J. Basic. Appl. Sci. Res., 3(10)113-118, 2013
© 2013, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Sustainability of Piped Water Supply Schemes in Rural Malawi through Community Management

Petros Nandolo Zuzani*, Raphael Ackim and Khumbo Kalulu

University of Malawi – The Polytechnic, P/Bag 303, Chichiri, Blantyre 3, Malawi, Southern Africa

Received: Feb 16 2013
Accepted: April 7 2013

ABSTRACT

Community management of rural piped water supplies is now widely established in many countries. However, the number of consumers makes the process of community management more complicated, both during construction and operation. In developing countries, about 30% of the rural water supply systems are not operational as they have broken down and eventually been abandoned. Gravity fed piped water supply schemes in rural Malawi face many similar challenges. This study investigated the impact of community management on the sustainability of gravity fed water supplies of rural Malawi. The study area was Dowa Rural Water Supply Schemes, which is one of the hybrid schemes operated by Central Region Water Board in the Central Region of Malawi. This study considered four schemes namely Chikuluti, Sankhulani, Kachere and Lingadzi, comprising 365 taps; however only 190 taps were studied. This was done using informant interviews, structured questionnaires, focus group discussions, community mapping and observations. The study used the multi-criteria analysis, which focuses on financial, social, technical, environmental and institutional factors.

Study results indicated that 25% of the schemes are sustainable, 25% partially sustainable and 50% unsustainable. There are frequent wash-aways of pipelines at river crossings and gullies and prevalence of broken, leaking, stolen and vandalised pipes and non-functioning valves. These problems emanate from insufficient funding, ineffective community water committees, lack of training, age of the system and political interference. This study therefore concluded that gravity fed piped water supply schemes in rural Malawi are unsustainable. It is recommended that the communities should contribute through proper participation, high level of commitment and proper management of funds. Additionally, government should start conducting training to community staff committees. Government and the private sector should also join hands in the provision of the needed funds.

KEY WORDS: Community Management; Dowa Rural Water Supply; Piped Water Supply; Rural Malawi; Sustainability.

INTRODUCTION

The Government of Malawi (GoM) is committed to improving the living standards of rural people by providing them access to safe water in adequate quantities for various purposes. The water supplies provided are mainly through ground water systems and gravity fed piped water systems. Large piped water supplies constitute a viable and cost-effective form of water supply in many developing countries.

The GoM implemented a nationwide programme of gravity-flow piped water supplies from the late 1960s to the mid-1990s. As a result of this national programme, Malawi has over 80 rural piped schemes serving a design population of almost two million people. The schemes vary widely in size: others serve over 350,000 people through thousands of kilometres of pipes, whereas others serve one or two thousand people with less than twenty kilometres of pipes. Most schemes are designed to serve under 50,000 people.

At the start of the schemes, for each scheme, a main committee, branch and village committees were elected to organise the various parts of the work during construction. After construction, the number of committees was reduced to a main committee, tap committees, and repair teams. All these committees worked on a voluntary basis. The GoM assigned technical personnel to each committee to oversee issues of repair and maintenance. It also provided on-the-job training to the main committees and repair teams. In addition, the GoM shouldered the responsibility of meeting the capital costs and costs of operation and maintenance of the schemes. However, a democratic transition and change of government took place in 1994. The incoming government replaced the previous paternalistic policies with the internationally prevalent principle that the consumers should manage and finance the operation and maintenance. It substantially reduced its own budget allocated to operating these schemes. Many of the water monitoring assistants were moved or neglected, and the supply of materials and skilled workers for repairs virtually ceased implying the users have had to take a more active leadership role by default.

