICT: ZIMBABWE

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ABSTRACT

A study was carried out in Mt Darwin District of Zimbabwe to evaluate the sustainability of a rural water supply project in terms of reliability of the system, local institutional, and human capacity development, as well as financing mechanisms. Study methods included focus group discussions, questionnaires, and field observations. Some 38% of the boreholes studied were not functioning. The average downtime for the boreholes was 3 weeks. Water Point Committees (WPCs) existed and functioned for all boreholes and, in 90% of the cases, the community made contributions for operation and maintenance only when there was a breakdown. Trained personnel were perceived to have inadequate skills. It was concluded that the average downtime was long compared to recommended durations. WPCs appeared functional while the financing mechanisms were found to be poor for effective maintenance of boreholes. In future projects, training should be prolonged and user payment for maintenance encouraged.

Key words: boreholes, financing mechanisms, human capacity development, institutional capacity, reliability, sustainability.

INTRODUCTION

During the International Drinking Water Supply and Sanitation Decade (IDWSSD), 1980 to 1990, there was a rapid expansion of rural water and sanitation infrastructure in Zimbabwe as the expertise in rural water and sanitation was readily available (Robinson, 2002). In Zimbabwe, from 1980 to 2002, there was a substantial increase in rural service coverage from 5% to 39% in terms of sanitation and from 30% to 78% in terms of water (UN, 2004). However, the massive financial injection to increase water and sanitation facilities has not been complimented with appropriate operation and maintenance strategies, community empowerment initiatives, and clear health and hygiene promotion strategies.

While the maintenance of latrines has been the responsibility of the users, the maintenance of most rural water points in Zimbabwe were under a centralized maintenance system, called the Three-Tier Maintenance System, meaning it had three structures (tiers). The first tier consisted of the District Maintenance Team (DMT), which was responsible for the overall operation and maintenance, planning, provision of tools and spare parts, and supervision of the second tier. The first tier was also responsible for the repair of major breakdowns assumed to be beyond the capacity of the second tier. The second tier consisted of Pump Minders (also known as Pump Mechanics) who were responsible for all mechanical repairs of the water supply systems in the wards. Their response to operational problems was assumed to be faster than that of the DMT as they were community-based and had the necessary tools and spares to undertake minor repairs for water points in the ward. The third tier comprised of a caretaker who was one of the water point users, selected by the community as a member of the water point committee. The caretaker was responsible for all routine maintenance works on the boreholes, which included taking care of the fence around the pump and the soakaway, ensuring that there is no stagnant water where mosquitoes can possibly breed.

The three-tier system was believed to be a good framework for sustainable water supply systems. However, this was not so due to a number of reasons. According to NAC (1996), the budget for operation and maintenance per water point fell from an average of Z$120 (USD 61[1]) in 1988/89 to Z$47 (USD 5.70[1]) in 1994/95. The average downtime (time a pump is down) of the system was up to 6

[1] Based on an average exchange rate of 1 USD to ZWD 1.96 for 1988/9 and 1 USD to ZWD 8.26 for 1994/5 qouted in the document "Zimbabwe (Economy)" available at http://www.theodora.com/wfb1990/zimbabwe/zimbabwe_economy.html (accessed 13 August 2008)

months in many parts of the country (NAC, 1996). This resulted in reduced access to safe water in the rural areas.

In recent years, the sustainability for centrally managed facilities in Zimbabwe has been affected by the reduction in budgetary allocations for rural water supply, which has led to the adoption of the Community Based Management (CBM) approach (Hoko & Hertle, 2006). The approach is considered as a viable strategy in the provision of basic services (Mudege et al., 2001). CBM is based on the desire to seize opportunities associated with the decentralization concept. It has been realized and accepted that the users are better placed to manage and maintain their water facilities than government departments. The belief is that by developing a sense of ownership, promoting participation and sharing costs among users, the water supply services will be sustainable (Mudege et al., 2001). However, in Zimbabwe the CBM approach came at a time when the resources of communities in Zimbabwe were more stretched than ever (Robinson, 2002).

