COMMUNITY BASED WATER SUPPLY MAINTENANCE SYSTEM AND SUSTAINABILITY OF IMPROVED WATER SOURCES IN ARAPAI SUBCOUNTY, SOROTI DISTRICT (UGANDA)

By

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DECLARATION

I, Thomas Epeet do hereby declare that, the content of this report is an outcome of my own original work and has never been submitted to any institution of higher learning for any award. All pieces of work used during the development of this report are duly acknowledged / cited.

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APPROVAL

This dissertation has been submitted for examination with the approval of the supervisors.

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DEDICATION

To: my two sons Kenneth Epeet and Clement Ejiet and daughter Bernadette Isimoni; together with their mother Hellen Kevin Apogo.

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LIST OF ABBREVIATIONS AND ACRONYMS

ADA	American Dietetic Association
CBMS	Community Based Maintenance System
CWSMI	Community-based Water Supply Management Institutions
DIM	District Implementation Manual
DWD	Directorate of Water Development
DWO	District Water Office(r)
HPM	Handpump Mechanic
IRC	International Reference Centre for Community Water Supply
LG	Local Government
MDG	Millennium Development Goal
MWE	Ministry of Water and Environment
MWLE	Ministry of Water, Lands, and Environment
NWP	National Water Policy
O&M	Operation and Maintenance
PSP	Private Sector Participation
RWS	Rural Water Supplies
RWSS	Rural Water Supply and Sanitation
SIP-15	Fifteen Years Strategic Investment Plan
SNV	Netherlands Development Organization
SPD	Spare Parts Dealer
SPR	Sector Performance Report
SPSS	Statistical Program for Social Scientists

SWAP	Sector Wide Approach to Planning
SWSC	Sub-County Water and Sanitation Committee
Triple-S	Sustainable Services at Scale
UMI	Uganda Management Institute
UNCSD	United Nations Conference on Sustainable Development
UNICEF	United Nations International Children Emergency Fund
WASH	Water, Sanitation, and Hygiene
WSC	Water and Sanitation Committee
WSS	Water Supply and Sanitation
WU	Water User
WUC	Water User Committee
WUG	Water User Group
YODEO	Youth Development Organization

ABSTRACT

This study investigated the relationship between community-based water supply maintenance system (CBMS) and sustainability of improved water sources in Arapai Sub County. The water sector in Uganda adopted CBMS approach to improve on the challenge of sustainability of public water sources after many approaches failed to do so. Community-based water supply management institutions (CWSMI), private sector participation (PSP), and government back-up support are constructs of CBMS studied. Sustainability aspects included financial, technical, institutional, and environmental. Study objectives were to examine the relationship between CBMS constructs and sustainability of water sources. The Systems Theory underpinned the study.The study used the cross sectional survey design that adopted the mixed method research approach for data collection and analysis. Questionnaire, interview, and documentary analysis methods were used for data collection. Findings showed that CBMS constructs had positive influence on sustainability of improved water sources and the study therefore concluded that they were interlinked. Representation of Women in WUCs was found inadequate. The study also found weak supply chain of spare parts and inadequate monitoring of water sources by government officials a challenge to sustainability. The study recommends meaningful inclusion of all stakeholders in water supply issues and calls for establishment of sustainable supply chain for the delivery of spare parts nearer to the WUs. Back-up support activities need to be sufficiently planned, budgeted for, and implemented. The study has documented unique findings on sustainability of water sources under CBMS in the study area thereby bridging the existing information gap. Proposed areas for further research are the effect of community participation; the effect of water supply technological options; and the influence of socio-economic, political, and demographic factors on sustainability of water sources.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This research aimed at exploring the relationship between Community Based water supply Maintenance System (CBMS) and sustainability of water sources in Arapai Sub County, in Soroti district (Uganda). CBMS in this study was conceived as the independent variable while sustainability of water sources considered the dependent variable. CBMS was measured in form of CWSMI; PSP in water supply systems; and government back-up support while sustainability was measured in form of financial, institutional, technical, and environmental aspects as explained in the conceptual framework (figure 1).

This Chapter covers the background to the study, the statement of the problem, and purpose of the study. It also contains objectives of the study, the research questions, the hypotheses, and the scope of the study. Furthermore, the chapter contains the significance, justification, and operational definitions of terms and concepts.

1.2 Background

1.2.1 Historical Background

The utilization of improved sources of drinking water is high worldwide. It is estimated that 87% of the world population obtain their drinking water from improved sources as do 84% of people in developing regions. Furthermore, estimates indicate that, even with this state of affairs, 884 million people in the world still do not get their drinking water from improved sources and almost all of them are in developing regions. Sub-Saharan Africa accounts for over a third of that number, and is lagging behind in progress towards the MDG target, with only 60% of the population using improved sources of drinking-water (World Health Organization [WHO] & UNICEF, 2010). The

Asian Development Bank [ADB], (2009) estimated 1.1 billion people who are without access to safe water supply globally with Asia and Pacific region contributing 700 million people to this figure.

Low sustainability of water sources in which about only two thirds of installed handpumps are working at any given time (Rural Water Supply Network [RWSN], 2010) is said to be a major contributor to this situation. For instance in Timor Leste, only one third of the constructed water supply systems functions one year after their construction (WaterAid, 2010). In the African continent, it was estimated that 50,000 water supply points had effectively stopped working (Skinner, 2009); 30% of which being in Sub Saharan Africa (Nkambule & Peter, 2012); the root cause being the water community's failure to plan for maintenance of facilities in a systematic way.

In Tanzania, Water point Mapping surveys conducted in 51 districts found that only 54% of all public improved water sources were functional. The same surveys found that even very new water sources had a problem whereby just two years after project completion, a quarter were already no longer functioning (Taylor, 2009). For the case of Mali, an evaluation in 1997 found 90% of water supply facilities fitted with pumps inoperable one year after installation (Harvey & Reed, 2004). In Mozambique, Jansz (2011) noted that sustainability of water sources still remains a challenge with the number of non-functioning water sources in the country hovering around 20%. According to Gbadegesin & Olorunfemi (2011), Nigeria had as big as 43% of her population with inadequate access to safe water after almost 60 years of water supply development and the Asian Development Bank (2009) reiterates that this situation is worse in rural areas.

In Uganda, only 84% of the water supply facilities are functional (Ministry of Water and Environment [MWE], 2013). For Arapai Sub county in Soroti district, the functionality is estimated at 83.8% (District Water Office [DWO], 2012).The challenge of sustainability of water sources has

generally been noted as undermining government and support agency efforts to increase safe water coverage and created a massive drag on meeting the Millennium Development Goals (MDGs) target on water and sanitation.

1.2.2 Theoretical Background

The Systems Theory proposed by Ludwig von Bertalanffy, (1950) and furthered by Ross Ashby, (1956) underpinned the study. Bertalanffy was both reacting against reductionism and attempting to revive the unity of science. He emphasized that real systems are open to, and interact with their environments, and that they can acquire qualitatively new properties through emergence, resulting in continual evolution. Instead of reducing an individual (e.g. the human body) to the properties of its parts or elements (e.g. organs or cells), systems theory focuses on the arrangement of and relations between the parts that connect them into an entity.

1.2.3 Conceptual Background

This study was developed based on the concept that sustainability of water sources for rural communities can best be achieved through a community based management approach. The basic principles behind this approach are that the community that benefits from an improved water supply has a major role in its development, ownership of the water system/facility after its development, and has an overall responsibility for its operation and maintenance (O&M). In this regard, community members are normally expected to contribute to initial system installation costs and to meet all ongoing maintenance and repair costs through regular payment of appropriate water tariffs.

Community management therefore, is idealized as a convenient concept for shifting responsibility for continuing O&M, and hence sustainability of facilities, from facility-provider to end-user. This means that the beneficiaries of the water supply have full responsibility, authority, and control over

it (Harvey & Reed, 2007) and are responsible for the management of maintenance of the water supply (Harvey & Reed, 2004 p. 169).

This line of thought is in agreement with the arguments advanced by other rural water supply sector stakeholders. The International Reference Centre for community water supply [IRC] for instance holds that sustainability of a water supply system can be achieved when part of its life cycle costs i.e. capital, operation, maintenance, administrative and replacement costs are covered at the local level and when it can be locally operated and maintained with limited but feasible external support. It is also in line with the second principle of the 1992 International Conference on Water and Environment [ICWE) –the Dublin statement on water and sustainable development held in Dublin, Ireland. This principle emphasizes that: water development and management should be based on a participatory approach that involves users, planners, and policy makers at all levels. This calls for full public consultation and involvement of users at the lowest appropriate level of decision making and in the planning and implementation of the water projects.

The third principle of the New Delhi Statement (1990) further stresses the need for community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes. The community based management concept also concurs with Agenda 21 that calls for strengthening of the role of major groups including the roles of children and youth, women, NGOs, and local authorities.

The other footing that provides an overall fundamental backing to community management of water supply services is the Mar del Plata resolutions. These hold that: communities must be provided with effective education on domestic hygiene, must be motivated, and involved as appropriate as possible, at every level of the programme. This includes involvement in planning, construction,

operation, and financing of services. They must also be involved in monitoring and safeguarding of the quality of the water supplied.

CBMS therefore, requires that; managerial decisions about levels of service, location of facilities, cost recovery, and O&M need to be made locally as well. The main role of government should be to establish institutional rules and processes that encourage such local decisions. In Uganda, the 1999 National Water Policy [NWP] and the 2011 National Framework for O&M of Rural Water Supplies (RWS) uphold community management of RWS in their principles and objectives to ensure sustainability.

Scholars have observed that though they are mobilized and sensitized, it may not be feasible to leave the communities to manage their water supply systems alone. Harvey and Reed (2004 p. 19) argued that sustainability of community based managed systems can be achieved when an ongoing support is injected from an overseeing institution by way of providing encouragement and motivation, monitoring, participatory planning, capacity building and specialist technical assistance in addition to establishment of legal community-based entities which legally own the systems they manage.

CBMS is an organization of interrelated factors whose relationship is geared towards attaining the sustainability of water sources. According to IRC,(as cited in Brikké & Bredero, 2003); a water service is sustainable when: it is functioning and being used and is able to deliver an appropriate level of benefits (in terms of quality, quantity, convenience, continuity, health) to all including the poorest women and men. The author adds that the service continues to function over a prolonged period of time (which goes beyond the life span of the original equipment). Furthermore, the authors also assert that a water service is sustainable when its management is institutionalized; it's O&M, administrative and replacement costs are covered at the local level with limited but feasible

external support and it does not affect the environment negatively. While examining sustainability, scholars, water sector professionals and practitioners such as WaterAid, (2011), Harvey & Reed (2004), Sara & Kartz (1997), and Mimrose, Gunawardena & Nayakakorala (2011) point out key issues all of which are in agreement with those stressed by IRC.

1.2.4 Contextual Background

Up to 1980s, many rural water supply services were supply driven and managed by government. However, limited government support and commitment rendered water supply services inefficient and ineffective as many governments were generally over stretched in attempting to maintain the rural water supplies. The community-based management system therefore, appealed to many governments that had already embraced decentralization because it relieved them of the additional burden of maintaining water services. Another reason that made community-based management relevant was the project approach that many governments adopted (Harvey, 2007). This required that, the project implementers have to leave the project area after several months thereby necessitating a community management structure that should be left behind to replace the outgoing management to ensure sustainability of the project.

Government of Uganda (GoU) in the late 1990s during the water sector reforms set a target to attain 90% functionality of improved rural water sources by the year 2015. Sustainability of water sources together with other interventions like establishment of new point water sources were anticipated to raise the safe water coverage in rural areas to 100% by the year 2015 (Directorate of Water Development [DWD], 2002). Implementers and practitioners have articulated this very well both in policy and in development plans of local and national levels.

To achieve the stated 90% functionality target and therefore sustainability, the water sector adopted the concept of CBMS where the operation and maintenance [O&M] costs for RWS are fully borne by communities. Local and Central Governments are to provide backup support and subsidize rehabilitation and costly repairs while the WUCs and Private sector play the role of operation and maintenance of the water sources. Interestingly, even so, the sustainability of water sources has still remained a huge challenge in which up to 19% of water sources are not working (Nekesa & Kulanyi, 2012). This has been the state of affairs in the Ugandan water supply sector over the past nine years ranging up to 2012 and has significantly contributed to the slow progress in attaining the targeted safe water coverage locally and nationally.

Table 1.1 shows the trends of functionality of water sources and safe water coverage in the study area.

Table 1.1: Trends of water sources functionality and coverage in the study area

Year	Water Source Functionality			Safe Water Coverage		
	National (Uganda)	District (Soroti)	Study Area (Arapai Sub County)	National (Uganda)	District (Soroti)	Study Area (Arapai Sub County)
2002	70	Missing data	Missing data	55	59	Missing data
2003	70	Missing data	Missing data	57	50	Missing data
2004	80	Missing data	88	60	50	Missing data
2005	82	90	88.1	61	65	Missing data
2006	83	89	82.6	61	71	Missing data
2007	83	85	79	63	73	65
2008	82	83	Missing data	63	76	Missing data
2009	83	85	70	65	77.9	73
2010	81	85	86	65	74	59
2011	83	81.2	81.7	65	66.8	63.4
2012	83	86	83.8	64	74	55.3

Source: Ministry of Water and Environment & Soroti District Water Office

Currently, the national safe water coverage is estimated at 67% (Ministry of Water and Environment, 2013). The coverage levels for Arapai Sub County by 2012 were 83% and 55.3% for functionality of water sources and access to safe water respectively (District Water Office,

2012).This implies that more than 17% of the water sources had failed by then. Such failure has been attributed to the traditional approach of focusing on building water facilities rather than focusing on the importance of involving communities in all aspects of water service delivery as rooted in the guiding principles of the Dublin (1992) statement on water and sustainable development.

Nkambule & Peter (2012) contend that, it is the traditional approach of focusing on building new water sources rather than focusing on the importance of community involvement in all aspects of water service delivery that has resulted in water services that have not been able to last. They specifically cite lack of community management as the main factor responsible for the failure. The other reasons according to WaterAid (2011 p. 11) are; limited capacity (in terms of knowledge, skills and material resources) of communities, local government institutions and other service providers to manage systems. Others are inadequate financial revenues to cover the full O&M and capital maintenance costs of facilities; and a fragmented approach to implementation with competing agendas and general disregard or lack of understanding of government frameworks by supporting institutions.

1.3 Problem Statement

During the water sector reform of the late 1990s, GoU set a target to attain 90% functionality of improved rural water sources and 100% safe water coverage by the year 2015. Ever since, concerted efforts have been made to improve sustainability of rural water supply facilities using CBMS approach. Despite these efforts and the passage of time, sustainability still seems a huge challenge as revealed from the review done by the researcher on District and Ministry reports from Soroti and Ministry of Water and Environment respectively.

Available literature shows that between 2004 and 2012, average functionality of water sources in the country and in nearly 40% of districts stagnated in the range of 80%-83% which is lower than the sector target of 90% by 2015 (MWE, 2012). This is an indication of prevalent crisis in sustainability of water sources more so on the face of CBMS, an approach which is highly regarded as the best to achieve sustainability of water sources. This does not portray well for the water sector in terms of its performance towards the attainment of MDG targets.

The study of sustainability under CBMS has never been done in Arapai Sub County and accordingly this manifests scarcity of information on sustainability of water sources under CBMS. This study therefore, was necessary to bridge this gap. The current trend of deficiency in sustainability of water sources if it is allowed to continue is likely to reduce access to improved water by many rural dwellers. Reduced access to improved water can have far reaching consequences especially on women and girls who lose productive time walking long distances to fetch water, take care of the children. They are also naturally inclined to suffer the risk of infections because of their monthly menstruation cycle and taking care of the sick, which requires them to have adequate access to clean water.

1.4 Purpose of the Study

This study had a purpose of investigating the relationship between community based water supply maintenance system and sustainability of improved water sources in Arapai Sub County.

1.5 Objectives

The study had the following objectives to achieve:

1. To examine the relationship between Community-level Water Supply Management Institutions (CWSMI) and sustainability of water sources in Arapai Sub County.
2. To evaluate the relationship between Private Sector Participation (PSP) in water supply and sustainability of water sources in Arapai Sub County.
3. To assess the effect of government back-up support for water supply systems on the sustainability of water sources in Arapai Sub County.

1.6 Research Questions

The following research questions guided the study:

1. Is there a relationship between CWSMI and sustainability of water sources in Arapai Sub County?
2. Is there a relationship between PSP in community water supply and sustainability of water sources in Arapai Sub County?
3. Does government back-up support in water supply affect the sustainability of water sources in Arapai Sub County?

1.7 Hypotheses tested

1. CWSMI have a positive relationship with sustainability of water sources.
2. There is no relationship between PSP in water supply and sustainability of water sources.
3. Government back-up support in water supply does not affect sustainability of water sources.

1.8 Conceptual Framework

The conceptual framework theorizes the relationship between the interacting factors of CBMS and sustainability of water sources (figure 1).