Over the last couple of years, the sustainability of some rural water schemes has been found to be questionable. For the gravity fed schemes (GFS) to be sustainable, there is need for sound engineering management of the schemes. The schemes need to provide adequate water services and the community is

Corresponding Author: Petros Nandolo Zuzani, University of Malawi – The Polytechnic, P/Bag 303, Chichiri, Blantyre 3, Malawi, Southern Africa pzuzani@poly.ac.mw; Phone: +265 (0) 1 870 411

expected to mobilise enough resources on their own to cover operations and maintenance costs. It is therefore crucial for rural water schemes to be sustainable so that the country can achieve its millennium development goal of increasing access to safe water by 2015. There is thus a need to assess the sustainability of the water schemes especially those still functional. The GoM had a target to reduce the proportion of non-functional water points in rural areas from 31% to 25% by 2011 (MoIWD, 2008a). In line with this, there is recognition that significant efforts need to be made to harmonise the wide range of approaches to operation and maintenance of rural water supplies that are being followed in Malawi. Further, there is need for significantly improved access to spare parts by water users. In addition, concerns have been documented regarding untrained village water point committees (VWPC); the quality of maintenance services and spare parts; inadequate financing mechanisms; lack of capacity to manage and undertake repairs which are beyond the capacity of local communities (Rural Water Supplies Sector Investment Programme, MoIWD, 2008).

The problem for this study was sustainability of rural gravity-fed water schemes. Existing literature on sustainability of rural water schemes in Malawi (Msukwa, 1990) were done using only one criteria, i.e. community participation. Use of individual criteria in the assessment of sustainability cannot adequately assess sustainability of rural water schemes. Panthie and Bhattarie (2008) points out that a multi-criteria analysis approach to sustainability enables the researcher to establish various aspects that have influence on sustainability. Sustainability requires an amalgam of financial, social, technical, environmental and institutional aspects of the project. This approach therefore shows the difference between the proposed approach and the old methods.

Thus, this research was aimed at investigating the sustainability of rural gravity fed piped water supply schemes through community based management. The goal was to establish the sustainability of community-managed piped water supply schemes in rural Malawi. The specific objectives of the study were to rate the variables likely to affect sustainability of water schemes, to calculate the sustainability scores for individual schemes and to classify sustainability levels of the water schemes.The study area (Figure 1) was Dowa Rural Water Supply Schemes, operated by Malawi's Central Region Water Board. Located in the Central Region of Malawi, it has a gravity-fed piped water supply system.

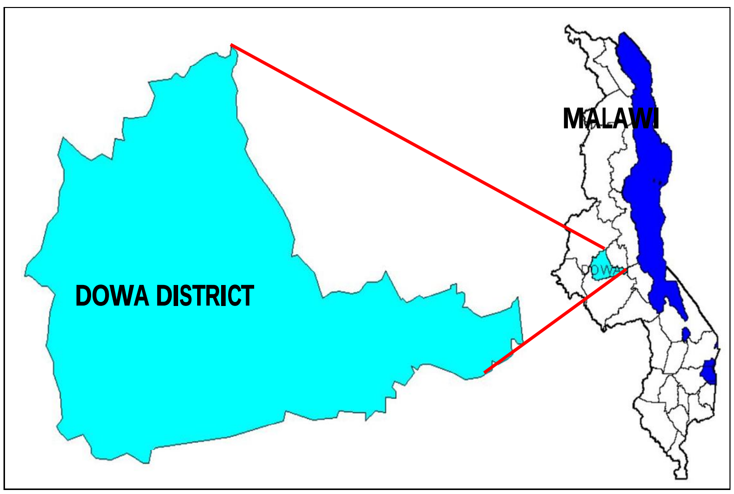

Figure 1: The study area

The contribution of this study to science is enormous. Notable among those contributions include:-

- The use of approaches to find solutions to water supply problems especially to rural areas;
- The use of multi-criteria, one of which is technical i.e. water source, yield and quality, physical condition of the system, water point functioning and possibility of a water supply system meeting demand.

This paper has been organized in such a manner that there is some sense of continuity to the reader. The first section gives an overview of the introduction. This is where the background to the problem is given including the goal of the study, objectives and scientific contribution of the paper. The second section presents methods and materials used in this study. It outlines the approach used in this study, the sampling procedure, methods of data collection as well as data analysis. A summary of results is presented in the third section. Discussion of results, conclusions, acknowledgements and references complete the remainder of the sections.