In line with the CBM approach, an international Non-Governmental Organization (NGO) implemented a water supply project in Mukumbura communal lands in Mt Darwin District, Zimbabwe. The overall objective of the water supply project was to increase access to water and consequently to reduce water borne diseases. The scope of the project included the rehabilitation of 52 non-functional boreholes and the drilling of 21 new boreholes. Under the project 56 Pump Minders and a number of Village Health Workers were trained. A total of 108 sessions of Participatory Health and Hygiene Education (PHHE) were also conducted over eight months. Communities were involved from the inception up to the end of the project. From August 2003 until the time of this study, the user communities were managing the water points.

This study investigated the sustainability of the Mukumbura water project under community-based management. Sustainability indicators studied included the reliability of the systems, local institutional and human capacity development, as well as financing mechanisms. This study was carried out in the period November 2005 to April 2006.

MATERIALS AND METHODS

Study Area

The study was carried out in Zimbabwe, a country located in Southern Africa. The specific study area was Mukumbura Communal Lands in Mt Darwin District. The location of Mukumbura is shown in Figure 1. The study area is in the agro-ecological region V, according to the land classification system in Zimbabwe, that is characterized by high temperatures (above 25 degrees Celsius) and low rainfall (below 500 mm/year), resulting in limited surface water resources even in normal seasons (Broderick, 1990). The major economic activities in the area include crop production and livestock farming, both of which are generally for subsistence. The community mainly depends on groundwater for domestic requirements with deep wells and boreholes being the main sources of drinking water. The reliability of these water sources decreases in the dry season due to many factors, including reduced groundwater table. Consequently the number of consumers per water point increases for the reliable ones, thus, increasing wear and tear. Livestock is also watered from the boreholes mostly during the dry season.

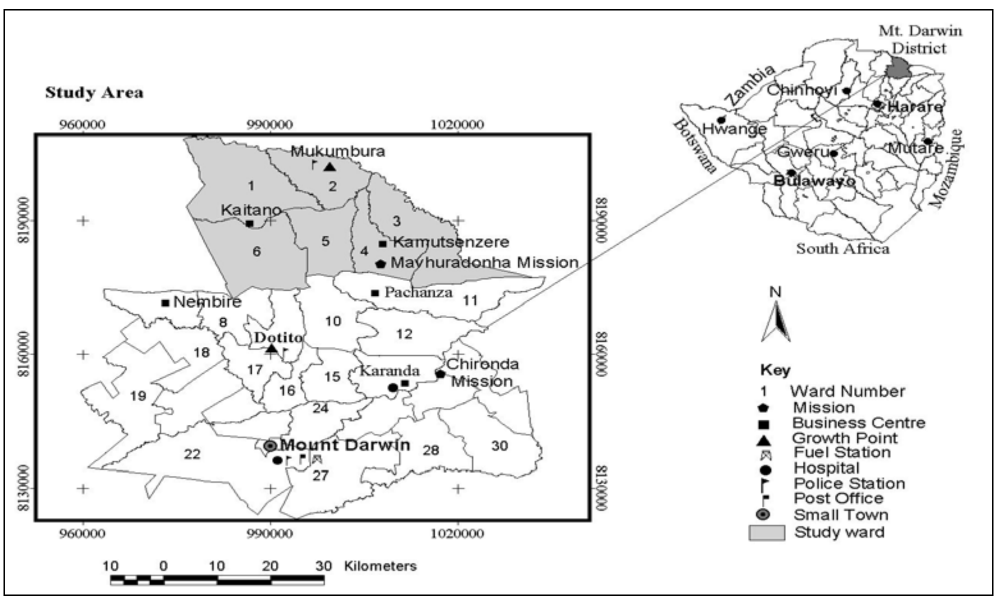

Figure 1: Map of the Study Area, Mukumbura Mt Darwin District

Data Collection

Major sustainability indicators of water supply projects include the reliability of the system, human capacity development, institutional arrangements, financing of operation and maintenance, and impact on rural livelihoods (Narayan, 1993; Katz and Sara, 1998). Indicators studied in this paper were the reliability of the system, financing mechanisms, human capacity development and institutional capacity development. Out of a total of 73 boreholes under the project, 43 (59%) in six wards were studied. A total of 192 questionnaires were administered on at least 4 households per each borehole studied. The households were selected randomly. One person was interviewed per household, of which the target age was above 25 years, and household heads or their spouses were preferred. The questionnaire was used to investigate the reliability of the systems, institutional capacity development, as well as financing mechanisms. Key informants from the user community and the implementing agent were chosen using the purposive sampling method. They were involved in 12 focus group discussions and some of them were involved in open-ended interviews. Field observations were used to observe the state of the boreholes, easiness of operation, as well as community's habits on water use as well as to supplement data from interviews.