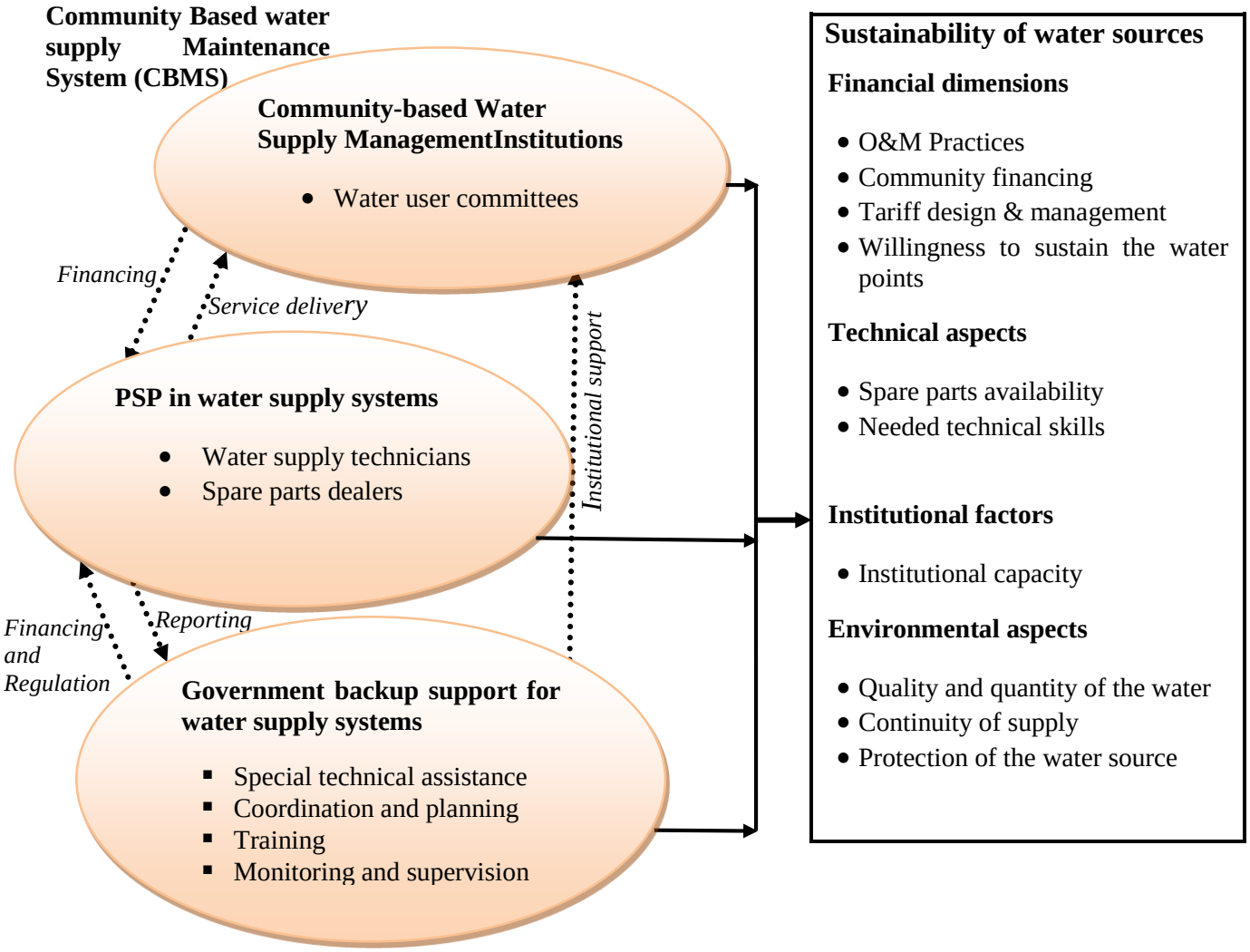

Figure 1: Conceptual framework showing the relationship between CBMS and sustainability of water sources

Source: Researcher construction adapted from Wateraid sustainability framework, (2011).

In this study, CBMS is the independent variable while the sustainability of water sources dependent. Community-based Water Supply Management Institutions, Private Sector Participation in water supply, and government back-up support were treated as possible explanations to the attainment of improved sustainability (Montangero, 2008; WaterAid, 2011; Ministry of Water and Environment,

2011). Sustainability of water sources entailed financial, institutional, technical, and environmental dimensions (Brikké & Bredero, 2003 p.3; Harvey and Reed, 2004; Tadesse, Bosona, Gebresenbet, 2013). The study explained the interrelationships between factors of CBMS, the effect of each one of them and their dimensions on sustainability of water sources as broken down in the conceptual framework.

1.9 Scope of the Study

1.9.1 Geographical Scope

The study was conducted in Arapai Sub County in Soroti district. Soroti district is located in Eastern Region of Uganda, lies approximately on latitudes 10 33I and 20 23I north of the equator, and longitudes 300 01I and 340 18I degrees east of the Prime Meridian, and is over 2500 feet above sea level. Data collection was done in villages that were randomly selected from all the five parishes in the study area. Soroti district is approximately 330 kilometers from the Central Business District of Kampala and takes about five hours' drive from Kampala capital city

1.9.2 Content Scope

The study focused on an investigation on the relationship between CBMS and Sustainability of water sources installed with handpumps. The study was well aware of other types of technologies of for supplying water to the population in the study area but chose those fitted with handpumps. This is because handpumps are the principal and popular technology for supplying water to people in rural areas (Harvey & Reed, 2004 pp.5-6; Oyo, 2006 p. 2) and they are the dominant technology in the study area (DWO, 2012 p. 9). Also, compared with other technologies like springs, rain water harvesting tanks, and Gravity Flow Schemes (GFS); handpumps depict the lowest functionality,

which is attributed largely to inadequate sustainability (Ministry of Water and Environment, 2012 p.55).

1.9.3 Time Scope

The study covered a period of eleven years; starting from 2002 through 2012.This period was chosen because the RWSS reform study that was carried out in the late 1990s resulted in a sub-sector Strategy and Investment Plan for the period 2000-2015 (SIP 15). Provision of sustainable safe water supply facilities, based on management responsibility and ownership by users is one of the main objectives of SIP15. With SIP15 in context, a 5-year Operational Plan (OP-5) was developed in 2002 covering the period 2002 – 2007 (Kimanzi, 2004 p. 276). It was therefore, in 2002 that CBMS became strongly emphasized as the best approach to deliver sustainability of water sources. In addition, handpumps have been found to take up to at least one year before they break down (Harvey & Reed, 2004, WaterAid, 2010).Therefore, from 2012 up to the time of this study is good enough period to provide the true picture on the performance of even the newly installed handpumps.

1.10 Significance of the Study

This kind of study had not been conducted in the study area which was a manifestation of scarcity of information on sustainability under CBMS. It has in part addressed this aspect by contributing to the knowledge which is important in decision making processes.

This study came up with findings, conclusions, and recommendations notably on women's involvement in water supply affairs; establishment of sustainable supply chains for spare parts; and back-up support by implementing agencies. These are really useful in informing policy processes at all levels of governance. The knowledge base created by this research is a foundation stone for

further research by scholars and other interested parties in the provision of clean safe water to low income communities.

1.11 Justification of the Study

In Uganda, CBMS is highly looked upon as the best option for maintenance of water sources yet sustainability has still remained a huge challenge as it stagnated between 80% and 83% nationally (MWE, 2012) and is estimated at 83% in Arapai Sub county (DWO, 2012). Similar studies have been done in some parts of the world concerning community management and sustainability of water sources but none in Arapai Sub County and not even in Soroti district. This is the reason why this study needed to be conducted.

Rural areas have handpump installation as the most widespread solution for supplying water to the community and yet estimates indicate that 30 percent of all potentially functional handpumps are not working especially in Africa (Oyo, 2006). Despite being the dominant technology in the study area (DWO, 2012 p. 9), it is also the technological option with the lowest functionality which is attributed largely to inadequate sustainability (MWE, 2012 p.55). In this perspective, this study found it necessary to investigate sustainability of improved water sources installed with handpumps in the study area in the context of CBMS.

1.12 Operational Definitions of terms and concepts

For the purpose of this research, the following terms were accordingly defined:

Community: means a group of people with common values and interests, living in one geographical area where given water supply system can realistically serve.

Community-based Water Supply Management Institutions [CWSMI]: Are community based structures such as WUCs, Water user groups, Water user associations that are responsible for the day-to-day O&M of water supply facilities.

Functionality: means the "percentage of improved water facilities found perfectly working at the time of spot check".

Government back-up support: denotes such support that is derived from government and other agencies that support communities in the provision of water and sanitation services. This support may include: training, monitoring, follow-ups, technical support, coordination, financing, and general capacity building.

Improved water sources: Generally referred to as water sources means engineered or conventionally constructed water sources for water supply for both domestic and other uses.

Maintenance: Refers to the activities aimed at sustaining the water supply in a proper working condition.

Operation: Refers to the everyday running and handling of a water supply, involving the actual delivery of services.

Private Sector: Are technicians involved in providing communities with water and in promoting safe water supply. They include individual contractors such as HPMs, Scheme Attendants, Masons, Plumbers, and spare parts dealers (adopted from IRC and Aguaconsult, 2011).

Sustainability: Sustainability of a water supply system is when the facility is continuously functioning throughout its design life while delivering an appropriate level of benefits, it's O&M, administrative and replacement costs are covered at the local level with limited but feasible external support; its management is institutionalized, and it does not negatively affect environment.

Water User Committee [WUC]: also known as Water and Sanitation Committee (WSC); is a community-based water supply management structure/institution established by Water Users (WUs) from permanent residents of the village.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter examines what other scholars have written about sustainability of rural water sources managed under Community Based Maintenance System. The literature review was structured in themes and sub-themes to reflect the order of the specific objectives of the study as well as the research questions.

2.2 Theoretical Review

In formulation of the theoretical perspective for studying CBMS and sustainability, The Systems Theory proposed by Ludwig von Bertalanffy, (1950) and furthered by Ross Ashby, (1956) provided a useful foundation.

A system is any collection of component elements that work together to perform a task (Microsoft Encarta, 2008). It is a constitution of elements, which are in exchange, and which are bounded. Elements can be virtually anything, the exchanges are any relationships that exist between elements, and the boundary is what can be sensed that separates a "system" from the background or environment. Many systems are goal directed (Gregory, undated).

Bertalanffy (1950) in developing The Systems Theory was both reacting against reductionism and attempting to revive the unity of science. He emphasized that focus was required on the necessity or the importance of all the links or parts of the system and on regular interaction or interdependency of activities/parts that form the emergent whole. Since a system is viewed as collection of elements that work together within a given environment to perform a task, any malfunction in any of the elements or stages or change in the system’s environment affects the entire system. The Systems

Theory takes account of the different needs of the various functional areas of the system to ensure that each one is strong.

In the application of The Systems Theory to the study of CBMS and sustainability of water sources, the elements analogous to those mentioned by Bertalanffy (1950) included: CWSMI, PSP in water supply, and government backup support mechanisms. These must inter-relate systematically in order to achieve sustainability of water sources. When any of the identified elements malfunctions or becomes absent, a community water supply management system will be affected and therefore, sustainability of the water supply system gets at stake.

For this study, the identified elements were the key thematic areas of interest. All these elements have a linkage with one another and these links have to be strong as recommended by Bertalanffy (1950) in order for CBMS to remain intact to deliver sustainability. The inter-relationship between these components and how they are theorized to create sustainability is highlighted in the conceptual framework (figure 1).

Systems thinking started thriving during World War II and because it was successful, it advanced significantly. According to Gregory (undated), the real problem that existed during war was that of logistics and supply lines to serve the warfront. Getting the correct figures and categories of combatants and support forces on top of materials and equipment including arms and weapons, to the right spot at the right time seemed to be the typical worry of the military. According to the author; planners however, found that systems theory gave them the needed concepts for solving such problems.

Similarly, it is viewed that the attainment of sustainability of water sources could prove complicated if the factors geared towards it are looked at in isolation. This is because each of the factors of

CBMS carries a unique contribution to sustainability of water sources yet its strength is dependent on one or two of the other factors. For instance, CWSMI need government back-up support for their establishment and capacity building so as to effectively influence sustainability of water sources and so does PSP. Government back-up support on the other hand requires the existence of competent CWSMI and PSP as a vehicle in aiding communities to sustain their water sources. The Systems thinking is required to leverage the interrelationship and interdependency of these aspects on their individual strength in order to foster water source sustainability.

2.3 Community-based water supply management institutions and sustainability

2.3.1 Water user committees and sustainability of water sources

The WUC is the basic Community-based Water Supply Management Institution (CWSMI) formed with full participation of users. Moriarty, Visscher, Bury & Postma (2000) postulate that water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels**.** According to Brikke (2000); Harvey and Reed (2004), having a WUC formed in full participation of users is crucial for community management and sustainability to be successful. The study realized that having a WUC in place which is locally selected ensures water supply sustainability under the community-based approach as also attested by WaterAid (2010).

2.3.1.1 Roles of the WUCs and sustainability of water sources

WUCs play important roles in CBMS some of which include: mobilizing users to collect capital and operation and maintenance (O&M) community contributions for construction, maintenance and repair of the water supply systems; maintaining an up-to-date register of water users (WU) and opening a bank account for O&M funds. Other roles include regularly visiting and monitoring the performance of the water sources; ensuring that preventive maintenance is done; acquisition of

spares parts and engaging Hand Pump Mechanics in repair works in case of a breakdown (Yan, Asante and Birner, 2010; Harvey & Reed, 2007). The Ministry of Water and Environment (2012) states other roles of the WUCs as signing repair agreements on behalf of the community; keeping the water source environment and drainage channels clean; formulating, ratifying and enforcing by-laws to govern the use of the water source; and reporting major breakdowns to the relevant authorities. The selection and replacement of a WUC/WSC where necessary; responsible use of the water source, attending meetings related to O&M; and paying contributions towards O&M of the water source are some of the responsibilities of the community which are geared towards the sustainability of the water source.

During the execution of their roles; Mathew (2005) stresses the need for transparency of the WUC activities especially clearness in rural community water supply accounts as an important factor to sustainability. Although emphasis can be made on the need for efficiency and effectiveness of the WUCs in carrying out their mandates, Montangero (2008) and Carter (2009) believe that a number of factors such as low tariffs and big number of defaulters arising from those who are unable or will not forfeit even the little agreed fee may jeopardize this. The authors argue that in this case when a major breakdown occurs, the funds available are insufficient to cover the true costs of maintenance and repair. Another threat cited by IRC Triple-S (2011) on the performance of the WUCs is lack of formality of their legal positions leaving them unable to continually run and manage water supply systems effectively.

This review found that, as the WUCs are striving to perform their roles and responsibilities, the Water users must be participating actively in the background. The water users are the foundation of CBMS since they must contribute O&M funds, select a WUC, and attend meetings among other responsibilities.

2.3.1.2 Women's participation in WUCs and sustainability of water sources

One aspect that defines the effectiveness of the WUC in relation to sustainability of water sources is gender sensitivity in its composition. Scholars have vividly noted that water and sanitation issues have major gender implications and that women in particular are often responsible for the management of water in developing countries. Women are capable and instrumental in educating their children on safe uses and proper sanitation and hygiene. In most rural areas, women and girls are trekking long distances to access water from remote locations. It is common to find women walking 6 kilometers daily to a water source, carrying up to 20 kilograms. Women and girls are inclined to suffer the most from the consequences of inadequacy of water and sanitation facilities (United Nations Conference on Sustainable Development – Rio+20, 2012). The third 1992 ICWE guiding principle (also called the Dublin statement on water and sustainable development) holds that women play a central part in the provision, management, and sustainability of water. However, it is noted that institutional arrangements for the development and management of water resources hardly ever echo the pivotal role of providing, using, and sustaining water and the living environment that is played by women.

Participation of women and young people, as well as men in water supply affairs is encouraged by implementers and facilitators (Brikke, 2000; Harvey & Reed, 2004). Consideration of women in the WUC is because of their bigger role in water issues, their bigger indulgent of the water source and their use of the water source most (Jansz, 2011).

In water stressed areas, it is noted that women spend a lot of time collecting water from unsafe water sources that may even be infested by disease causing organisms, causing severe illness, which sometimes leads to bereavement. This is in addition to exposure to sexual abuse and other forms of violence while collecting water. For this reason, there is always a deliberate effort undertaken to

ensure that women are enrolled in water supply affairs (MWE, 2012) so that some of those issues that are directly affecting them can be clearly articulated during forums.

World over, women's participation is still a challenging issue in facilities projects despite their being exposed to the dangers caused due to lack of water and unimproved sanitation (Tam, 2012 p.149). In some communities, women are always shut down by men whenever they try to contribute in water supply forums as found by Ali (2013). The author claims that during meetings, men shut down most women and these same men proceed to submit the same issues that the women independently attempted to express. For fear of annoying the men and risking being shouted at and teased by them, the author adds that the female members of the water committee always kept quite even when they knew that the information that the man was giving was wrong. The dreaded embarrassment in front of men, the lack of practice at being vocal and responsive, and the lack of confidence prevented women from taking an effective part in the meetings.

Huby & Stevenson (2003) explained that many project failures are blamed on inadequate community participation and overlook of women's views. They argued that if people tolerate to walk far to fetch water, they are motivated to support an improvement; but this will be defeated especially when women do the walking and men take the decisions. For this same reason, Sara & Kartz (1997) argued that projects must dedicate substantial amount of resources to social mobilization to ensure equity and inclusion in decision making in order not to hurt the overall commitment to sustain the water supply system.