MATERIALS AND METHODS

The research approach used in this study was the multi-criteria analysis, which was adapted from Panthi and Bhattarai (2008).This approach focuses on all aspects/criteria affecting sustainability of a water scheme. The main criteria used are technical, social/environmental, financial and institutional (Figure 2). The main criteria are used to assess whether a water scheme is sustainable or not.

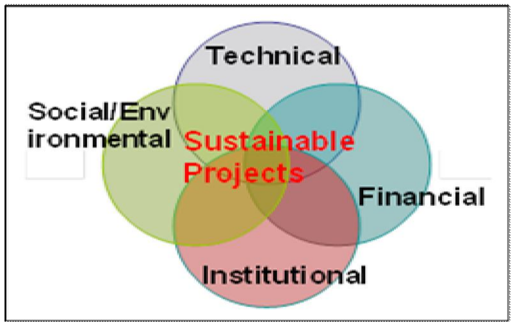

Figure 2: Components of a sustainable water project

These criteria were divided into thirteen (13) main variables, which were further divided into twenty-six (26) sub-variables as shown in Table 1. The sub variables are the indicators of sustainability under each main variable. Each sub variable is assigned a weight of importance depending on its influence on sustainability of water project. As an example, one of the main criteria used in the study is "Technical". The technical aspects used include source yield and quality, physical condition of the system, water point functioning and meeting demand. The variable "source yield and quality" is further divided into three sub variables namely reliability, adequacy and depletion, water quality at the source and accessibility, chance of contamination and conflict. The sub variables were again measured, judged or rated at project site to establish variable rate. Each sub variable was rated for each individual project on a five point scale: excellent (80-100%); very good (70-79%); good (50-69%); fair (30 - 49%) and poor (< 30%).Then each variable rate was multiplied by the weight assigned to it earlier. Figure 3 is a flow chart which demonstrates the main criteria used to asses sustainability of the four schemes. It also shows the thirteen main variables and twenty six sub variables. The cut-off point to determine whether a water scheme is unsustainable, partially sustainable or sustainable is also indicated.

Sampling Procedure

The unit of analysis was the water schemes at community level and household level. This study was conducted in four water schemes comprising a total of 365 taps. From these taps, however only 190 taps were considered for study. The 365 taps corresponds to 10950 households. From the 190 taps, only 72 taps were being used at community level. The sample size used in this study was 190 households. Only those households which used the communal water schemes were selected using judgmental sampling.

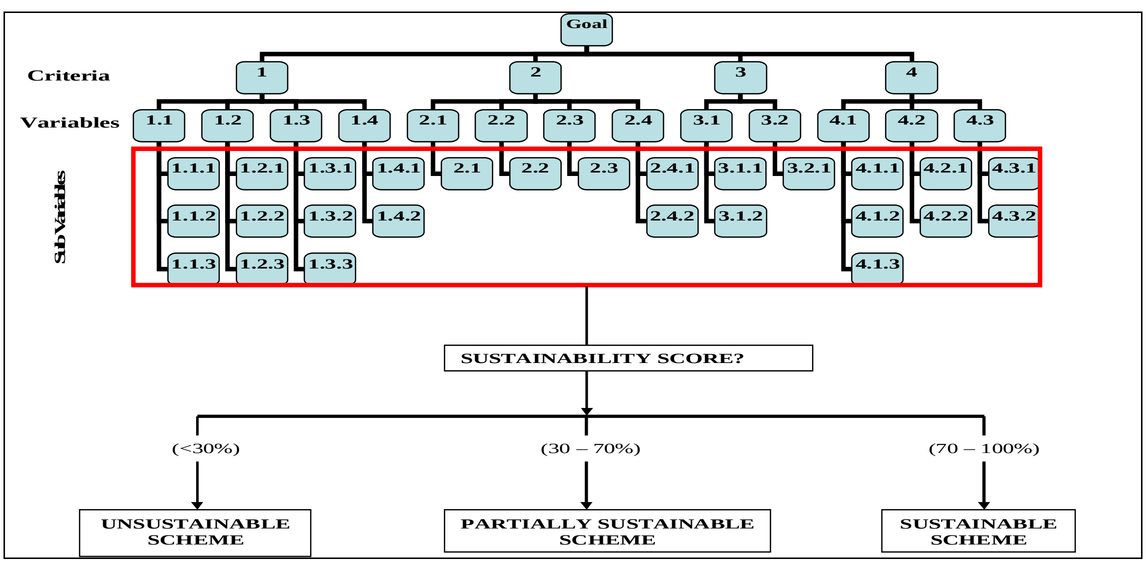

Figure 3: Flow chart of the main criteria, variables, sub variables and sustainability score cut-off point