Data Analysis

Qualitative data was analyzed by developing themes related to specific objectives. These themes were reliability of the systems, financing mechanisms, human capacity development, and institutional capacity development. Quantitative data was analyzed using excel.

RESULTS AND DISCUSSION

Reliability of the Systems

The reliability of the system was studied by assessing the functional state of the borehole, downtime, breakdown rate, and easiness of operation. Results of each of these aspects are presented in the sections that follow.

Functioning and State of the Boreholes

The functional state was studied by field assessment of the boreholes by the Research Team. The proportion of boreholes which were found to be non-functional in each ward season is shown in Figure 2. A total of 38% (16) of all the boreholes under study were not functioning. Teezed (2002) reported that the breakdown rate for most centrally managed systems in developing countries is between 70% and 80%. The high percentages of non-functioning boreholes in wards 1 (50%), 2 (42%), and 3 (40%) maybe due to availability of alternative sources of water such as wells and riverbeds which were reported by at least 60% of the community in the wards studied. Availability of alternative unsafe sources has been reported to affect the proper operation and maintenance of the formal system (Hoko & Hertle, 2006).

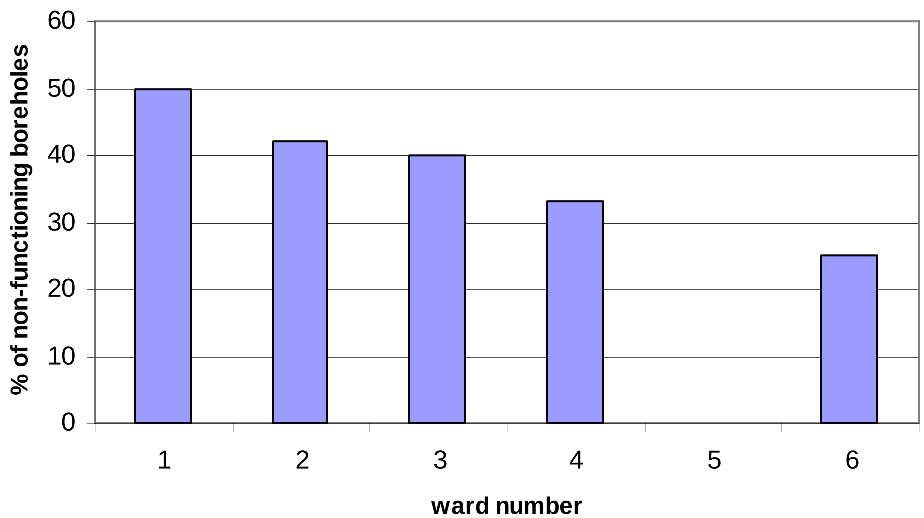

Figure 2: Percentage of Non-Functioning Boreholes per Ward as of April 2006

In assessing the condition of the headworks, headworks for functional boreholes, which had paint in good condition, well-fastened parts, no missing parts, and no rusting parts were deemed satisfactory. While those which were not functional and/or with poor paint condition, rust, loose, or missing parts were deemed as unsatisfactory. The condition of the headworks was deemed satisfactory in 98% (maximum) of the cases in ward 5, and was least satisfactory in 35% of cases in ward 1. Missing parts were observed on a minimum of 29% of boreholes in ward 5 and on a maximum of 75% in ward 1. It was also observed that some boreholes, especially in ward 1, were tied by rubber and wire. Possible reasons for the missing parts could have been misuse and vandalism. It appears missing parts may be linked to the high number of non-functioning boreholes in ward 1. Hoko & Hertle (2006) also linked high breakdown rate to missing parts in the Mangwe District in Zimbabwe.

The breakdown rate in the study area was very high and up to 50% in some wards. Missing parts appeared to be the major cause of the high breakdown rate.