The Asian Development Bank [ADB] (2009) emphasizes that women are the main providers of domestic water and maintainers of a hygienic household environment. It suggests that, involvement of women in the planning; implementation, monitoring, and operation and maintenance (O&M) of water supply systems should be encouraged.

Cognizant of the challenges facing full women participation in water supply affairs, the Ministry of Water and Environment in developing the Rural Water and Sanitation (RWS) five year operational plan (OP5) set six critical requirements to guide LGs institutions and other stakeholders in providing water and sanitation services. The second of the six critical requirements (District Implementation Manual [DIM], 2012 p.60) emphasizes meaningful involvement of women by: ensuring the composition of WUCs/ WSCs to include at least 50% women; women taking up key positions in the WUC/WSC (i.e., chair, vice-chair, secretary, treasurer); and half of the water point attendants and HPMs to be women. It is believed that in society, women are trust worthier than men; tend to be responsible for domestic water supply within the home and according to DIM (2012 p. 78), it is the reason they are often given the position of treasurer in the WUC.

Arising from this review, the study noticed that even up to this 21st Century, women in some communities in the world still suffer from suppression in certain development arena like the one of water supply. This is happening even when it is widely known that women's participation in the water supply projects is crucial for so many benefits. However, the positive side of this is that the water sector practitioners and implementers are doing all that is possible to have these curtailed.

2.4 PSP in water supply and sustainability of water sources

The National Water Policy [NWP], (1999) holds that; the private sector will be responsible for the activities at sub-county level. Private technicians will undertake repairs and half-yearly preventive maintenance of the handpumps. Retail distribution of spare parts will take place through local shops at sub-county level.

2.4.1 Community water supply technicians and sustainability of water sources

The key technicians for handpumps are the HPMs. The HPM operates in the sub-county as a private contractor responsible for maintenance/repair of boreholes and his/her remuneration is done by WUC. According to the DIM (Ministry of Water and Environment, 2012); HPMs, Plumbers and Masons undertake maintenance and repair work at the request of WSC, sub-county or district local government and are to act as supervisors of the water sources.

One HPM is in charge of 40-50 boreholes and there should be at least one HPM per sub-county. The HPMS are trained by specialized institutions or appropriate individuals and to match with the changing technology, their skills need to be upgraded (MWE, 2011).

The O&M framework (MWE, 2011) indicates that trained HPMs play a critical role in the CBMS by carrying out repairs of water facilities with appropriate tools given by the district or development partners and are paid by the WUCs through the O&M funds collected. In this framework, regrets have been expressed due to the fact that, in many cases HPMs undertake repairs, but WUCs do not pay them in time or at all. In regard to the performance of the HPMs relative to the profit that they make from their work; Harvey & Reed, (2004) note that professional satisfaction and esteem may prove important motivators for such stakeholders; profit being the principal driving factor notwithstanding.

Monitoring and reporting on the functionality of the water sources is one of the roles that HPMs are supposed to play. It is observed that, to fulfill this role, the HPMs need to be facilitated as it is unrealistic to expect them to incur cost of monitoring and reporting on the functionality of water facilities without being compensated. Nekesa & Kulanyi (2012) hold that when HPMs are facilitated and involved in decision making processes, they are able to effectively and efficiently

execute their roles resulting in availability of adequate information around operation and maintenance such as: information on costs, functionality, and consumer feedback loop.

This study has not found scholars in the literature reviewed holding any documentary evidence on the involvement of HPMs in decision making as. The literature reviewed suggests that government and other agencies provide HPMs with tools to ease their work and this study considers this as a good practice but the regulatory aspects on the usage of these public tools is not brought out.

2.4.2 Handpump Spare parts dealers and sustainability of water sources

Oyo, (2006) holds that Handpump installation is the most widespread solution for supplying water to the many millions of people in Africa's rural areas and yet at any given moment; 50 percent or more of hand pumps is nonfunctional due in part to difficulties in obtaining spare parts. Harvey (2011) holds that there is a critical need to increase the sustainability of rural water supply services, especially in sub-Saharan Africa. He cites supply chains that do not deliver spare parts close to customers at an affordable cost as one of the primary reasons for low levels of sustainability. He maintains that most of the users of Handpumps live in rural areas, where they require access to spare parts through some form of distribution network and that spares are typically not readily available.

There is yet no known clear sustainable supply chain for handpump spare parts (Harvey and Reed, 2003; Ministry of Water and Environment, 2011). In the findings of Jansz (2011); almost all respondents complained that a number of alternative approaches had been tried and failed including the private sector and they argued that government needed to set in and rescue the situation. A research in Ghana, Kenya, Uganda, and Zambia carried out by Harvey and Reed in 2006 found that, supply of handpump spare parts to rural areas is not a viable stand-alone commercial activity. The

national framework for operation and maintenance of RWS in Uganda (MWE, 2011) has also noted handpump spare parts supply still being a weak link in CBMS in Uganda.

In depth analysis by Oyo (2006) established that; the viability of unsubsidized privately operated supply chains will require most countries in Africa between 10 to 20 years of subsidized spare part supply chains before the supply of spares becomes self-financing. The author further found that this may even go longer in the case of very poor and far less densely populated countries because the demand for spares is largely a function of a country's population density and income levels. He also established that self-supporting supply chains for spare parts alone will not be viable in rural Africa and that success is more likely if spares supply chains are linked to related water technology services such as pump installation and maintenance services.

An assessment to improve management structures in water supply by Youth Development Organization (YODEO) on behalf of the Netherlands Development Organzation (SNV) in Adjumani district (as cited in Nekesa & Kulanyi, 2012) identified several causes of low functionality of boreholes. Some of these cause included: the lack of spare parts, inadequate repairs, high prices of repairs and difficulty to access a trained technician.

Manufacturers have a role to manufacture, supply, and distribute materials and components needed for maintaining and repairing water source facilities to district-level dealers. Spare parts dealers (whole sale and retailers) appointed by the spare parts manufacturer play a role of stocking, retailing and distributing spare parts for water facilities (NWP, 1999; MWE, 2012). The nonexistence of spares dealers in villages and districts can have adverse implications on sustainability in that; transport costs increase the cost of spare parts and consequently maintenance and ultimately the down time (when the water facility is not functioning) is increased (Harvey & Reed, 2006).

From the literature reviewed, all over the world, nearly no attempts to ensure availability of pump parts nearest to the water users have ever succeeded. This is a challenge to researchers, implementers, and practitioners in the water sector. The HPMs and the WUCs can be in place but their efficacy in ensuring that hand pumps are operational may become a nightmare in the absence of spare parts.

2.4.3 Government back-up support and sustainability of water sources

All around the world government has a crucial and often increasing role to play in the provision of rural and small town water services (Rural Water Supply Network [RWSN], 2015). Ministry of Water and Environment (2012) and the NWP (1999) hold that; government is generally the owner of water supply assets. As such it has a role to coordinate efforts related to water service development and providing regulatory oversight of water service providers. This role includes supervision of the HPMs; ensuring safe custody of the tools for HPMs; and development of by-laws for O&M. Government and its development partners also have to adequately plan and budget for follow-up activities (e.g. training and re-training of WUCs, HPMs and caretakers, monitoring visits, and co-financing of major repairs). They also have to cater for their financing in some programs because this is the only way sustainability of the sources can be checked (Harvey & Reed, 2004 p.97, 2007; MWE, 2012).

Due to limited funds for new investments and replacements, emphasis are directed to addressing issues that affect O&M and functionality to ensure sustainability through strengthening of regulatory functions, at both central and local government levels Nekesa & Kulanyi (2012).

It is important to establish back-up support mechanisms to communities that have benefited from water source improvements in order to ensure success of CBMS. The DIM (MWE, 2012 p.78) emphasizes that; necessary support should be given to ensure continued functioning of established

structures and facilities. Communities need to be regularly visited by an overseeing institution to monitor systems, reaffirm the need to contribute to O&M, and sustain willingness to this need. Where community-based water supply services have demonstrated sustainability, it is due to strong institutional support provided by government and external agencies to the community (Harvey and Reed, 2004).

To help the communities carry on with their roles, they need training in bookkeeping and financial management. This support may be obtained from local authorities and professionals coming from the private sector in case of major issues (Brikke, 2000; RWSN, 2010; Mathew, 2005; Carter, 2009).WUCs need external support (retraining and technical support) once established in order to keep them motivated and this support can be provided by an implementing agency (Jansz, 2011). When the capacity of communities is built up, they manage to operate and maintain their own water sources and in many instances achieving up to 90% functionality and a down time of only 1-4 days (DeGabriele, 2002).

Ongoing institutional support through training and regular monitoring; use of other forums to reiterate roles and responsibilities; facilitating linkages between communities and support agencies e.g. private sector; and setting and enforcement of bye-laws and regulations enhance communities to undertake their roles and responsibilities (MWE, 2012). This can help to forestall some of the problems like declining willingness to pay for O&M (Harvey and Reed, 2011). It is noted that, good community management structures alone cannot keep the infrastructure in working order if they have not been properly trained (Rural Water Supply Network, 2010) and WUCs need to be assisted to be transparent with their water fund management (Mathew, 2005).

Harvey & Reed (2007) found that the highest operational sustainability levels were recorded in specific districts where local government and/or NGOs played a dynamic role in supporting

communities. They noted a strong need to distinguish between ‘community participation’ that is a prerequisite for sustainability and ‘community management’ which is not. Communities need to be supported through encouragement and motivation; monitoring and evaluation; participatory planning, capacity building, and specialist technical assistance.

2.5 Summary of literature review

The study has found from the reviewed literature that communities need to be encouraged to sustain their water sources with limited external support; the limit of such support however, is not explicitly indicated. With the limited external support in context, the discussions by the various authors of the literature reviewed could lead to a conclusion that considerable government and other agency support is required especially on software aspects, which include the establishment, strengthening, and sustenance of the other factors of CBMS i.e. CWSMI and PSP. Summary of literature review

Much as many studies have attempted to explain how sustainability of water sources can be achieved, none of those reviewed here were specifically designed to test the effect of CBMS on sustainability of water sources. A study conducted by Nkambule & Peter (2012) only assessed the sustainability of rural water supply schemes using the Multi Criteria Analysis Approach. This did not bring out the linkage between CBMS and sustainability of rural water sources. This is a gap which this study sought to bridge by testing the hypotheses stated in chapter one.

Throughout the literature reviewed, some of the studies did not have theories under pinning them while in others the theories were not adequately used to explain the relationship between community management and sustainability of water sources. For instance, Harvey (2007) highlights some theoretical frameworks that are used to support community management such as neoliberal perceptions on reduced state involvement; water as a basic human right; water as economic good;

and people first empowerment approaches but does not go ahead to use any of them. Theory application has therefore, been a major gap in the studies reviewed.

There have been common arguments identified from the literature reviewed. One point of converging views from the scholars concerns spare parts supply in which they note nowhere in the world with known sustainable supply chain for spare parts for repairing handpumps.

Another point of common argument advanced by the scholars is about the external support required from the implementing agencies .they contend that this though limited plays a crucial pivotal role in the promotion of community management approaches towards the achievement of sustainability of water sources.

This study identified some divergent arguments in the literature one of which was regarding community management versus community participation in the quest for the attainment of sustainability of water sources. Harvey (2007); Carter (2009); Mtinda & Holmen (2006) argued that community management alone without community participation cannot achieve sustainability of water sources. However, Nkambule & Peter (2013 p.223) believe that even though low sustainability levels in rural Africa are attributed to majorly lack of community management, community participation on the other hand has not been able to solve the problem of sustainability of water sources.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methodology that the study employed. It presents the research design that was used, the study population, the sample size and selection strategies; sampling techniques and procedure, data collection methods and instruments; data analysis, quality control, and measurement of variables.

3.2 Research design

The study employed the cross sectional survey design. This is because the study intended to pick only some representative sample elements of the cross section of the population as recommended by Olsen and Diane (2004 p. 7). Secondly, this study was to be conducted across participants over a short period of time and the information gathered would represent what was going on at only that point in time and Amin (2005 pp. 212-213) recommends this kind of design for such a study. Another reason for adoption of this design was because it is fast and fewer resources would be needed since everything is measured at one specific time point. It does not necessitate the researcher to make follow up of the participants (Picho, 2014 p. 183).

The cross sectional survey design is exploratory and according to the American Dietetic Association [ADA] Research Committee (2011 p. 4); this helps to identify associations between variables which indeed the objectives of this study were more concerned with.

Both quantitative and qualitative approaches were adopted as the former enhances the understanding of the meaning of numbers, while the latter gives precise and testable expression to

qualitative ideas. With the engagement of these two approaches, a higher degree of reliability and validity of the results was achieved as recommended by (Amin, 2005 p. 71).

3.3 Study population

Preliminary investigations by the study established that, the study area had a total of 39 water sources constructed and fitted with handpumps between 2002 and 2012 inclusive. Based on this number and category of water sources, a study population of 277 people was used. This comprised the WUC members and Caretakers inclusive (6 members per water source), Village [commonly known as Local Council One (LC1)] Chairpersons of the villages where the water sources were located, and Sub county HPMs. Others included two key informants – Assistant Community Development Officer in charge Arapai Sub County and Assistant District Water Officer in charge community mobilization in the District water office of Soroti. These were chosen because they are the key players involved in CBMS, and therefore, were envisaged to be conversant with the affairs of management and sustainability of water sources.

3.4 Sample size and selection

The table used by Krejcie & Morgan in their 1970 article "Determining sample size for research activities" was used for the determination of sample size. This is because of its simplicity as it helps researchers avoid tedious procedures altogether and in addition, this table that can be used to determine the appropriate sample size for almost any study (The Research Advisors, 2006). The details of the sample size and selection are shown in Table 3.1. Because the study population of 210 for WUC members does not have a direct sample size corresponding to it from the Krejcie & Morgan 1970 Table, the research obtained the sample size of 136 by interpolation between the boundary figures in the Table at 95% confidence level (5% margin of error).

Table 3.1: Sample size and selection

Category	Accessible/Target Population	Sample Size	Sampling Technique
Water sources fitted with handpumps	39	35	Simple random
WUC members	210	136	Simple random
Caretakers	35	35	Purposive
Chairperson LC1	28	28	Purposive
HPMs	2	2	Purposive
Sub County key informant	1	1	Purposive
District key informant	1	1	Purposive
Total	**277**	**203**	

Source: A construction based on Krejcie & Morgan Table (1970) and Soroti District Water Office (2012)**.**

3.5 Sampling techniques and procedure

In order to obtain a representative sample, simple random sampling was used to select the water sources to be investigated and WUC members because each member needed an equal and independent chance of inclusion in the sample (Amin, 2005 pp 244-246; Mugenda & Mugenda, 2003 p. 45; Olsen and Diane, 2004 p. 16). Purposive sampling was used to select Caretakers, Village Chairpersons, and Sub County and District informants because this group of respondents was smaller and they were considered much involved in implementing water sector activities. They therefore understand management of water sources better and Amin (2005) recommends such knowledgeable people for interviews.

3.6 Data collection methods

Guided by the nature of the problem under investigation – the sustainability of water sources under CBMS; three data collection methods were used: questionnaire, interview and documentary analysis. Amin (2005 pp 63-75) suggests that such data collection methods allow methodological triangulation.

3.6.1 Questionnaire

Information was gathered by administering questionnaires to WUC members and Caretakers who individually filled them as recommended by Amin (2005 p. 269). The researcher or research assistant where required offered necessary explanations with reference to the questions in the questionnaire. During the preliminary work, the study found that all the respondents at least had some basic reading and writing skills. This is because one of the criteria for selection of the WUC members was that, a candidate had to have some level of literacy and numeracy (District Water Office, 2012) and based on this; there was no need to interpret the questionnaire in to the local language.

Since the sample of WUC members and caretakers was large, the questionnaire method was found suitable for collecting data from such a sample because of its convenience and economy. Questionnaire method also gives greater assurance of anonymity to the respondent sand hence making them feel freer to express their views than they would do personally to the researcher. The other reason why the questionnaire method was used to collect data is because of the less pressure it places on the respondents for immediate response that it allows them to take their time and pace to complete the questionnaires (Picho, 2014 p. 184).

3.6.2 Interview

An interview is an oral questionnaire where the investigator gathers data through direct verbal interaction with participants (Amin, 2005 p. 178). A face-to-face interview was conducted with the Village Chairpersons, HPMs, Sub County and District key informants. During this process, thye study guaranteed maximum cooperation for the respondents to achieve accurate data.

In this study, interview method of collecting data was used because of its in-depth pursuance of information around the topic and usefulness as a follow-up to certain responses to questionnaires

thereby serving the purpose of triangulation (Amin, 2005 p. 178). Mugenda & Mugenda (2003 pp 83-84) encourages the use of interviews because they are more flexible than questionnaires and reduce confusion from respondents on the questions. Wherever possible the interview was also tape recorded.

3.6.3 Documentary Review method

Qualitative documents were reviewed to provide the secondary source of data as detailed out by Picho (2014). Documents reviewed included the water user's register; water source maintenance records, minutes of meetings, preventive maintenance agreement, and financial management documents and reports. This helped to corroborate findings from questionnaires as well as interviews.