Data collection

This study was conducted in four schemes namely Chikuluti, Sankhulani, Kachere and Lingadzi in Dowa district. The study used face-to-face interviews to collect data from the water users, focus group discussions with the water committee members and observation of the schemes for the technical aspects of the scheme. The instruments used include a household questionnaire to collect information from the water users. The questionnaire asked the water users to provide data on the aspects of the water scheme such as water fetching time, establishment of the fund for operation and maintenance. A checklist schedule was used to collect data on the technical aspects of the scheme such as the water quality, condition and functionality of the system. The focus group discussions were held with water/user's committee members. A discussion guide was used to collect data on views on sustainability and community participation.

Table 1: Criteria, Main variables, sub variables and weights used to calculate the Sustainability scores

Criteria	Main Variable	Sub Variable	Weight
A1.Technical	A1.1 Source yield & quality	A1.1.1. Reliability, adequacy, depletion	0.054
		A1.1.2. Water quality at source	0.023
		A1.1.3 Accessibility, chance of contamination & conflict	0.023
	A1.2. Physical condition of system	A1.2.1. Design adequacy, site & technology	0.008
		A1.2.2. Condition &functionality of system	0.054
		A1.2.3.Natural threat to physical system	0.038
	A1.3. Water point functioning	A1.3.1. Maintain design flow	0.120
		A1.3.2. Water quality	0.040
		A1.3.3.Surrounding drainage system	0.040
	A1.4. Meeting demand	A1.4.1. Water fetching time	0.070
		A1.4.2. Status of meeting additional demand	0.030
A2. Social/Environmental	A2.1. Use of water facility	A2.1.1. Status of use by population	0.100
	A2.2. Community participation	A2.2.1. Decision making operation and maintenance	0.050
	A2.3. Environmental	A2.3.1. Mitigation measure& drainage	0.050
	A2.4. Social inclusion & equity	A2.4.1. Inclusion (ethnic group)	0.031
		A2.4.2. Equity (men, women)	0.019
A3. Financial	A3.1. Availability of fund	A3.1.1. Establishment of O&M fund	0.025
		A3.1.2. Regularity and saving	0.010
	A3.2. Use of fund	A3.2.1. Use of savings/surplus fund	0.020
A4. Institutional	A4.1. Users' committee	A4.1.1. Existence, functioning and meetings	0.054
		A4.1.2. Ownership of scheme & activities	0.023
		A4.1.3 Representation on committee	0.023
	A4.2.Maintenance committee/caretaker	A4.2.1. Existence	0.025
		A4.2.2. Functioning	0.025
	A4.3. Coordination and linkage	A4.3.1. With local leaders	0.025
		A4.3.2 Training & external support	0.025

Source: Panthi and Bhattarai (2008)

Data analysis

Analysis of the schemes was done using the multi-criteria framework while the household questionnaires were analysed using Microsoft Excel. Focus groups discussions and observation checklists were summarized. Calculations were done for each scheme to determine its sustainability score. The water schemes were then classified into levels of categories using their sustainability scores. Figure 3 shows the sustainability categories used which were: sustainable (70-100%), partially sustainable (30-70%) and non-sustainable (<30%).

RESULTS

The results on the sustainability scores for the individual water schemes studied were summarized and compiled as shown in Table 2. The study revealed that 25% of the schemes are sustainable with sustainability score of 71.3%, 25% were partially sustainable with sustainability score of 48.9% and 50% were non-sustainable with sustainability scores of 24.4% and 27.3%.