Downtime Period of Boreholes

Results presented in this section are based on interviews with the key informants. Downtime period is the period between the breakdown date and the date of repair. The reported downtime ranged from 1 week to 4 months, while the average was 3 weeks. The average downtime is longer than the 2 days recommended for reliable boreholes (Dayal et al., 2000; Hoko & Hertle, 2006). It is important to ensure that the downtime is kept short, as Carter (1996) claims that a pump which breaks down frequently, but which is quickly repaired is better than one that breaks down infrequently, but takes long to be repaired.

When asked about the possible reasons for the long down times, respondents were of the opinion that the long downtimes were due to lack of willingness to pay and inability to pay among the beneficiary community, which delayed repairs. The average downtime of the boreholes of 3 weeks found in this study was lower than that of the three-tier operation and maintenance system, which was 6 months according to NAC (1996). The frequency of borehole breakdowns in all wards was reported to be higher during the dry season compared to the wet season. This is due to the fact that in the dry season there is increased demand for water; also some boreholes dry up, leaving a few functional ones with excess pressure that result in increased wear and tear, leading to breakdown. Continuous usage of boreholes results in increased wear and tear, especially in rehabilitated boreholes, which often have many old parts, that could be already exhausted (UNICEF, 1995). Key informants suggested that during the dry season one borehole could be shared by as many as 550 people, compared to 400 people in the wet season. An expected level of service is 250 people per water point (Harvey & Reed, 2004). The high usage rate of the boreholes increases chances of frequent breakdowns, thus, reducing the reliability of the system. The down period was found to be long and averaging 3 weeks, compared to a generally accepted period of 2 days. The long downtimes were possibly linked to unwillingness to pay and the increased pressure on the remaining functional boreholes, especially in the dry period.

Ease of Operation of Boreholes

In this section, the results are based on physical assessment of the water points by the research team. During the study, ease of operation was measured by the number of pumping strokes required before water was discharged from the boreholes. Figure 3 shows the results of the assessment for ease of operation of the boreholes.

It was found out that the number of strokes were a minimum of 4 to a maximum of 74. The range of strokes with the highest percentage (36%) was 10-20 while the ranges with the least percentage (7%) were those below 10 and above 50. The number of strokes with the highest frequency (mode) was 17 strokes while the average was 23 strokes. In Zimbabwe, a maximum of 4 strokes is generally acceptable (Hoko & Hertle, 2006). Only one water point had 4 strokes. In 70% of the cases, respondents perceived water points with strokes above 20 to be difficult to use, especially by children and old people. Hoko & Hertle (2006) reported that the operation of water points was deemed difficult by a minimum of 19% to a maximum of 64% in Mwenezi and Mangwe Districts in Zimbabwe, respectively. Therefore, most boreholes studied discharged water after more than the 4 strokes generally accepted in Zimbabwe and most respondents perceived the water points difficult to operate.