3.7 Data collection instruments

In line with the data collection methods stated and with guidance from the objectives of the study, conceptual framework and the literature reviewed; the study developed three types of instruments for use in data collection. These included structured questionnaires/feedback forms, interview protocol, and documentary analysis guide.

3.7.1 Questionnaire

A questionnaire is a form consisting of interrelated questions prepared by the researcher (Amin, 2005 p. 269). Structured questionnaires containing closed-ended statements were administered to collect largely quantitative data from WUC members and Caretakers in a manner recommended by Amin (2005) and Mugenda & Mugenda (2003). Questionnaires were used because according to Olsen and Diane (2004 p. 18); they help to collect specific information relevant to the study. The questionnaire was constructed based on a Likert-type scale.

3.7.2 Interview guide

An interview protocol for asking questions and recording answers was used and recording was by hand as recommended by Creswell (2009). The interview protocol had questions designed to elicit views and opinions from the participants and involved unstructured and open-ended questions that were kept few in number as recommended by Amin (2005). An introductory section preceded the interview questions and an appreciation message to the respondent for the time and information shared succeeded.

3.7.3 Documentary analysis checklist

To guide documentary review, documentary analysis checklist was used. The documentary analysis checklist helped to solicit items and information from members of the WUC and WUs who provided the items required in the checklist for review and also helped substantiate where required. The items/documents required included: repair and maintenance agreement, O&M records, financial management records, users' register, O&M plan, and proceedings of meetings.

3.8 Data quality control: validity and reliability

Data collection tools will only be useful if they are valid i.e. measure what they purport to measure and reliable i.e. collect data in the same way by different people, at different times and in different locations. Accurate and dependable data is obtained if the two statistical requirements are met i.e. by the use of relevant instruments (Picho, 2014 p. 185).

3.8.1 Validity

For validity, all the items in the data collection tools were subjected to rating and Content Validity Index (CVI). The tools were sent to four experts to solicit their rating. These experts were identified from the Ministry of Water and Environment (two of them) and the other two from the District Local Governments. Three experts returned the questionnaires duly filled and the summary of their

opinions is presented in Table 3.2. CVI was computed using the following formula as explained by Amin (2005): $CVI = \frac{\text{No. of items rated as valid}}{\text{Total No. of items in the tool}}$

Table 3.2: Summary of expert opinion on questionnaire validity

Expert	Total number of items in the questionnaire	No of items rated valid	No of items rated not valid	Validity
1	47	45	02	0.96
2	47	39	08	0.83
3	47	47	00	1.00
Overall	**141**	**131**	**10**	**0.93**

Source: Primary data

The computed CVI for the questionnaire was found to be 0.93 and for interview guide i.e.

$$CVI = \frac{\text{No. of items rated as relevant}}{\text{Total No. of items in the tool}} = \frac{141}{131} = 0.93$$

Since Amin (2005 p. 288) recommends CVI to be equal or greater than 0.7; the tools were considered fit to measure what they were intended to measure with respect to the objectives, research questions, and hypotheses of the study.

3.8.2 Reliability

To ensure consistency, dependability of the instruments and their ability to tap data that provide answers to the objectives of the study, pre-tests were done in the Sub County of Asuret within Soroti district prior to actual data collection. Raw data from the instruments were subjected to a reliability factor analysis and reliability test. From these, the study computed the Cronbach coefficient alphas as described by Gravetter & Forzano (2012), and Amin (2005).

Table 3.3: Alpha reliability coefficients on questionnaires pre-test

Variables	**Cronbach's Alpha**	**No of items**
CWSMI	0.709	10
PSP	0.873	08
Government back-up support	0.774	07
Total alpha	**2.356**	**25**

Source: Primary data

The Cronbach's coefficient alpha was computed using SPSS Version 16.0. From the pre-tested and analyzed field data, the Cronbach's Alpha was computed using the formula:

$$\alpha = \frac{\sum(alpha)}{Number\ of\ \text{var}iables} = \frac{2.356}{3} = 0.785 \approx 0.8.$$

As recommended by Amin (2005); for the items measuring the variables to be considered dependable for data collection, the Cronbach's coefficient alpha should be equal to or greater than seven (≥0.7); and since the computed Cronbach's coefficient alpha is 0.8, the tool was considered reliable.

Similarly, after data collection; another reliability test to determine the reliability of the instruments and the appropriateness of the data collected was done. The results are presented in table 3.4.

Table 3.4: Alpha Reliability Coefficients on questionnaires after data collection

Variables	**Cronbach's Alpha**	**No of items**
CWSMI	0.612	09
PSP	0.740	08
Government back-up support	0.634	07
Total alpha	**1.986**	**24**

Source: Primary data

$$\alpha = \frac{\sum(alpha)}{Number\ of\ \text{var}iables} = \frac{1.986}{3} = 0.662 \approx 0.7 .$$

The result of the analysis revealed Cronbach's alpha coefficient of 0.7 for the overall.

The Cronbach's coefficient was adopted for the reliability test because it is the best for cases when test items have several alternative answers – as it was in this study; each of which is given a different weight as in the Likert scale (Gravetter & Forzano, 2012 p. 443; Amin, 2005 p. 302).

3.9 Data collection procedures

After successful proposal defense and submission of the approved proposal, an introductory letter to conduct the study was obtained from UMI. One Research Assistant was identified and trained in the proper use and administration of the data collection instruments and also familiarized with the objectives, the methodology and the ethical issues surrounding the study. Validated questionnaires were hand delivered to the respondents, while emphasizing on issues of voluntary participation, anonymity and confidentiality. Completed questionnaires were collected after the time agreed with respondents. Some respondents asked for more time to complete the questionnaire and it was appropriately granted. Key informants were contacted prior to the interview date to seek their consent to participate in the study and were provided with the necessary details of the study. During the interview, responses were tape recorded and also transcribed.

3.10 Measurements of variables

An ordinal scale was used to measure the variables. A 5 – Likert –type rating scale with standardized response categories was adopted and used to examine the level of agreement with statements on a five point scale as explained by Mugenda & Mugenda (2003 p.66). The level of agreement was rated as strongly disagree (SD), disagree (D), not sure (NS), agree (A), and strongly

agree (SA) with weights 1 – 5 respectively. Amin, (2005 p. 265) notes that the Likert scale is flexible and easy to construct compared to other types of attitude scales and this study chose it on that basis.

3.11 Data analysis

3.11.1 Quantitative data analysis

Quantitative data from pre-coded questionnaire was edited for uniformity, accuracy, consistency and comprehensiveness and entered to Statistical Program for Social Scientists (SPSS 16.0) data editor where it was analyzed. Descriptive statistical analysis was done to determine percentages and frequencies as recommended by Gravetter and Forzano (2012). This package was preferred because of its capacity to handle numerical data.

Relational statistics (correlation coefficient) was used to establish how variables were related i.e. measure of the strength of the linear association between the variables and the direction of the association. The study used Spearman's correlation technique to establish the direction and degree of the relationship that existed between the variables. The variables of this study being of ranked category were measured in an ordinal scale (the Likert-type scale). Amin (2005) recommends Spearman's correlation technique for the establishment of the direction and degree of association for such variables.

Simple regression analysis was performed to establish the dependence of the dependent variable on the independent variable of the study. This analysis aided the determination of the percentage effect or variation that the independent variable had on the dependent variable. A coefficient of determination $R^2$was computed and used to infer the magnitude of this variation. Simple regression technique was adopted since the study was dealing with only one independent and one dependent variable. Other data was presented using tables, graphs, bar charts and pie charts.

3.11.2 Qualitative data analysis

Qualitative data obtained from interviews was analyzed by searching and sorting it in form of recurrent behaviors or patterns. Recurrent data groups were identified and put together in themes as explained by Amin (2005 p 324). In depth analysis began by fragmenting sentences from the data and putting them into groups or themes which were then tagged or coded. The analysis was manually done and some of the key statements/themes from the respondents were summarized in a narrative form as a representation of the major findings and are presented in chapter four of this report as illustrations.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS

4.1 Introduction

This chapter presents, analyses, and interprets the quantitative and qualitative key findings of the study. It comprises of response rate, results of the background characteristics of the respondents, results on the substantive objectives, and descriptive results. The chapter captures the presentation, analysis, and interpretation of results of the study.

4.2 Response rate

One hundred seventy one (171) questionnaires were administered to WUC members and caretakers and of this these, 168 were returned reflecting a response rate of 98.2 % for this category of respondents - i.e.

$$\text{Response Rate} = \frac{\textit{Number of questionnaires returned}}{\textit{Total number of questinnaires administered}} \times 100 = \frac{168}{171} \times 100 = 98.2\%$$

The response rate for the various categories of respondents and the overall average response rate are summarized in table 4.1.

Table 4.1: Response rate

Category of respondents	Data collection method	Target sample	Actual response	Response rate
WUC members	Questionnaire	136	133	97.8
Care takers	Questionnaire	35	35	100
LC1 Chairpersons	Interview	28	24	85.7
HPMs	Interview	2	2	100
Key informants	Interview	2	2	100
Overall average response rate		**203**	**196**	**96.7**

Source: Primary data

Shih & Fan (2007) hold that a survey response rate is an important consideration because low response rate can give a sampling bias especially if the non-response is unevenly distributed among the sample categories. They explain that response rate greatly weakens the validity of findings and

inferences drawn from any research. The study considered the achieved response rate of 96.7 % to be good enough because Mugenda & Mugenda (2003) hold that, response rate of 70% and above is adequate for any study.

The response rate was generally high and the study has attributed to adequate level of mobilization of the respondents, precise and meticulous administration of the data collection instruments. This makes the validity of results of this study strong.

4.3 Demographic characteristics of the respondents

This section is a description of the characteristics of the study population.

The study sought to analyze age, gender, education level, and position in the WUC aspects of the respondents. Table 4.2 provides the details of these aspects based on the responses on the questionnaires by the respondents.

Table 4.2: Demographic characteristics of the respondents

Aspect	Description	Position in the Committee						Total
		Chairperson	Treasurer	Caretaker	Secretary	Member	Vice Chairperson	
Gender	Male	22(91.7%)	2 (10%)	21 (60%)	17 (85%)	32(55.2%)	5 (45.5%)	99 (58.9%)
	Female	2 (8.3%)	18 (90%)	14 (40%)	3 (15%)	26(44.8%)	6 (55.5%)	69 (41.1%)
Total		**24 (14.3%)**	**20(11.9%)**	**35(20.8%)**	**20(11.9%)**	**58(34.5%)**	**11(6.5%)**	**168(100%)**
Age	20-29	3 (12.5%)	5 (25%)	3 (8.6%)	0 (0%)	4 (6.9%)	0 (0%)	15 (8.9%)
	30-39	3 (12.5%)	2 (10%)	8 (22.9%)	12 (60%)	23(39.7%)	0 (0%)	48(28.6%)
	40-49	7 (29.2%)	7 (35%)	15(42.9%)	4 (20%)	17(29.3%)	9 (81.8%)	59(35.1%)
	50-59	6 (25.0%)	6 (30%)	6 (17.1%)	4 (20%)	10(17.2%)	1 (9.1%)	33(19.6%)
	60-69	5(20.8%)	0 (0%)	3 (8.6%)	0 (0%)	3 (5.2%)	1 (9.1%)	12 (7.1%)
Total		**24 (14.3%)**	**20(11.9%)**	**35(20.8%)**	**20(11.9%)**	**58(34.5%)**	**11(6.5%)**	**168(100%)**
Education level	Primary	12(50%)	16(80%)	32(91.4%)	8 (40%)	48(82.8%)	10 (90.9%)	126(75%)
	Secondary	7 (29.2%)	2 (10%)	2 (5.7%)	7 (35)	9 (15.5%)	1 (9.1%)	28(16.7%)
	Certificate	4 (16.7%)	2 (10%)	1 (2.9%)	5 (25%)	0 (0%)	0 (0%)	12 (7.1%)
	Diploma	1 (4.2%)	0 (0%)	0 (0%)	0 (0%)	1 (1.7%)	0 (0%)	2 (1.2%)
Total		**24 (14.3%)**	**20(11.9%)**	**35(20.8%)**	**20(11.9%)**	**58(34.5%)**	**11(6.5%)**	**168(100%)**

Source: Primary data

4.3.1 Gender

The cross tabulation results show that more than a half (58.9%) of the WUC members was males as compared to women (41.1%). The results indicate that though effort was accorded to gender considerations in the composition of the WUCs, it is significantly skewed in favour of the males. As far as the occupation of key positions (i.e. Chairperson, vice chairperson, secretary, and treasurer) in the WUC is concerned, table 4.2 reveals that apart from the position of treasurer which is dominated (90%) by the females against men (10%); the rest of the key positions were dominated by men. Overall; women occupied only 29 (38.7%) key positions compared to 46 (61.3%) occupied by men. Even though women majorly occupied the position of treasurer; this finding is generally against the principle of meaningful involvement of women which is held by the DIM (ministry of Water and Environment, 2012 p.60); where emphasis have been laid on the composition of WUCs/ WSCs to include at least 50% women representatives. The finding is in conformity with the third 1992 ICWE guiding principle (the Dublin statement on water and sustainable development). This holds that; 'women play a central part in the provision, management, and safeguarding of water and yet this pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources'.

During the qualitative study, apart from one village where a female was an LC1 Chairperson, all the LC1 Chairpersons as well as HPMs who were interviewed were males. This was illustrated in figure 2.

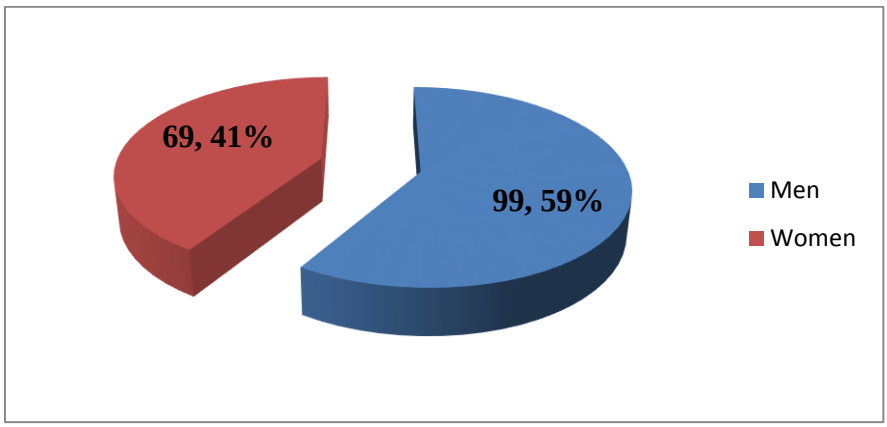

Figure 2: Gender participation in water supply in Arapai Sub County

Source: Primary data

The results mean that implementers have not scored adequately in terms of meaningful involvement of women in the water supply affairs. More effort and commitment is still needed in the study area to adequately achieve meaningful involvement of women in community water supply issues by way of ensuring their composition in WUCs to at least 50% as required by Ministry of Water and Environment (2012).

The implication of this is that; the pivotal role played by women in water supply and environmental affairs cannot fully be harnessed when a significant portion of women is kept outside the arena of water supply practice. This is likely to hurt sustainability of water sources in the study area. To this study, this implies that more views were gathered from men than women. However, the small disparity of 7.1% between male and female respondents in terms of gender balance can be tolerated.

4.3.2 Age of the respondents

In terms of age, the cross tabulation in table 4.2 shows that all the age groups were represented in the various positions in the WUC apart from the position of vice chairperson in which respondents aged 20-29 and 30-39 years were not represented. The majority (35.1%) representation emanates from the respondents belonging to the age category of 40-49 and closely followed by age category

of 30-39 (28.6%). The respondents in age categories 50-59(19.6%), 20-29(8.9%), 60-69(7.1%) ranked third, fourth, and fifth respectively. Overall, the majority of the respondents (72.6%) were between the age of 18-49 years while a few (26.7%) were aged 50 years and above. This distribution is illustrated in Fig 3. Qualitative study revealed that, all the LC1 Chairpersons were of age bracket 40-69.

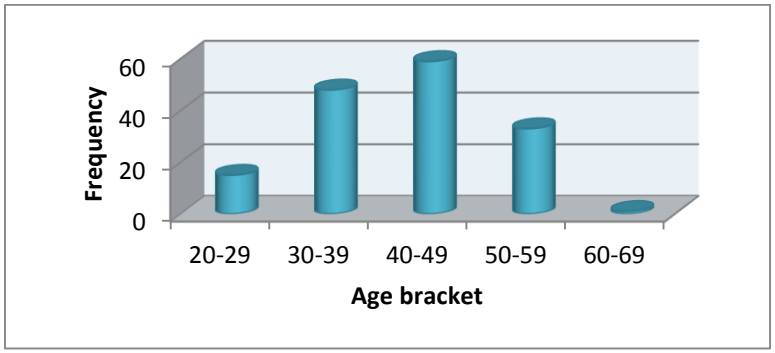

Figure 3: Representation of respondents by age

Source: Primary data

Results show a mixture of both the old and the youth among the WUCs. The study noted that this is a demonstrated in-built succession measure and plan that is important for the long term sustainability of water sources. This is because the youth who will have the responsibility over the water supplies tomorrow are being groomed for the current and future contribution, management, and leadership of the improved water supply facilities.