Table 2: Results of sustainability scores for each water scheme

Sub Variable	Weight	Total Scores for individual water schemes			
		Chikuluti	Kachere	Sankhulani	Lingadzi
A1.1.1. Reliability, adequacy, depletion	0.054	2.6	1.2	1.5	2.5
A1.1.2. Water quality at source	0.023	1.3	0	0.2	0.0
A1.1.3 Accessibility, chance of contamination & conflict	0.023	1.5	0.5	0.6	1.0
A1.2.1. Design adequacy, site & technology	0.008	0.5	0.3	0.2	0.5
A1.2.2. Condition &functionality of system	0.054	4.8	2.7	2.6	4.8

A1.2.3.Natural threat to physical system	0.038	3.5	1.7	1.8	3.2
A1.3.1. Maintain design flow	0.120	6.5	0	0.7	1.7
A1.3.2. Water quality	0.040	1.5	1.1	1.2	2.0
A1.3.3. Maintaining design flow	0.040	2.2	0.8	0.9	1.6
A1.4.1. Water fetching time	0.070	4.6	2.3	2.5	4.7
A1.4.2. Status of meeting additional demand	0.030	2.3	0.5	0.5	1.1
A2.1.1. Status of use by population	0.100	7.0	2.1	0	4.0
A2.2.1. Decision making operation and maintenance	0.050	3.5	0	1.2	0.6
A2.3.1. Mitigation measure& drainage	0.050	4.0	0	1.3	0.3
A2.4.1. Inclusion (ethnic group)	0.031	4.5	1.3	1.2	2.7
A2.4.2. Equity (men, women)	0.019	4.3	0.9	1.9	1.8
A3.1.1. Establishment of O&M fund	0.025	1.8	0.2	0.0	0.4
A3.1.2. Regularity and saving	0.010	0.5	0.1	0.2	0.3
A3.2.1. Use of savings/surplus fund	0.020	0.8	0.7	0.6	1.4
A4.1.1. Existence, functioning and meetings	0.054	1.8	0.8	0.9	1.7
A4.1.2. Ownership of scheme activities	0.023	2.6	0.5	0.8	1.1
A4.1.3 Representation on committee	0.023	2.1	1.4	1.3	2.6
A4.2.1. Existence	0.025	2.2	1.3	1.2	2.4
A4.2.2. Functioning	0.025	1.6	1.5	1.6	2.4
A4.3.1. With local leaders	0.025	2.0	1.2	1.1	2.3
A4.3.2 Training & external support	0.025	1.4	1.3	1.4	2.2
TOTAL SUSTAINABILITY SCORES		**71.3%**	**24.4%**	**27.3%**	**48.9%**

DISCUSSION

Information gathered from interviews and observations indicated that there were frequent wash-aways of pipelines at river crossings and gullies and prevalence of broken, leaking, stolen and vandalised pipes and non-functioning valves. The contributing factors to these problems were insufficient funding, ineffective community water committees, lack of training, age of the system and political interference.

Research carried out by University of Malawi–Centre for Social Research in 1989, revealed that many GFS in the country were not operational due to a number of problems. The major problems were low level of commitment and ownership of communities to maintain the GFS and vandalism of scheme facilities. As such, it was recommended that the communities should own and manage the GFS and should be given adequate training (Msukwa 1990). Studies conducted on Chambe, Lifani and Lingamasa water schemes in Malawi in 2002 indicated that even though the three schemes were still working, each was only partially working (Table 3). Parts of their distribution networks had been washed away and the consumers had not raised enough money to replace them, nor had the government provided enough maintenance and repair materials. Results of this study partly concurs with these findings.

Table 2: Example of three Gravity Fed Schemes that are partially working in Malawi

Scheme	Date completed	Population served	Pipeline length (km)	No. of tap stands	No. and %ge working
Chambe	1970	30,000	96	270	184 (68%)
Lifani	1977	20,000	100	152	106 (70%)
Lingamasa	1981	12,000	43	118	93 (79%)

Source: Salim (2002)

A study carried out by Baumann and Danert in 2008 on Operation and Maintenance of Rural Water Supplies in Malawi also suggest that practically all of Malawi's rural Gravity Flow Systems (GFS) are in a sorry state. This again vindicates findings of the current study.