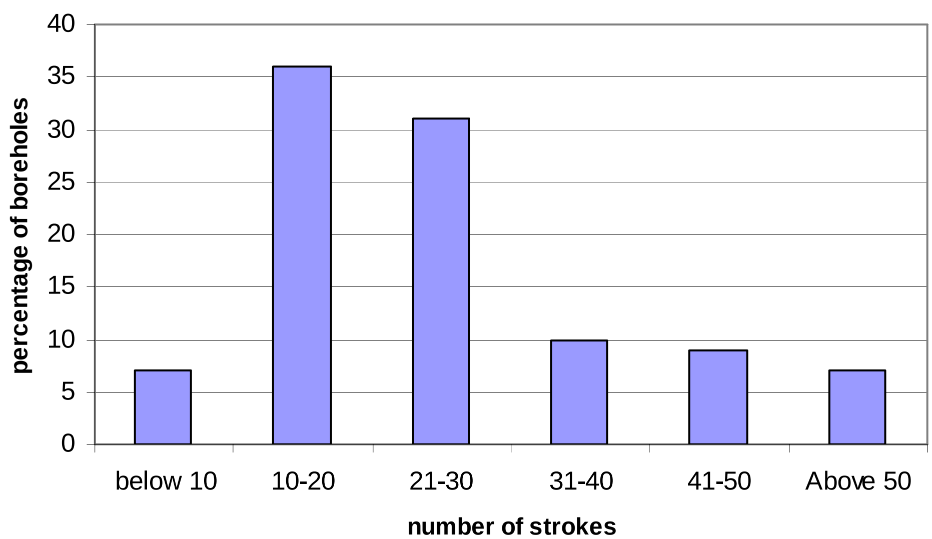

Figure 3: Ease of Operation of Boreholes in Mukumbura District as of April 2006

Institutional Capacity Development

Institutional capacity development was studied by interviews with the user community and key informants. In this study, institutional capacity development refers to the development and training of local community management groups, known as Water Point Committees (WPCs). WPCs form the lowest institutions in rural water supply management. These committees were reported to exist for all boreholes studied in the six wards. Despite their existence at all boreholes, respondents claimed that WPCs were not effective in managing the operation and maintenance of boreholes. Indicators for this ineffectiveness suggested by the interviewees included poor record keeping and inability to mobilize the community, especially in times of breakdown of the boreholes. In most cases, WPCs did not have records of borehole breakdowns, maintenance expenditure, and subscriptions collected. It was also found that in most cases the WPCs did not call for regular meetings, especially during the rainy season, as the community was busy in the fields. There is need for a formal community organization, or committee, if the system is to be sustainable (Katz and Sara, 1998; Billig et al., 1999). The existence of ineffective WPCs reduces opportunities for sustainable water supply as it may prolong the downtime of boreholes (Teezed, 2002). In this study, some of the reasons cited for the delays in repairs were lack of spares and poor collection of subscriptions for water point repairs. These two factors are somehow linked to the effective operation of the boreholes.

Water Point Committees existed for all boreholes studied although the community perceived them to be ineffective in most cases. Their ineffectiveness has been linked to poor operation and maintenance of boreholes and the long down periods of the systems.

Human Capacity Development

In this study, human capacity development was studied by investigating the existence and effectiveness of trained personnel, such as Pump Minders and Village Health Workers. Pump Minders are responsible for the maintenance of boreholes at ward level, while Village Health Workers are responsible for dissemination of health and hygiene education. Results of this section are based on interviews with key informants, Pump Minders, and Village Health Workers.

Pump Minders

This section presents results of interviews with pump minders and key informants. A total of 56 new Pump Minders were trained in a four-day workshop during the implementation of the project. Pump Minders are generally not employed by any organization, although they work closely with local water supply institutions, such as the Rural District Council and the District Development Fund, a government department responsible for the maintenance of rural water supply schemes. They are engaged by the community to attend to borehole problems whenever there is a need. During the implementation of the project, the people trained to be Pump Minders were aged 23 to 48 years of age. It was established at the time of the field work for this study, that there were still more trained female Pump Minders available in the area than male counterparts. Male Pump Minders were said to have migrated to towns in search of better paying employment. Social and cultural norms appear to be the major reason why more female Pump Minders trained under the project are still in the area compared to male Pump Minders. Generally, in Zimbabwe, men may be away from their rural homesteads working in towns to raise income, while women remain at the homestead taking care of the family. In a similar study in Zimbabwe by Hoko and Hertle (2006), respondents reported that most of the people who where trained during the project had either left the districts or did not have adequate tools or depth of knowledge for effective repairs of water points. Effective operation and maintenance of the system can only be achieved if there are trained personnel to assist in the operation and maintenance of the system (Billig et al., 1999).

Respondents were of the opinion that the migration of trained Pump Minders to towns was due to the low amounts paid to Pump Minders for borehole repairs, as often communities were willing to pay low amounts. During the time of data collection it was reported that between US$1 and US$2 was paid to Pump Minders for repairing a borehole. Most Pump Minders trained under the project felt that they did not have adequate skills and knowledge for effective borehole maintenance as a result of the short training period (4 day workshop) and the absence of refresher courses. All Pump Minders interviewed claimed the tools were inadequate for effective operation and maintenance of the water points. The availability of tools is really crucial for the repair of boreholes since skills alone cannot result in boreholes being repaired (Dayal et al., 2000). Most of the Pump Minders trained under the project, especially men, had since left the area in search of better paying jobs. Most Pump Minders felt they did not have adequate skills and that repair tools were inadequate. Lengthening of the training period, provision of adequate tools and incentives are some of the interventions cited by some of the interviewees to improve the performance of the system.