This age distribution is significant for this research because all the respondents are consenting adults who adequately understand issues pertaining to CBMS and sustainability of water sources. This increases its validity and reliability.

4.3.3 Level of education of the respondents

In terms of education, table 4.2 shows that the majority of the respondents (75%) had attained primary education; followed by those that had attained secondary (16.7%). The respondents that had attained certificate and diploma (7.1%) and (1.2%) ranked third and fourth respectively. Overall, the cross tabulation indicates that all the positions in the WUCs were majorly filled by respondents who had attained at least primary education. All the LC1 Chairpersons interviewed had attained various levels of education with the majority of them being at primary level.

With this basic education, it means the respondents have both numerical and functional literacy, which enables them to sufficiently comprehend issues. This means that the respondents are trainable in formal water supply management affairs especially on records management and simple book keeping which is a prerequisite for enhancing their roles and keeping them motivated to continue running the water supply facility. This is required for enhancement of financial and institutional aspects of sustainability.

To this study, it implies that correct and accurate responses were solicited since the respondents were able to read and comprehend the survey instruments and this increases the validity and reliability of the data that was collected.

4.4 Empirical findings

The study presents empirical findings hereunder objective by objective.

4.4.1 Community-based water supply management institutions and sustainability

The research question number one that guided this objective asked whether there was a relationship between CWSMI and sustainability of water sources in Arapai Sub County. To answer this

question, respondents were asked to rate various facets of community-based water supply management institutions on sustainability of improved water sources in Arapai sub county. The results that emerged are shown in table 4.3.

Table 4.3: Descriptive statements about CWSMI

Statements on community-based water supply management institutions					**Response**	**Mean**	**SD**
	SD	**D**	**NS**	**A**	**SA**		
	1	**2**	**3**	**4**	**5**		
	Freq.(%)	Freq. (%)	Freq.(%)	Freq. (%)	Freq. (%)		
All the members of the water user committee were elected by the general assembly of the users	3(1.8%)	0(0%)	0(0%)	14(8.3%)	151(89.9%)	4.85	0.589
Half of the members of our Water user committee are women	5(3.0%)	65(38.7%)	9(5.4%)	50(29.7%)	39(23.2%)	3.32	1.282
Women are willing to be part of the Water User Committee	0(0%)	2(1.2%)	9(5.4%)	73(%)	84(50%)	4.42	0.652
Women in our committee hold executive positions (Chair-person, vice chairperson, secretary, treasurer)	2(1.2%)	13(7.7%)	1 (0.6 %)	103(61.3%)	49(29.2%)	4.10	0.842
Women's participation in the committee is not interfered	4(2.4%)	14(8.3%)	7(%)	75(44.6%)	68(40.5%)	4.12	0.992
Having women in the committee leads to better facility management	1(0.6%)	5(3.0%)	7(%)	75(32.7%)	68(59.5%)	4.48	0.766
The water user committee has made a register for all water users	0(0%)	0(0%)	1(%)	59(35.1%)	108(64.3%)	4.64	0.495
The water user committee collects maintenance funds from the water users	0(0%)	0(0%)	0(%)	65(38.7%)	103(61.3%)	4.61	0.488
Having a water user committee helps to keep the water source working	0(0%)	0(0%)	0(%)	61(36.3%)	107(63.7%)	4.64	0.482

Source: Primary data
SD(1)=strongly disagree, D(2)=Disagree, NS(3)=Not sure, A(4)=Agree, SA(5)=Strongly Agree

4.4.1.1 Descriptive results

Table 4.3 shows descriptive statements about CWSMI, the percentage responses and frequency.

Of the 168 respondents, 165 (98.2%) agreed with the statement that all the members of the WUC were elected by the general assembly of water users while only 3(1.8%) disagreed. This indicates that the majority of the WUC members were elected by the general assembly. This was supplemented by the results from the interviews of LC1 Chairpersons where the respondents were in consensus that the community through voting elected the WUC. When asked how community-

based institutions are established in the sub county; the Sub county key informant said that they were generated from the village planning meetings guided by the community based services department. This supports the findings from the WUCs respondents and the LC1 Chairpersons in which the majority (98.2%) of the respondents agreed that all the members of the WUC were elected by the general assembly of water users. Considering the village as the basic unit for promoting the community-based approach, this finding meant that the WUCs in Arapai Sub County have the recognition, legitimacy and the mandate of the WUs to undertake the O&M on their behalf. For the success of O&M of improved water sources under the CBMS, such institutions as the WUCs are fundamental in enhancing sustainability.

Mixed responses were obtained about the question of half of the members of the WUC being women. Slightly more than half [89(53%)] of the respondents agreed, followed by 70(41.7%) who disagreed; and then 9 (5.4%) who were not sure. Qualitative interviews with LC1 Chairpersons generated the same results in which slightly a half the number of respondents interviewed stated that 50% of the WUC members were women. Interviews revealed that there were some WUCs with as low as 20% women representation. This finding means that although there could be a deliberate effort undertaken to ensure that women are enrolled in water supply affairs, this has not been largely achieved in the study area. It indicates that while women and children are known to be more vulnerable to bad sanitation conditions and lack of water, controversially their participation in water supply affairs is still.

About the statement that women in our committee hold executive positions (Chairperson, vice chairperson, secretary, treasurer); 152 (90.5%) agreed with it followed by 15 (8.9%) who disagreed and only 1 (0.6%) respondent was not sure. Respondents during interviews were in consensus on aspect of women holding executive positions. It was noted that, even in WUCs which had as low as

20% women representation; those few women held executive positions. This finding was reinforced by statements from the interviews held with the LC1 Chairpersons and HPMs as quoted below:

> *The percentage of women in the committee is 50%, most of them are treasurers, vice chairpersons, and it has made mobilization of funds easier.*
>
> *Women representation is 20% because most of the women are left behind. Yes; they also hold key positions; e.g. there is one who is a treasurer because women are trusted and are good managers of funds.*

This finding was further supported by information extracted from the records during documentary review in which minutes of community and WUC meetings had names of women listed as members of WUCs and holding key positions. Financial management and maintenance records also showed that the control of in-flow and out-flow of O&M funds was mostly done by treasurers whose names appeared to be those of women.

This finding implies that women hold executive positions in the WUCs, which validates the emphasis of meaningful involvement of women in water supply affairs by ensuring that they take up key positions (i.e., chairperson, vice-chairperson, secretary, and treasurer); in the WUC/WSC. This finding further means that the women who are believed to be trust worthier than men and tend to be more responsible for domestic water supply within the home are often given key positions in the WUC especially that of treasurer. This is likely to enhance proper management of O&M of users' contributions, which is a pre-requisite for the attainment of financial sustainability.

On the statement that women's participation in the committee is not interfered; 143 (85.1%) of the respondents agreed while 18 (10.7%) disagreed and 7 (4.2%) were not sure. This finding implies that in Arapai Sub County, those women who find themselves in the WUC freely take up effective part in the meetings and contribute during meeting deliberations without any interference. Since women have a superior role and understanding in water issues and use the water point most, consideration of their views in water supplies undertakings is likely to enhance all the aspects of

sustainability because they can be stimulated to energetically support and sustain any improvement on the water source. This is because, whenever there is a water crisis in an area and based on the central role that they play in water supply; it is women who spend a lot of time collecting water from polluted and contaminated sources thereby exposing them to higher risks of illness that could even result in mortality. This is of course in addition to being exposed to sexual abuse and other forms of violence while collecting water.

On the statement that having women in the committee leads to better facility management, 143(92.2%) of the respondents agreed, 6(9%) disagreed while 7(4.2%) were not sure. The respondents substantiated this during the interviews when they were asked to explain whether they think women involvement in the committee leads to better facility management. The LC1 Chairpersons and the HPMs where in consensus that having women in the WUC leads to better facility management. They explained that women are better financial managers compared to men; they are good funds raisers, actively attend meetings, can ably educate their fellow women and children on preventive maintenance issues, are not corrupt, and are incorruptible. HPMs when probed over this statement responded as cited below:

> *Women are always good treasurers. When the borehole breaks down they always see to it that repairs are done immediately. They are easily approachable and find it easy to talk to fellow women on water source maintenance.*

This finding agrees with the United Nations Conference on Sustainable Development (Rio+20) which holds that, women are often responsible for the management of water; they educate their children on safe water uses and proper sanitation and hygiene in developing countries.

The finding suggests that stakeholders even at community level are aware of the synergies that can accrue when women are working together with men in water supply affairs. At a higher level, it means that implementers and facilitators are encouraging the participation of women as well as

men. Therefore, they are likely to devote enough resources to social mobilization to ensure that all members of the community including women and other traditionally excluded groups participate in decision making in order to bring about the overall commitment to sustain the water system.

All of the 168 (100%) respondents agreed that the WUC collects maintenance fees from the water users. This position was re-echoed by all the LC1 Chairpersons during the interview and some of them had the following to say:

> *Yes; because the HPM is always paid after his work. As an LC1 Chairperson, I always receive complaints of people who do not pay for the water.*
>
> *Yes; being an LC1 Chairperson, I am a member. Financial records are being checked from the treasurer and secretary to see the accountability.*
>
> *Yes; because there is a register of water users and they use it for money collection and it is monthly. Because as an LC1; I saw them paying the HPM.*

This finding connotes that the WUC is fully in charge of collecting the community contribution for meeting initial construction costs and for the O&M and repair of the water supply systems. However, even though this was strength on the part of the WUC, there was no documentary evidence of how the funds collected were properly kept. The financial management records of all the 35 water sources visited did not show an aspect of banking of the O&M funds collected. Asked to substantiate why this was the case, the respondents hinted that they had limited knowledge on how to open up water source bank account and how to run it. This is not in favor of the DIM (Ministry of Water and Environment, 2012) that stipulates in part the roles of the WUCs as: mobilizing WUs to contribute funds towards O&M, collecting these funds on a regular basis, and opening a bank account for keeping these funds.

With the statement that having a WUC helps to keep the water source working; all of the 168 (100%) respondents agreed. All of the 24 LC1 Chairpersons and the 2 HPMs that were interviewed

also agreed when asked whether having a WUC helps keep the water source working as cited below:

> *Yes; the committees have by-laws which they enforce on people. The committee holds meetings regularly and helps in fund mobilization and repairs of the borehole regularly. The committee also helps in lobbying for funds for repairing of boreholes at the Sub county level.*

Indeed the majority of the interviewed respondents further stressed the need to have the competency of the WUCs improved through training and to re-constitute those that have disintegrated as one of the best operational practices in the quest for sustainability.

This finding meant that the respondents attach special importance to WUC for the sustainability of communal water supplies by recognizing the fact that, water development and management should be based on a participatory approach, involving users, planners, and policy-makers at all levels as held in the Dublin statement, (1992). The finding reflects the need for participation through the formation of a WUC as an important aspect for successful community management and sustainability of improved water sources.

4.4.1.2 Correlation analysis of CWSMI and sustainability of improved water sources

The study used Spearman's correlation technique to establish the direction and degree of a relationship that existed between CWSMI and sustainability of improved water sources in the study area. Table 4.4 indicates how the results emerged.

Table 4.4 shows the correlation results for the variables; CWSMI and Sustainability. Results reveal that there was a moderate positive linear relationship of .326 = 32.6% between CWSMI and sustainability of water sources. At the 95% confidence level the sig. value was = .000 and given that the value was less than 0.05 the error margin ($p<0.05$), hence a statistical significance.

Table 4.4: Correlation results of CWSMI and sustainability of improved water sources

Correlations[a]				
			Community-based Water Supply Management Institutions	Sustainability of Improved Water Sources
Spearman's rho	Community-based Water Supply Management Institutions	Correlation Coefficient	1.000	.326**
		Sig. (1-tailed)	.	.000
	Sustainability of Improved Water Sources	Correlation Coefficient	.326**	1.000
		Sig. (1-tailed)	.000	.
**. Correlation is significant at the 0.01 level (1-tailed).				
a. List wise N = 168				

Source: Primary data

This means that CWSMI through having a WUC that is elected by the general assembly and composed of at least 50% women; a WUC in which women hold executive positions and their participation in the committee business is not interfered; and a functional WUC that has a water user's register and collects O&M funds are likely to bring about sustainability of improved water sources.

4.4.1.3 Regression analysis for CWSMI and sustainability of improved water sources

The study used simple regression technique to determine the percentage effect or variation that CWSMI had on sustainability of improved water sources. A coefficient of determination $R^2$was computed and used to infer the amount of variation that CWSMI had on the sustainability of improved water sources in the study area (see results in table 4.5). Simple regression technique was adopted since the study was dealing with only one independent and dependent variable.

Table 4.5: Model summary of regression analysis results on CWSMI and sustainability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.345[a]	.119	.114	.289

a. Predictors: (Constant), CWSMI

Source: Primary data

The model summary table 4.5 shows that; R=.345, R^2=.119, adjusted R^2=.114 and standard error of estimate of .289. The adjusted R^2 value of .114 clearly reflects an 11.4% (.114 x 100%) effect of CWSMI on sustainability with the remaining percentage of 88.6% attributed to other factors.

4.4.1.4 Conclusion on hypothesis one

The null (h_0) hypothesis was rejected and the alternative (h_1) hypothesis that; "CWSMI have a positive relationship with sustainability of water sources in Arapai Sub County" was accepted.

4.4.2 PSP in water supply and sustainability of improved water sources

To answer research question number two that asked whether there was a relationship between PSP in community water supply and sustainability of water sources in Arapai Sub County, respondents were asked to rate various facets of PSP in water supply on sustainability of improved water sources in Arapai sub county. The results that emerged are shown in table 4.6.

Table 4.6: Descriptive statements about private sector participation in water supply

Statements on private sector participation	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq.(%)	Freq.(%)	Freq.(%)	Freq.(%)	Freq.(%)		
Hand pump mechanics are readily available to repair the water source	3 (1.8)	26 (15.5)	2 (1.2)	94 (56.0)	43 (25.6)	3.88	1.020
Hand pump mechanics always do a good job for us	0 (0.0)	4 (2.4)	5 (3.0)	89 (53.0)	69 (41.1)	4.34	.655
Hand pump mechanics train caretakers on minor repairs of hand pumps	15 (8.9)	46 (27.4)	15 (8.9)	67 (39.9)	25 (14.9)	3.24	1.255
Hand pump mechanics visit our water source always to check for faults	33 (19.6)	67 (39.9)	9 (5.4)	45 (26.8)	13 (7.7)	2.63	1.282
Charges by Hand pump mechanics for repair works are affordable	4 (2.4)	48 (28.6)	7 (4.2)	90 (53.6)	19 (11.3)	3.43	1.092
Hand pump mechanics have enough tools to carryout repair works	1 (0.6)	9 (5.4)	17 (10.1)	93 (55.4)	48 (28.6)	4.06	.809
We buy borehole spares from the hard-wares in the sub county	71 (42.3)	74 (44.0)	11 (6.5)	12 (7.1)	0 (0.0)	1.79	.856
The cost of the spares is affordable	24 (14.3)	64 (38.1)	9 (5.4)	62 (36.9)	9 (5.4)	2.81	1.228

Source: Primary data

4.4.2.1 Descriptive results

Table 4.6 shows that 137 (81.6%) of the respondents agreed with the statement that HPMs are readily available to repair the water source and 29 (17.3%) and 2 (1.2%) respectively did not agree and were not sure with this statement. The majority of the LC1 Chairpersons who answered in affirmative when asked to comment on the response of the HPMs whenever they are called upon for repair work underpinned this finding. Their popular comment was:

> *Their response is positive and immediate and they are readily available especially when there is money. In addition, the Handpump mechanic comes immediately whenever there is a problem especially for water sources that are nearer to him.*

The LC1 Chairpersons however, hinted that there are instances when the Handpump mechanics delay to respond especially when the WUC has not organized money for their payment, spare parts have not been purchased or the WUC has other commitments.

On average therefore, the respondents agree that the HPMs are readily available to repair water sources. This finding indicates that the implementing agencies devote some effort to ensure that trained technicians, as HPMs are available within the Sub County to help communities in O&M issues of their water sources. This finding also signifies that the HPMs are committed to their job of repairing handpumps. The HPMs being key private technicians for handpumps repair in the Sub County are vital for sustainability of the water sources.

Regarding the quality of work that the HPMs perform during repairs, apart from only 4 (2.4%) and 5(3%) who disagreed and were not sure respectively, the rest of 158 (94.1%) of the respondents agreed that HPMs always do a good job for them. On the sufficiency of tools used by HPMs, the majority 141 (84%) of the respondents agreed that HPMs have enough tools to carryout repair works. These findings mean that HPMs have received adequate training and tools from specialized institutions and thus have sufficient capacity to handle the repairs of handpumps. They also suggest

that the skills of the HPMs have been upgraded to match with the changing technology. Skilled and tooled HPMs play a critical role in CBMS by carrying out repairs of water facilities to the satisfaction of the WUs, which is a sign of guaranteed technical sustainability.