The schemes in Malawi now range in age from a few years to almost 30 years. With schemes of this age maintenance requirements are high, mainly to replace pipes washed away by streams during the rainy season. The problems in cost recovery have affected sustainability. In 1997, a survey of schemes comprising a total of almost 900 tap stands found that less than 50% of the tap stands were supplying water. This indicated a significant decline since the early 1980s when surveys showed over 90% of tap stands functioning. However, this deterioration is not surprising because, since 1994, people have had to manage (and, if necessary, finance) the operation and maintenance of their schemes with minimal training or support. There appear to be two main influences on the viability of the schemes. First, the larger schemes serve people of different ethnic groups and cultural practices, which cause problems when agreeing project management and financial arrangements. According to the same recent survey, these larger schemes have a significantly worse record of maintenance than the smaller, more socially cohesive, schemes. Secondly, the people are extremely poor and have many demands on their limited supply of cash. If the water supply fails they find alternative sources, even though these are usually distant, low yielding and poor quality, such as scrapes in riverbeds. This implies that they have not received sufficient education about the merits of a piped water supply to motivate them to spend their money on it. In communities where external support agencies have been carrying out such education, the people seem to be more motivated to sustain the supply.

CONCLUSIONS

Gravity fed piped water supply schemes in rural Malawi are therefore not functioning properly and hence unsustainable. Consequently, the schemes have low levels of water services provided as evidenced by long down time of water points. Rural gravity fed piped water systems provide high level of water accessibility to rural masses compared to other water sources. Although these water supply systems have high initial capital costs, their running costs can be relatively bearable if the schemes provide adequate water services and proper training to scheme management teams.

In the four villages schemes, people seem not to appreciate the need for the water supply scheme and the need to contribute towards the scheme fund. The low scores for establishment of O&M funds for Kachere (0.2) and Sankhulani (0), regularity and saving for Kachere (0.1) and Sankhulani (0.2), and use of surplus funds for Kachere (0.7) and Sankhulani (0.6) are clear testimonies. However, ownership is mainly dependent on the satisfaction of water services they receive at their tap points. If the tap is dry or has experienced frequent water interruption, people are not willing to pay their monthly contributions and assisting in scheme work.

The dwindling number of hired staff and scheme committees is a result of inadequate incentives in the schemes. There seem to exist institutional problems of scheme ownership. The communities need to give adequate support to their water scheme committees by performing their obligations in time like paying their contributions in time, assisting the committees in scheme work and encouraging them in their noble work. However, the lower scores for the two criteria i.e. existence, functioning and meetings and ownership of scheme activities seem to suggest otherwise.

It is recommended that the communities should contribute through proper participation, high level of commitment and proper management of funds. Additionally, government should start conducting training to community staff committees. Government and the private sector should also join hands in the provision of the needed funds. This will enable the country to attain millennium development goals of providing safe clean water to all citizens.

ACKNOWLEDGEMENT

I wish to acknowledge the University of Malawi - The Polytechnic for funding this research project. Further acknowledgements go to Mr Raphael Ackim, a former undergraduate student who spent most of his time collecting data for this study

REFERENCES

Baumann E. and Danert, K., 2008. Operation and Maintenance of Rural Water Supplies in Malawi. Study report, Lilongwe, Malawi.

GoM., 2008. Sector Information Management System in the Water and Sanitation Sector – Concept Note and Guidelines. Ministry of Irrigation and Water Development, Malawi Government, October 2008

Msukwa L.A.H., 1990. Community Based Operation and Maintenance of Rural Water Supplies. Centre for Social Research, University of Malawi.

Panthi K. and Bhattarai S., 2008. A framework to assess sustainability of community based water projects using multi criteria analysis. Miami press, Florida International University, USA.

Salim A.S., 2002. Rural Piped Water Supplies in Ethiopia, Malawi and Kenya: Community Management and Sustainability: Field Note 13.