Village Health Workers

Results of this section are based on interviews with Village Health Workers and the user community. It was reported that there were at least two Village Health Workers (VHWs) trained under the project in each ward studied. Approximately 70% of the respondents claimed that the trained VHWs were no longer dealing with water supply and sanitation issues. VHWs are expected to promote health and hygiene behavior and practice through participatory health and hygiene education of the community. They were said to be concentrating more on family planning and HIV and AIDS issues due to increased donor and government activities on these issues in the study area. During donor driven projects or programs, participants often get some incentives, which may be in the form of money and food. This has led to a decrease in the promotion of health and hygiene education, an important aspect of successful water and sanitation projects. It was possible that the high percentage (70%) of families, which did not have latrines, may be partly due to the lack of education on sanitation issues, which was affected by the effectiveness of the VHWs.

Financing Mechanisms

This section is based on the results of interviews with the user community and key informants. Results showed that 73% of the respondents were making cash contributions for borehole maintenance. The remaining fraction was not making any contributions due to various reasons, which included claims of low ability to pay and low reliability of the boreholes. However, the ability to pay was not verified, although the reliability of the water points (as measured by the fraction of water points that were broken down at the time of study) was found to be high at 38% (see chapter on Reliability of the Systems). It was found out that 90% of the WPCs only collected money in times of breakdowns, as villagers did not want to contribute the money on a regular basis for fear of abuse of the money by the WPCs. This resulted in long downtimes in some cases as a lot of time was needed to mobilize the community to contribute funds for repairs, coupled with the time required for the purchase and delivery of the requisite spares. Hoko & Hertle (2006) reported that the community contributed funds for maintenance only when there was a breakdown in 84% to 93% of responses in a study in four districts in Zimbabwe.

In some cases, it was reported that the community made contributions in the form of labor, food, and grain instead of cash. Being an agriculture-based community, money is often available following harvests than at other times of the year. Harvey & Reed (2004) recommend communities to pay in kind (for example a bag of maize) in situations where they cannot afford cash contributions. Communities can stock spare parts using the contributions to facilitate repairs throughout the year (Dayal et al., 2000). Stocking of spares could be a good strategy in view of the prevailing hyperinflationary environment in Zimbabwe.

Financial records, which were generally maintained by the Treasurers of the WPCs, showed that certain households seldom contributed towards borehole maintenance and at time names of non-contributing households did not appear in the records of users. This was seen by those interviewed as affecting the community's willingness to pay.

It was found that contributions were made only when there was a breakdown. This situation resulted in long down times due to the need to mobilize resources in the event of a breakdown. There was poor financial record keeping. There is need to develop strategies to enhance willingness to pay by the users.

CONCLUSIONS

Based on the results, the following conclusions were made:

1) The reliability of boreholes was found to be fairly high with the percentage of non-functioning boreholes being 38%. The average downtime of 3 weeks was higher than the 2 days generally accepted. However, the downtime found in this study was lower than the one for the 6 months for three-tier operation and maintenance system, an operation and maintenance approach used in Zimbabwe in the old days. Most boreholes were deemed difficult to use.

2) Water Point Committees existed for all boreholes studied although the community perceived them to be ineffective in most cases. Their ineffectiveness was linked to poor operation and maintenance of boreholes and the long down periods of the systems.

3) Although a considerable number of Pump Minders were trained under the project; especially men, had left the area in search of better paying jobs. The trained personnel felt they did not have adequate knowledge and skills for proper operation and maintenance of the boreholes possibly due to the short training duration and inadequate tools.

4) The Village Health Workers trained under the project were no longer concentrating on health and hygiene education owing to their involvement in other donor initiated programs reportedly in pursuit of the associated incentives. This has negatively impacted on health and hygiene behavior and practice as suggested by the high proportion of the community without proper sanitation.

5) The financing mechanisms were observed to be poor. Contributions were made only when there was a breakdown. This has resulted in long down times, as funds are not readily available for maintenance, therefore, depriving communities of the benefits of using safe borehole water.

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