When responding to the statement that HPMs visit our water source always to check for faults; 100 (59.5%) of the respondents disagreed while 58 (34.5%) agreed and only 9 (5.4 %) were not sure. This finding was strengthened by the interview with the LC1 Chairpersons in which a large majority of them disagreed when asked whether HPMs visit the water sources to check for faults. They argued that this was the case because the HPMs were not facilitated to do the monitoring of water sources and that they were few and far away. The following are views from some of them:

> *No; they come only on programme whenever they are called because they are fewer i.e. only two and yet Arapai Sub County has got seven parishes and it is only one HPM who is active.*
>
> *No; unless they are called because they say that government has never facilitated them to do the monitoring work.*
>
> *They rarely come – only whenever he is on his way to repair another borehole because most of them are committed and are not facilitated.*

The majority of interviewed respondents suggested that the best way to enhance sustainability with respect to PSP is to train more HPMs to increase their number to at least one in each parish for the five parishes in the study area.

This finding indicates that the monitoring and reporting that is one of the roles that HPMs are supposed to play is not sufficiently done. In fact, the Sub county key informant when asked during the interview whether the HPMs submit reports claimed having seen no report submitted by the HPMs. This is unfortunate situation because it is such informative reports submitted by such key stakeholders that can be used during situation analysis to design appropriate interventions. In the absence of such reports, the status quo of the water supply facilities will be hard to change.

Regarding charges by the HPMs for repair works, 109 (64.9%) agreed that the charges were affordable; 52 (31%) disagreed and only 7 (4.2%) were not sure. The majority of LC1 Chairpersons who were interviewed also agreed that the charges imposed by HPMs for repair works were affordable. Some of the respondents noted the following:

> *Their prices are fair because the WUC always agrees with him on which amount to pay (negotiable) depending on the problem.*
>
> *The charges are affordable because they usually do not charge the water users beyond what the district has told them. In most cases they charge 40,000 Uganda Shillings if the problem is big.*
>
> *The charges are high especially when it comes to major repairs; the community finds it hard to pay.*

During the documentary review, the maintenance records of boreholes pointed out issues of additional transport costs levied by the HPM. For instance on record it was noted: "*the challenge that this committee experiences is that; the HPM always charges them a lot of money for his transport besides the money they are to pay him after his work*".

On average, the respondents had mixed views about the costs of handpump repairs by the HPMs. This finding shows that there is perhaps little knowledge or inadequate enforcement of the regulations that are in place (if any) regarding the activities of the HPMs including their levies for the work which they do for the WUCs. The finding also meant that since the fee that is to be paid to the HPM is to be negotiated, charges are bound to vary depending on the negotiating ability of an individual WUC. This can have adverse implications on sustainability especially if the charges are negotiated higher and beyond the capacity of the WUs to meet in time.

Respondents had mixed reactions on the statement that the cost of the spares is affordable. About half of the respondents i.e. 88 (52.4%) disagreed, 71 (42.3%) agreed with only 9 (5.4%) not sure.

Even with mixed responses on this statement, it emerged clearly that the majority of the respondents disagreed with it. During the interview, one respondent said: *"the fee charged by Handpump mechanics is affordable; it is only spare parts which are expensive".*

This finding hints that the cost of spare parts for maintenance of handpumps in the study area is not affordable. This is likely to increase the cost of maintenance and ultimately increasing down time – the time when the water facility is not functioning.

On the statement that, we buy borehole spares from the hard-wares in the sub county; 145 (86.3%) respondents disagreed, 11 (6%) were not sure and only 12 (7.1%) agreed. The majority of the respondents were in disagreement with this statement. This was corroborated by the responses from the LC1 Chairpersons and HPMs during interviews as noted below when they were asked how water users acquire spare parts for repairing their water sources. "*Through the money mobilized by the water users and they get their spares in the district hard ware spare parts shops and use a motorcycle for transportation which is expensive for them".*

When asked how the sub county ensures that spare parts needed for repairing the water sources are easily accessible to the WUCs, the Sub county key informant noted: *"This is very difficult to tell since the communities prefer dealing directly with the HPMs".* This is an indication of the absence of a reliable spare parts supply chain in the Sub County and apparently, little effort is invested in addressing this loophole.

During the documentary review, the problem of accessing spare parts was cited in the minutes of committees and maintenance records of the majority of water sources. Long distance to spare parts centers (mostly mentioned as located in Soroti town) and the associated transport costs were identified as the major bottle necks faced by the WUCs in reinstating broken down handpumps – they made the whole activity expensive and as a result some WUCs had resorted to second hand

spare parts that are a little cheaper to acquire. In fact, the interviewed respondents considered that, establishment of a sustainable spare parts supply chain that includes a spare parts shop at the Sub County was the best thing to do. This they said would bring the spare parts nearer to the community and reduce on all the costs associated with scarce spares.

This finding meant that there is no clear sustainable supply chain for handpump spare parts in villages in the study area. This renders the accessibility of spare parts for pump maintenance and their respective supply chains as one of the frail links in the quest for sustainability of water sources. The nonexistence of spares dealers in the study area can have adverse implications on sustainability since transport and other administrative costs can significantly increase the cost of spare parts.

4.4.2.2 Correlation analysis of PSP and sustainability of improved water sources

The study used Spearman's correlation technique to establish whether a relationship existed between PSP in community water supply and sustainability. Table 4.7 indicates how the results emerged.

Table 4.7: Correlation analysis results of PSP in community water supply and sustainability

Correlations[a]				
			Sustainability of improved water sources	PSP in community water supply
Spearman's rho	Sustainability of improved water sources	Correlation Coefficient	1.000	.296**
		Sig. (1-tailed)	.	.000
	PSP in community water supply	Correlation Coefficient	.296**	1.000
		Sig. (1-tailed)	.000	.
**. Correlation is significant at the 0.01 level (1-tailed).				
a. Listwise N = 168				

Source: Primary data

Table 4.7 shows the correlation results for the variables; PSP in community water supply and sustainability. Results reveal that there was a moderate positive linear relationship of .296 = 29.6%

between PSP in community water supply and sustainability. At the 95% confidence level the sig. value was = .000 and given that the value was less than 0.05 the error margin ($p<0.05$), hence a statistical significance. This means that PSP in community water supply through: adequately tooled HPMs who are readily available to duly perform the repairs on the handpumps; regulation of handpump repair charges; stocking of spare parts and improvement of their supply chains within the sub county is likely to bring about sustainability of improved water sources in the study area.

4.4.2.3 Regression analysis for PSP and sustainability of improved water sources

A regression technique was used to determine the percentage effect or variation that PSP in community water supply had on sustainability (see results in table 4.8).

Table 4.8: Model summary of regression analysis results on PSP and sustainability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.239[a]	.057	.051	.299

a. Predictors: (Constant), PSP in Community Water Supply

Source: Primary data

The model summary table 4.8 shows the R=.239, R^2=.057, adjusted R^2=.051 and standard error of estimate of .299. The adjusted R^2 value of .051 clearly reflects a 5.1% (.057 x 100%) effect of PSP in community water supply on sustainability with the remaining percentage of 94.9% attributed to other factors.

4.4.2.4 Conclusion on hypothesis two

The null (h_0) hypothesis was accepted and the alternative (h_1) hypothesis that; "there is no relationship between PSP in water supply and sustainability of improved water sources in Arapai Sub County" was rejected.

4.4.3 Government back-up support and sustainability of improved water sources

Research question number three concerned whether government back-up support in water supply affects the sustainability of water sources in the study area. To ascertain this, respondents were asked to rate various facets of government back-up support on sustainability of water sources in the study area and results emerged as shown in table 4.9.

Table 4.9: Descriptive statements about government back-up support on water supply

Statements on government back-up support systems	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
Government officials visit to check on major issues related to the water source	51(30.4)	45(26.8)	16(9.5)	46(27.4)	10(6.0)	2.52	1.331
Communities were educated on water issues by government	22(13.1)	54(32.1)	15 (8.9)	58(34.5)	18(10.7)	2.98	1.280
Government has set the maximum repair charges by the hand pump mechanics	10 (6.0)	20(11.9)	81 (48.2)	40(23.8)	15 (8.9)	3.18	.968
The water user committee was trained	17(10.1)	45(26.8)	7 (4.2)	77(45.8)	22(13.1)	3.25	1.266
Government gives refresher training to the hand pump mechanics	12 (7.1)	8 (4.8)	108(64.3)	30(17.9)	10 (6.0)	3.11	.862
Tools used by the hand pump mechanics were provided by government	11 (6.5)	7 (4.2)	88 (52.4)	42(25.0)	20(11.9)	3.32	.967
The Hand pump mechanics are facilitated to monitor water sources	20(11.9)	22(13.1)	106(63.1)	9 (5.4)	11 (6.5)	2.82	.945

Source: Primary data

4.4.3.1 Descriptive results

While responding to the statement that government officials visit to check on major issues related to the water source; 96 (57.2%) of the respondents disagreed while 56 (33.4%) agreed and only 16 (9.5 %) were not sure. This finding was supported by responses from interviews with LC1 Chairpersons in which slightly more than half of the respondents disagreed when asked whether government officials visit to check on major issues related to the water source. The respondents presumed that as best operational practice, there was need for implementing agencies to plan and allocate resources

to enable officials to do regular visits to check on the major issues affecting the communities and their water supplies. Some of the responses are cited below:

> *No because of the reasons, we cannot tell. Either they are busy or not. As an LC1 Chairperson, I can't tell why they can't come.*
>
> *No. unless they are informed on issues pertaining to the borehole because in most cases they rely on the information presented to them by the executive committee.*
>
> *No. they don't come because they say that they are not facilitated to do it due to lack of transport and allowance.*

This finding indicates that regular visits that are needed by the community and that are supposed to be provided by an overseeing institution are lacking. Consequently, the need to contribute for O&M and the willingness to sustain this need cannot be re-affirmed and hence creating unsuitable environment for sustainability to thrive in.

In response to the statement that communities were educated on water issues by government; respondents 76 (45.2%) agreed and 76 (45.2%) equally disagreed with only 15 (8.9%) not sure. There were mixed responses on this statement. The information obtained from the documentary review corroborated this finding. The documents reviewed indicated that some members of the WUCs were trained while others did not receive any training at all. This finding questions government's effort to train communities in simple bookkeeping and financial management in order to help them carry on with their roles. The finding gives a picture of inadequate effort and energy being invested in building the capacity of the WUs and WUCs to handle affairs geared towards the achievement of sustainability of water sources. Sustainability of a water source relies on WUCs and communities in general whose capacity is adequately built up to run the affairs of O&M of their water sources. Some of the affairs that can motivate and solicit willingness of the users to continue contributing the agreed users' fees include: organizing and attending meetings, keeping O&M records and providing a convincing accountability of the O&M funds that were collected.

During the interview, while responding to the question on how stakeholders could improve on the sustainability of improved water sources in line with the government back-up support, the majority of the respondents suggested that community education on water and sanitation issues was a pre-requisite.

With regard to the statement that government has set the maximum repair charges by the HPMs, 30 (17.9%) of the respondents disagreed; nearly a half (48.2%) of the respondents were not sure and 55 (32.7%) agreed with the statement. Results indicate that WUCs and communities at large are not aware of the bracket of levies that the HPMs are supposed to charge whenever they provide a service. The regulation of handpump repair charges is a function of government to ensure that the WUCs are not over charged by the HPMs and the HPMs are not underpaid by the WUCs. This finding meant that implementing agencies seem to have underperformed on this aspect of creation of awareness on the WUs on the available regulations. With this situation at hand, it will be quiet difficult for the WUCs to enter in to handpump repair agreements with the HPMs since one of the key ingredients of such agreement is the offer by the HPM to do the job whose price the WUC has to ably negotiate with the HPM. Indeed, during the documentary review and in water sources where repair agreements were found missing like in Onyorai and Aloet-Akum boreholes; the WUC confessed that they did not know how to design one, what to include in it; and in addition they did not comprehend its importance. The inadequate awareness of the ceiling of repair charges that are imposed by the HPMs can result in to exorbitant prices and can have adverse effects on the overall sustainability of water sources.

On the statement that, the WUC was trained; 61 (36.9%) disagreed, 99 (58.9%) agreed and only 7 (4.2%) were not sure. This finding was corroborated by the interview findings in which slightly half of the respondents acknowledged that the WUCs were trained. Results mean that some effort is

being expended by implementing agencies to provide some external support (retraining and technical support) to the WUCs in order to keep them motivated. WUCs acting as community management structures need to be assisted to be transparent with their water fund management through proper training because this is what will keep the facilities working. Unending institutional support through education and habitual monitoring; use of other media to restate roles and responsibilities; easing associations between communities and support agencies e.g. private sector; and setting and enforcement of bye-laws and regulations enhance communities to undertake their roles and responsibilities. These can help to pre-empt some of the problems like weakening enthusiasm to meet O&M that can significantly affect sustainability.

As for the statement that HPMs are facilitated to monitor water sources; the majority 106 (63.1 %) of the respondents were not sure, followed by 42 (25%) who disagreed and only 20 (11.9 %) agreed. The majority of the respondents interviewed said that HPMs do not monitor the performance of water sources. They believed that non-facilitation was the reason why HPMs were not making any visit to the improved water supply facilities. Interviewed respondents were more knowledgeable on the status of facilitation of the HPMs to monitor the performance of water sources. This could be attributed to their being in close touch with government and other agency development programmes that the ordinary WUCs may not easily be in position to.

In response to whether the tools used by HPMs were provided by government, nearly half of the respondents – 88(52%) were not sure. About 108 (64.3%) of the respondents were also not sure whether government gives refresher training to the HPMs. Results generally mean that, little is known of government's package of support to the work of HPMs. WUCs and WUs in general need to be made aware of the available technical services and competencies harbored by the HPMs including any support rendered to them by external agencies. This awareness is important to enable

them reach a fair bargain with the HPMs especially during the formulation of handpump preventive maintenance and repair agreements and while negotiating on any other payments to be made to the HPMs. This finding implies that WUCs and WUs cannot easily negotiate favorable preventive maintenance agreements and repair charges with the HPMs and this is likely to disable communities in sustaining water sources.

4.4.3.2 Correlation analysis of government back-up support and sustainability

Spearman's correlation technique was used to establish the type of relationship between government back-up support and sustainability. Table 4.10 indicates how the results emerged.

Table 4.10: Correlation analysis results of government back-up support and sustainability

Correlations[a]				
			Sustainability of Improved Water Sources	Government Back-up Support in community Water Supply System
Spearman's rho	Sustainability of Improved Water Sources	Correlation Coefficient	1.000	.209**
		Sig. (1-tailed)	.	.003
	Government Back-up Support in community Water Supply System	Correlation Coefficient	.209**	1.000
		Sig. (1-tailed)	.003	.
**. Correlation is significant at the 0.01 level (1-tailed).				
a. Listwise N = 168				

Source: Primary data

Table 4.10 shows the correlation results for the variables; government back-up support in community water Supply systems and sustainability. Results reveal that there was a weak positive linear relationship of .209 = 20.9% between government back-up support in community water supply systems and sustainability. At the 95% confidence level the sig value was = .003 and given that the value was less than 0.05 the error margin ($p<0.05$), hence a statistical significance. This means that government back-up support in community water supply systems is likely to bring about sustainability of improved water sources. This is particularly through government officials visiting to check on major issues related to the water source; education of communities on water issues;

regulation of the repair charges levied by the HPMs; training and re-training of the HPMs and WUCs; and facilitation of the HPMs to monitor water sources.

4.4.3.3 Regression analysis for government back-up support and sustainability

A regression technique was used to determine the percentage effect or variation that government back-up support had on sustainability (see results in table 4.11).

Table 4.11: Model summary of regression analysis on Government Back-up Support and sustainability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.070[a]	.005	-.001	.307

a. Predictors: (Constant), Government Back-up Support in community Water Supply System

Source: Primary data

The model summary table 4.11shows the R=.070, R^2=.005, adjusted R^2=-.001 and standard error of estimate of .307. The adjusted R^2 value of -.001 clearly reflects a -0.1% (-.001 x 100%) effect of government back-up support on sustainability with the remaining percentage of 99.9% attributed to other factors. The negative value of adjusted R^2 reflects the negative effect on sustainability of reduced government back-up support on community water supply in the study area.

4.4.3.4 Conclusion on hypothesis three

The null (h_0) hypothesis was accepted and the alternative (h_1) hypothesis that; "government back-up support in water supply do not affect sustainability of water sources in Arapai Sub County" was rejected.

4.5 Sustainability of improved water sources

To analyze sustainability of improved water sources in Arapai Sub County, the study examined financial, technical, institutional, and environmental dimensions of sustainability.

The financial dimensions are about good O&M practices, community financing, subsidy, and willingness by the water users to sustain the water sources. It also entails tariff design and management. The technical aspects included availability, accessibility, and cost of spare parts; and the engagement of the needed technical skills (human resource) to operate and maintain the water supply system. The environmental factors included quality of the water (whether the water needs to be treated), quantity of the water in terms of yield and continuity of supply, adequate protection of the water source, and the impact of waste water on the environment. The institutional factors included strengthened institutional capacity in terms of the WUCs playing their roles that include development of O&M plan; setting up, approval, and implementation of by-laws.

Respondents were asked to rate the various aspects of sustainability of improved water sources in Arapai Sub County. The results that emerged are shown in table 4.12A-D.

Table 4.12A: Descriptive statements on financial sustainability

Statements on financial sustainability	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
Water users are willing to pay fees for repairing the water source	6 (3.6)	16(9.5)	2 (1.2)	99(58.9)	45(26.8)	3.96	.993
The user fee is decided by all the water users	1 (0.6)	1 (0.6)	0 (0.0)	68(40.5)	97(57.7)	4.55	.598
The fees collected from the water users is enough to meet all the repair costs	15(8.9)	74(44.0)	9 (5.4)	55(32.7)	15 (8.9)	2.89	1.216
Hand pump mechanics are paid immediately after their work	4 (2.4)	46(27.4)	3 (1.8)	72(42.9)	43(25.6)	3.62	1.203
The water users are given accountability of the collected money	4 (2.4)	7 (4.2)	3 (1.8)	88(52.4)	66(39.3)	4.22	.865
It takes less than one week for the water source to be repaired after breakdown	30(17.9)	62(36.9)	11(6.5)	54(32.1)	11 (6.5)	2.73	1.265

Source: Primary data

SD(1)=strongly disagree, D(2)=Disagree, NS(3)=Not sure, A(4)=Agree, SA(5)=Strongly Agree

Table 4.12A shows that, 144 (85.7%) of the respondents agreed that WUs are willing to pay fees for repairing the water sources. Another 165 (98.2%) agreed that the user fee was decided upon by the entire WUs. These findings were backed by responses provided by the LC1 Chairpersons during interviews in which the majority indicated that the WUs were always willing to pay users' fees. One of them said, "*They are always positive because they know very well that it is their duty to do minor repairs and keep the bore hole working and maintained".*

These findings mean that the WUCs fulfill their roles of maintaining an up-to-date list of water users, mobilizing WUs to contribute towards O&M and collecting these funds on a regular basis; and ensuring that preventive maintenance is carried out. The findings also meant that the community members are playing their roles of selecting a WUC and paying contributions towards O&M. The O&M charges must fit within the willingness-to-pay limits of the WUs and should be conserving, affordable, fair, enforceable, and serviceable in order to ensure the financial sustainability of the water supply facility.

The basic principles behind achievement of sustainability of a water supply facility through CBMS are that the community has a major role in its development; should own the water facility after its development, and have overall responsibility for its O&M. In this regard, community members are normally expected to contribute to initial system installation costs and to meet all ongoing maintenance and repair costs through the regular payment of appropriate water levy. Notwithstanding the traditional thinking that water is a basic social good, God given and a life line of mankind, and should if possible be supplied free of charge, some input is needed in order to access it as a portable product by some convenient means. In other words, water is social good that is basic to human life but also requires some degree of financial support to facilitate the O&M of facilities used for its extraction.

As to whether the agreed user fees collected from the WUs were enough to meet the entire repair costs, 89 (52.9%) of the respondents disagreed leaving only 70 (41.6%) in agreement. This finding was confirmed when the HPMs were interviewed and in which they responded that users' contributions were made but were unable to meet all the expenses for the repair and maintenance of the facilities. In response, one of them was noted saying: "*Yes but the funds are not always enough due to failure of some water users to pay the agreed money*".

This finding was also buttressed by the documentary review findings in which WUC records indicated that money mobilized by the WUCs was not enough to buy spares and pay for other O&M related costs. Negative attitude towards WUC by WUs – that the WUC members embezzle O&M funds for their own survival; high cost of spares, long distance to spares centers requiring additional fees for transport were cited as major reasons causing the inadequacy of the funds collected by the WUCs.The others are high rate of defaulters, and the thinking within the WUs that it is the role of government to maintain the water supply facilities.

This finding implies that some WUs set low tariffs and this coupled with high numbers of defaulters – those who are unable or evade paying even the small-agreed fee makes it difficult to meet the actual repair and maintenance costs of the facility. This is likely to jeopardize the financial sustainability of the water supply facilities.

The majority 115 (68.5%) of the respondents also agreed that HPMs were paid immediately after their work. When HPMs were asked whether they were paid promptly for their work, they argued that WUCs sometimes promptly paid them and sometimes payment is delayed because in most cases the WUCs preferred buying spare parts first and then payment the HPM later. HPMs are key technicians for handpumps whose remuneration is done by WUC after they have undertaken maintenance and repair work at the request of the WUC. The finding indicates a good O&M

practice from the WUCs and the WUs at large and is likely to create good working relations between the HPMs and the WUCs. The result can be prompt response and good quality work from the HPMs whenever called upon by the WUC and this has positive implications on the financial and technical sustainability of the water sources.

On issues of accountability; respondents 154 (91.7%) agreed that WUs are given accountability of all the money collected. This position was supported by a slight majority of LC1 Chairpersons during interviews when they were asked whether they had received any complaints from the WUs on mismanagement of the maintenance funds. One of them answered, *"No; because the money the committee collects is always used for repair of the borehole and for buying spare parts".*

The finding indicates that WUCs are efficient and effective in planning and budgeting for O&M funds and exhibit transparency during execution of their roles and responsibilities. The transparency of village water accounts is an important factor for financial sustainability as it builds up the confidence and trust of those who contribute on those who collect fees.

In response to the statement regarding the time taken to reinstate broken down water sources, 92 (54.8%) of the respondents disagreed that it takes less than a week to repair the water source while 65 (38.6%) agreed that the water source was repaired within a week after it had broken down. Those who were not sure constituted 11 (6.5%). This finding is corroborated by qualitative findings during the documentary review in which some boreholes like Agemo borehole that were reported not functional for nearly a year. This finding means that the users of such boreholes that take a long time before they are repaired have to resort to alternative water sources which may be contaminated and/or considerably far away.

Table 4.12B: Descriptive statements on technical sustainability

Statements on technical sustainability	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
Technical problems are reported to the hand pump mechanic immediately they occur	7 (4.2)	18(10.7)	1 (0.6)	90(53.6)	52(31.0)	3.96	1.060
The spare parts for the water source are within easy reach	15(8.9)	127(75.6)	1 (0.6)	18 (10.7)	5 (3.0)	2.22	.870

Source: Primary data

SD(1)=strongly disagree, D(2)=Disagree, NS(3)=Not sure, A(4)=Agree, SA(5)=Strongly Agree

Table 4.12B shows that, 142 (84.6%) of the respondents agreed that, technical problems are reported to the HPMs immediately they occur. This finding implies that broken down water sources could be reinstated immediately after break down and this would ensure continuous supply of clean safe water to the community but this is not the case as established from the previous section.

With regard to the availability of spare parts, the majority 142 (84.6%) of the respondents disagreed that the spare parts for the water source were within easy reach. This finding was confirmed when the LC1 Chairpersons were asked to substantiate on how WUCs acquire spare parts. The respondents were in consensus that, the WUCs acquire spare parts using water users' contributions and that the spare parts are bought from Soroti town that is located about 10 km away from the study area and are transported using hired privately owned motorcycles. One of the respondents noted: *"They get the spares in Soroti town using a motorcycle which is too expensive for them".*

This finding means that spare parts supply continues to be a feeble link in CBMS in the study area. Spare parts dealers play an important role of stocking, retailing, and distributing spare parts for water facilities. The non-existence of spares dealers can be reason for the remote existence of spare parts in the study area and this can have adverse implications on financial and technical

sustainability because transport costs increase the cost of spare parts and consequently maintenance costs. This ultimately increases the down time – the time when the water facility is not functioning.

Table 4.12(C): Descriptive statements on institutional sustainability

Statements on institutional sustainability	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
The water user committee holds meetings regularly	6 (3.6)	15(8.9)	4(2.4)	127(75.6)	16(9.5)	3.79	.870
We have developed a maintenance plan for our water source	5 (3.0)	20(11.9)	4 (2.4)	118(70.2)	20(11.9)	3.77	.918
We have by-laws governing the affairs of our water source	4 (2.4)	2 (1.2)	2 (1.2)	90 (53.6)	70(41.7)	4.31	.773
The by-laws were agreed upon by the entire water users	2 (1.2)	7 (4.2)	3 (1.8)	81 (48.2)	75(44.6)	4.31	.804
The by-laws were approved by the Local council/government	7 (4.2)	46(27.4)	7 (4.2)	80 (47.6)	26(15.5)	3.43	1.172
The water user committee enforces the by-laws	4 (2.4)	35(20.8)	5 (3.0)	66 (39.3)	58(34.5)	3.83	1.184

Source: Primary data

Table 4.12C shows that, 143 (85.1%) of the respondents agreed that water WUCs hold meetings regularly. The respondents 138 (82.1%) also agreed that an operation and maintenance plan was in place. These findings were supported during the documentary review in which the majority of the water sources that were visited had minutes of meetings and O&M plans in place. For water sources which did not have minutes of meetings like for Omariai borehole, this was attributed to laxity and failure of the WUC to convene meetings. It was also cited that, transition between the outgoing WUC and incoming WUC was not always smooth. This made accountability of funds collected and the WUC's actions difficult and ultimately negatively affecting the morale of the WUs to continue contributing for O&M. The same reasons were alluded to for Agemo borehole, constructed in 2002 in Amotot village which had broken down and therefore not functional for more than one year.

As to whether there were by-laws governing the affairs of the water sources, 160 (95%) of the respondents agreed and a further 156 (92.8%) agreed that the by-laws were agreed upon by the entire WUs. The majority of the LC1 Chairpersons interviewed approved this position in which they said that every borehole had its own by-laws and the following were stated as examples:

> *No cows should share with humans the same water source.*
>
> Every *water user is to pay monthly fee for the repair of the borehole.*
>
> The time of closing and opening *of the borehole should be strictly observed.*
>
> *Clean containers are to be used for collecting water.*
>
> *No bathing within the borehole.*

A majority 106 (63.1%) of the respondents agreed that the by-laws were approved by the LCs/government. When probed further on the approval of the by-laws, the majority of the respondents that were interviewed reiterated this finding. The LC1 Chairpersons acknowledged seeing and approving copies of their water users' by-laws as cited by one of them below: *"As an LC1 Chairperson, I have copy which I endorsed and even the Sub county officials approved it".*

When asked whether communities have by-laws governing O&M of their water sources, the district key informants agreed that there existed by-laws; 30% of which are written down and about 70% non-written and are implemented by mutual trust and consent. Substantiations from respondents during documentary review concurred with this finding. On the contrary, the Sub county key informant claimed not to have knowledge of any by-law made by the water users and submitted to the Sub County. During the documentary review and field visits, it was found that, the by-laws, which were not enforced, were those not approved by government. Consequently, those water sources that the water users did not have properly written down by-laws and those whose by-laws were not approved were observed having wanting functionality.

This finding meant that inadequate attention was accorded by implementers to the issue of constituting and formalizing by-laws necessary for the smooth running of the water supply facilities. This could be reason why there is high prevalence of defaulters of by-laws which the respondents revealed during interviews because of the difficulty to implement such unofficial laws. This discourages institutional sustainability since there are no formalized by-laws under which the CWSMI (WUCs) and the general community can easily comprehend during the O&M of their facilities. This can lead to break down of community-based institutional set up and thereby affecting institutional sustainability.

With regards to enforcement of the by-laws, 124 (73.8%) of the respondents agreed that the WUC enforced the by-laws. This finding meant that the institutional capacity at community level is to some extent being built up. It means that the implementing agencies are doing what is required to have the community-based institutions in place and equipping them with skills necessary for the O&M of water sources. The endorsement of the by-laws by the WUs is a good step towards attainment of the legitimacy and reliability of the by-laws. Ongoing institutional strengthening through encouragement to hold meetings, planning for O&M activities and setting up and implementing by-laws can help to forestall some of the troubles like declining enthusiasm to pay for O&M which is a crucial aspect for the sustainability of the water sources that are managed under the CBMS.

Table 4.12(D): Descriptive statements on environmental sustainability

Statements on environmental sustainability	Response					Mean	SD
	SD	D	NS	A	SA		
	1	2	3	4	5		
	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)		
The water yield from our water source meets our water needs	6 (3.6)	40(23.8)	11 (6.5)	75 (44.6)	36(21.4)	3.57	1.172
We are satisfied with the quality of water from our water source	5 (3.0)	26(15.5)	13(7.7)	61(36.3)	63(37.5)	3.90	1.156
We have arrangements for cleaning around our water source	0 (0.0)	1 (0.6)	3 (1.8)	108(64.3)	56(33.3)	4.30	.533
Our water source is fenced	22(13.1)	58(34.5)	1 (0.6)	47 (28.0)	40(23.8)	3.15	1.446
There is a soak pit for our water source which prevents flooding	2 (1.2)	10 (6.0)	0 (0.0)	79 (47)	77(45.8)	4.30	.846

Source: Primary data

SD(1)=strongly disagree, D(2)=Disagree, NS(3)=Not sure, A(4)=Agree, SA(5)=Strongly Agree

Table 4.12D shows that, 111 (66.0%) of the respondents agreed that the water yield from their water sources meets their water demands and 124 (73.8%) agreed that they were satisfied with the quality of water from their water source. The implication of this finding is that, a significant percentage (34%) of women still walks long distances in search of water. This has negative implications on sustainability since all the water users are not realizing direct benefits in form of adequate quantity and acceptable water quality.

Respondents 164 (97.6%) agreed that they have arrangements for cleaning around their water sources and 156 (92.8%) agreed that there is a soak pit for their water source which harvests and stores waste water. However, a slight majority 87 (51.8%) of respondents agreed that their water sources were fenced. There is a clear contradiction when respondents largely agree that they have arrangements for cleaning around their water source and yet the water sources are not fenced. This means that despite imparting knowledge to the WUCs on the need to clean around water sources, a lot more is needed to motivate them to spear head this very aspect.

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter; the summary, discussions, conclusions, and recommendations of the study were presented according to the key findings. Limitations, contributions, and areas for future researches were also integrated. Objective-by-objective summaries of findings of the study were presented in this chapter following a descriptive, correlation and regression analysis of the data collected.

5.2 Summary

The study established that a relationship exists between the variables and determined the nature of the effect or variation that the independent variables held on the dependent variable. The summary of the findings is presented according to the three main objectives.

5.2.1 The relationship between CWSMI and sustainability of water sources

The quantitative data analysis from the previous chapter revealed a correlation coefficient of 0.326 (32.6%) suggesting that there is a moderate positive statistical relationship between CWSMI and sustainability. Qualitative data obtained during the study in which all the interviewed respondents agreed that having well constituted and competent CWSMIs (WUCs) leads to better facility management also concurred with this statistical result. Both qualitative and quantitative data revealed that there were inadequate funds for O&M of the water sources and this was linked in part to weakness in WUCs to mobilize the WUs to pay adequate users' fees and their failure to account for the spent funds. Thus, the finding indicates that CWSMI are likely to influence the sustainability of improved water sources in the study area.

5.2.2 The relationship between PSP in water supply and sustainability of water sources

The analysis of quantitative data on PSP from the previous chapter revealed a correlation coefficient of 0.326 (32.6%) suggesting that there is a moderate positive statistical relationship between PSP in water supply and sustainability. During qualitative interviews; the majority of the respondents argued that there was need to train more HPMs to increase their number and to make them parish-based. In addition, a majority of them also contended that the spare parts needed to be brought nearer to the community. They argued that this is what would greatly contribute to the sustainability of improved water sources. This therefore, concurred with the statistical result obtained. Thus the finding indicates that PSP in water supply is likely to influence the sustainability of improved water sources in Arapai Sub County.

5.2.3 The effect of government back-up support and sustainability of water sources

A correlation coefficient of 0.209 (20.9%) was obtained from the analysis of quantitative data on government back-up support and sustainability from the previous chapter. This suggests that there is a weak but positive statistical relationship between government back-up support and sustainability. The qualitative findings indicated that implementing agencies did not visit communities to check on major issues regarding their water sources. These findings also revealed that there was need to educate communities on water supply issues, train WUCs, and increase the number of trained HPMs. These imply that government back-up support has not been fully realized and they agree with the obtained statistical result. Thus, the findings indicate that when little attention is paid to government back-up support towards community water supply, sustainability of improved water sources suffers.

5.3 Discussion

This section presents the key findings of the study under the three main objectives.

5.3.1 The relationship between CWSMI and sustainability of water sources

The study discovered that every improved water source under investigation had a WUC responsible for the management of the day-to-day O&M activities to ensure its sustainability. Quantitatively, it was found that all of the respondents acknowledged the need for a WUC in order to keep the water source working. This was in line with the qualitative finding in which all of the interviewed respondents agreed that having a WUC helps to keep the water source working. The statistical finding that showed 165 (98.2%) of the respondents agreeing that the members of the WUC were elected by the general assembly of WUs also agrees with the qualitative results where the respondents were in consensus that the WUC was elected by the community through voting.

These findings are in line with the New Delhi Statement (1990) which encourages community management of services with strengthening of local institutions in implementing and sustaining water and sanitation programmes in context. They also agree with the third principle of the Dublin statement, (1992) on water and sustainable development that holds that water development and management should be based on a participatory approach that is inclusive of stakeholders at various levels. These findings further agree with Brikke (2000); Harvey and Reed, (2004) who hold that; a WUC appropriately elected is crucial for successful community management of improved water sources. This means that the WUCs were legitimate, and had the mandate and the backing of the entire community. Because the WUCs are constituted by the village community, and considering the village as the basic unit for promoting the community-based approach, one would expect the sustainability of all the water sources in the study area to be successful; this is not the case. Why even with the strength of the legitimacy of the WUCs the sustainability of water sources is still a challenge in the study is a question that requires answers.

The quantitative finding that WUCs barely had 50% representation of women in their entire membership concurred with the qualitative findings which also indicated the same and which further discovered that some WUCs had as low as 20% women representation. This was in contradiction of the ideology of one of the six critical requirements that is highlighted in the NWP (1999) and the DIM (Ministry of Water and Environment, 2012) that emphasize meaningful involvement of women by ensuring their composition in the WUCs/ (WSCs) to be at least half. Consequently, the women's bigger role in water issues and their greater understanding of the water point is not adequately tapped. This finding questions the efficacy of the sector managers at local and national levels in devoting resources for carrying out social mobilization to ensure that all members of the community including women and other traditionally excluded groups participate in decision-making. This would be in order to gain collective commitment to sustain the water supply system as pointed out by Sara & Kartz (1997) and the ADB (2009).

It is important that both male and female participate in the water supply affairs so that the synergies of their different roles and capabilities translate in to sustainability of the water supply facility. Indeed the study found that, water sources with a higher women representation were better managed than those with lower women representation. For example, water sources with a WUC that had a higher women representation had unique arrangements in place such as remunerating the Caretaker, checking of financial records from the treasurer could easily and freely be done regularly. In addition, meetings were held regularly and repairs on the water source were done promptly.

During the quantitative survey, it was established that women who were in the WUCs occupied executive positions in the committee especially that of the treasurer as agreed by 61.3(90.5%) of the respondents. Qualitative results from interviews indicated consensus on the aspect of women holding executive positions in the WUC and it was further established that, even in WUCs which

had as low as 20% women representation; those few women held executive positions. The documentary evidence in which minutes of committee meetings and financial management records depicted women holding executive positions especially that of treasurer is in consonance with the quantitative finding. This is consistent with the fundamental principles of strengthening the role of major groups including the roles of children and youth, women, and local authorities which are held in Agenda 21. Ministry of Water and Environment (2012) also holds that having women meaningfully involved in water supply affairs enhances proper management of O&M users' contributions, which is a pre-requisite for the attainment of financial sustainability.

Quantitative findings in which 143 (92.2%) of respondents agreed that having women in the committee leads to better facility management were supported by a qualitative result in which there was consensus within the respondents over the same issue. The respondents argued that women were better financial managers compared to men; they are good fund raisers; they actively attend meetings; can ably educate their fellow women and children on preventive maintenance issues; and most importantly; they are not corrupt and are incorruptible. This findings agree with the United Nations Conference on Sustainable Development (Rio+20) which holds that, women are often responsible for the management of water; they educate their children on safe water uses and proper sanitation and hygiene in developing countries.

The findings mean that stakeholders even at community level are aware of the synergies that can accrue when women are working together with men in water supply affairs. However, the quantitative and qualitative findings that WUCs barely had 50% women representation contradict this aspect. Why even with adequate knowledge of the benefits for women inclusion in water supply affairs; their representation is still minute in important organs like the WUC is a matter that requires to be addressed. In order to benefit from the central role that women play in domestic water supply

within the home, there is need for more commitment and willingness to increase their numbers in WUCs and in any other water supply decision-making forums.

Qualitative findings that the WUCs have made a water users' register which is used during the collection of the user fees confirms the quantitative finding in which all of the 168 (100%) respondents agreed that the WUC collects maintenance fees from the water users. Documents from all the water sources surveyed included a water users' register, which respondents argued to be helpful in the collection of O&M funds also corroborated the quantitative results. These findings are in line with Yan, Asante and Birner, (2010); Harvey & Reed, (2007) who hold that the WUC is in charge of collecting contributions for capital development and for meeting the O&M and repair costs of the water supply system. The findings also harmonize with Ministry of Water and Environment (2012) which stipulates in part the roles of the WUCs as: maintaining an up-to-date list of water users; mobilizing WUs to contribute towards O&M and collecting these funds on a regular basis to be kept in the bank; and ensuring that preventive maintenance is carried out. This is in conformity with The Systems Theory, which holds that a system is a collection of elements that work together to perform a task. In this case, the WUCs collecting money from WUs to buy spare parts and to pay the HPMs in order to have the water supply system maintained and functioning is typical of a functioning system.

However, even though quantitative and qualitative results depicted strength on the part of the WUC in the mobilization of the O&M contributions, there was no documentary evidence of how the funds collected were properly kept. The financial management records of all the 35 water sources visited did not show an aspect of banking of the O&M funds collected which contradicts Ministry of Water and Environment (2012) that emphasizes the banking of all the O&M funds collected. When asked to substantiate on why this was the case, a significant number of the respondents hinted that they

had limited knowledge on how to open up water source bank accounts and did not know how to run it. Leaving public funds in individual custody could lead to misappropriation, which is dangerous for financial sustainability.

5.3.2 The relationship between PSP in water supply and sustainability of water sources

The quantitative finding that HPMs are readily available to repair the water sources in which 137 (81.6%) of the respondents agreed was underpinned by qualitative results in which the majority of the respondents agreed that the HPMs were readily on call for repair work. This finding is line with Ministry of Water and Environment, (2012) that holds that a HPM is expected to operate at the sub-county level where the WUCs can easily have access to him/her. However, although both qualitative and quantitative results majorly portrayed HPMs being on call, respondents claimed that this was achieved with difficulty because the seasoned HPMs were few (2 in number) operating in the entire sub county of five parishes. This agrees with Youth Development Organization [YODEO], (2007) and WaterAid (2004) (as cited in Nekesa and Kulanyi, 2012) who identified and presumed the difficulty to access a trained technician and limited availability of HPMs as one of the several causes of low functionality of boreholes.

In Arapai Sub County, the study established that there were only two trained and legitimately recognized HPMs moving throughout the villages in the Sub County doing maintenance and repair works on water sources. It was revealed that water sources nearest to the HPM and for those where the HPM was promptly paid and in which the community was generally supportive received immediate attention from the HPM whenever there was a problem.

This finding implies that a lot more is required from the implementing agencies to devote ample effort and commitment to ensure that trained technicians are sufficiently available locally to help

communities in O&M issues of their water sources. In fact, much as the few available HPMs were claimed to be on call, all the water sources that were in disuse; e.g. Angai primary school borehole and Agirigiroi shallow well had their break down and disuse attributed to poor access to the HPMs in addition to other factors. Broken down water sources take more than one week before they are repaired, this study has established. This is contrary to DeGabriele (2002) who held that for adequately managed water sources, it takes 1-4 days for their reinstatement after they have been broken down. The challenge of few and distant HPMs needs to be dealt with pragmatically since HPMs are key technicians for handpumps who play an important role in CBMS leading to sustainability of water sources.

Quantitative findings indicate that monitoring of the functionality of water sources in Arapai Sub County is minimally done by the HPMs as brought out by 100 (59.5%) of the respondents. A large majority of the respondents during the qualitative survey concurred with those respondents in the quantitative survey when they disagreed that HPMs visit their water sources to check for faults. These findings contradicted the National O&M framework (Ministry of Water and Environment, 2011) that stipulates one of the roles of HPMs as that of monitoring and reporting on the functionality of the water sources; a role that the HPMs need to be facilitated to do.

This study established non-facilitation of HPMs and long distance between the water sources and the HPMs as the cause of failure by the HPMs to do monitoring. Monitoring by the HPMs was considered a special task, which needed some form of reward. This meant that the monitoring and reporting, which is one of the important roles that HPMs are supposed to play, is not sufficiently done.

The study also discovered that HPMs hardly submit monitoring and repair reports to the Sub County local government. Nekesa & Kulanyi (2012) who also reiterated the need for HPMs to do

monitoring, discussed that such a situation of HPMs not submitting reports could result to inadequate information around O&M such as: information on costs, functionality, and consumer feedback loop. This therefore, could ultimately lead to difficulty in deducing appropriate interventions with respect to sustainability of improved water sources.

Qualitative and quantitative findings from this study have indicated that there is no clear sustainable supply chain for the delivery of spare parts to the WUs for the repair of handpumps in Arapai Sub County. When prompted whether the WUs obtain spare parts within the Sub County, the majority of the respondents during qualitative survey disagreed thereby supporting quantitative approach results in which 86.3% of the respondents disagreed that they obtain spare parts within the Sub county. This has made the availability, accessibility, affordability and the appropriateness of handpump spares difficult in this Sub County. Further qualitative interviews with the sub county key informant revealed that the Sub County officials had inadequate knowledge on how WUs acquire spares. The key informant explained that he had no idea of how the WUs acquired spares because they always dealt directly with the HPMs and not the Sub County.

The study established that the WUCs and/or HPMs always traveled to Soroti town to purchase spare parts for the repair of handpumps whenever there is a breakdown of the water source. These findings further substantiated the statistical result that was obtained. It was noted that, additional transport costs incurred by the HPM made him to hike the overall fees for the repair and maintenance works and hence making the whole repair and maintenance process expensive for the WUCs and the WUs in general. This finding is in line with Oyo, (2006) who holds that at any one given moment in Africa; 50 percent or more of handpumps are nonfunctional, due in part to difficulties in obtaining spare parts. The same view is held by Harvey and Reed, (2003, 2004&2006); Nekesa and Kulanyi (2012); and Ministry of Water and Environment, (2011). Jansz

(2011) got the same finding during a study in which almost all respondents complained of lack of a clear approach of accessing the spare parts to the water users.

This antagonizes the thinking in The Systems Theory because weak PSP, which is exhibited by the absence of spare parts dealers, means that the WUCs even if they collected O&M funds from the WUs would do little with it if they cannot easily access and acquire the needed spare parts. Equally, the HPMs cannot work without spares and this is likely to render the entire CBMS arrangement redundant. The role of a spare parts supply chain is to deliver the correct spares and/or services to the WUs at the right time, cost, and quality, to achieve the fundamental elements of availability, accessibility, affordability, and appropriateness.

Without an apt sustainable arrangement to convey spares closer to the WUs, it implies that spare parts supply will still stay as a hazard to sustainability of improved water sources in the study area. This is a situation that needs a pragmatic solution because as already discussed, it could have far-reaching effects on water supply management and usage in the study area. Increased transport and other related administrative costs can ultimately increase the cost of spares and of repair and maintenance works, causing increased down time (when the water facility is not functioning).

5.3.3 The effect of government back-up support on sustainability of water sources

Monitoring of water supply facilities in Arapai Sub County by government officials was found wanting as 96 (57.2%) of the respondents disagreed that government officials visited to check on major issues related to their water source. This finding was supported by qualitative results in which slightly more than half of the respondents disagreed when asked whether government officials visited to check on major issues related to their water sources.

This study established inadequate facilitation in form of transport and other allowances, and/or commitments elsewhere as claimed in the qualitative findings as the reasons for failure to monitor water sources by government officials. This finding contradicts Harvey and Reed (2004) who hold that communities need to be regularly visited by an overseeing institution to monitor systems, reaffirm the need to contribute to O&M, and sustain willingness to this need. The finding further deviates from the position held by Ministry of Water and Environment (2012). This is: it is important to establish back-up support mechanisms to communities that have benefited from water source improvements in order to ensure success of CBMS by planning and budgeting for follow-up activities like training and re-training of WUCs, HPMs and caretakers; monitoring visits, and co-financing of major repairs. Qualitative findings indicated that agency officials are only known to make visits when they are informed of the issues pertaining to the functionality of the water sources.

In the context of the struggle for sustainability, one of the important dimensions of monitoring is accountability which gives assurance to user communities that services are appropriate, affordable and in compliance with standards. As noted by WaterAid (2011); when monitoring systems explicitly feedback information on performance to those who have the mandate to do something about it; for example area HPMs, and WUCs; then their performance can improve.

In Arapai Sub County, quantitative findings revealed that the WUCs and communities generally are not aware of the bracket of levies that the HPMs are supposed to charge whenever they provide a service as only 81 (48%) indicated that they had some idea on the ceiling of levies from the HPMs. Although qualitative findings indicated that the repair charges were affordable as agreed by the majority of the respondents, the regulations governing those charges remained unclear to them. This finding diverges from the position held by Nekesa & Kulanyi (2012); that communities must be made aware of the availability of the HPMs, the nature and cost of the services offered by them. It is

important for communities also to be educated on the sufficient amount of funds that they need to contribute which should be enough to meet the entire repair costs of the facility needed by the HPM. Earlier findings indicate that users' contributions are always made but are unable to meet all the expenses for the repair and maintenance of the facilities because the users are left to decide on this fee on their own without adequate guidance thus leaving them room to decide on any amount.

The regulation of handpump repair charges is a function of government to ensure that the WUCs are not over charged by the HPMs and the HPMs are not underpaid by the WUCs (MWE, 2012). Apparently, implementing agencies have not done much to create awareness on the availability of regulations regarding the activities of the HPMs thereby creating information gap. With this situation at hand, it will be quiet difficult for the WUCs to enter in to handpump repair agreements with the HPMs since one of the key ingredients of such agreement is the offer by the HPM to do the job whose price the WUC has to ably negotiate with the HPM. Members of the WUC of Onyakai primary school borehole for instance claimed that they did not know how to design one and what to include and that they understood no need for it. The inadequate awareness of the ceiling of repair charges by the HPMs can result in to exorbitant prices charged and can have adverse effects on sustainability of water sources.

The quantitative findings that the WUC did not receive adequate training in which barely half 99 (58.9%) of the respondents agreed that the WUC was trained were also supported by qualitative findings wherein slightly half of the respondents acknowledged that the WUCs were trained. Some WUCs like for Abata borehole, Amotot borehole and Dakabela Health Centre III borehole were alleged to have never received any training at all. This finding conflicted with Brikke (2000); Mathew (2005); Carter (2009); RWSN (2010); and Jansz (2011) who hold that, to help the communities carry on with their roles; they need training in book-keeping and financial

management, re-training and technical support; and this support may be obtained from the local authorities and from professionals coming from the private sector and implementing agencies. This finding queries the government's effort to help the communities carry on with their roles by training them in simple bookkeeping and financial management. The finding showed that, not much effort and energy is invested in building the capacity of the WUCs to handle affairs geared towards the achievement of sustainability of water sources. It therefore, contradicts Ministry of Water and Environment (2012) which holds that communities get enhanced to take on their roles when they get continuous institutional support through training and regular monitoring. As established by Harvey and Reed (2011), continuous back-up support can help to pre-empt some of the problems like fading willingness to pay for O&M. This finding also does not match with what is held by RWSN (2010); that good community management structures are necessary but if they are installed without proper training, they cannot keep the infrastructure in working order. Sustainability of water sources relies on WUCs and communities in general whose capacity is adequately built up to run the affairs of O&M of water sources which include keeping O&M records and providing a convincing accountability of the O&M funds that were collected. This is what will solicit willingness of the users of the water supply facility to continue contributing the agreed fees.

5.4 Conclusions

Having looked through the findings and discussed them in relation to other research conducted elsewhere, the following objective-by-objective conclusions can be drawn from it:

5.4.1 The relationship between CWSMI and sustainability of water sources

Both qualitative and quantitative results of this study revealed a moderate positive relationship between CWSMI and sustainability of water sources in Arapai Sub County. The alternative hypothesis that CWSMI have a positive relationship with sustainability of water sources in Arapai

Sub County was supported by the findings and was thus accordingly accepted and the null (h_0) hypothesis that CWSMI have a negative relationship with sustainability of water sources in Arapai Sub County was rejected.

Since the p value was found to be smaller than 0.05, it was concluded that CWSMI significantly affect the sustainability of improved water sources in the study area. The R^2 value 0.119 (11.9%) that was obtained also confirmed that CWSMI affect sustainability. Interviews held with respondents regarding the need for CWSMI (WUCs), participation of women in the WUCs and the general functioning of the WUCs all pointed towards a positive relationship with sustainability of improved water sources.

Therefore, from the findings it can be concluded that the two variables are interlinked and hence any step taken to ensure the establishment of competent and all-inclusive CWSMI is likely to enhance the sustainability of improved water sources in Arapai Sub County.

Three main lessons have been learnt during the investigation of the relationship between CWSMI and sustainability of water sources under the community based management system. First, when little investment is made in establishing WUCs and building their capacity, sustainability of water sources suffers. Second, any weaknesses in WUCs in carrying out their roles and responsibilities e.g. mobilization of users to contribute towards O&M of water sources and planning, budgeting, and proper utilization of O&M funds kills the morale of the water users in fulfilling their responsibilities. This is likely to lead to O&M deficiencies e.g. inadequate availability of O&M funds that can be detrimental to sustainability of water sources. Third, women have a significant part to play in water supply and therefore, need to be adequately involved in it.

5.4.2 The relationship between PSP in water supply and sustainability of water sources

There is a moderate positive relationship between PSP in water supply and sustainability of water sources in Arapai Sub County as revealed by both qualitative and quantitative results of this study. These findings therefore, do not support the alternative hypothesis that "there is no relationship between PSP in water supply and sustainability of water sources in Arapai Sub County and this hypothesis was accordingly rejected. The null (h_0) hypothesis that "there is a relationship between PSP in water supply and sustainability of water sources in Arapai Sub County" was consequently accepted.

With the p value being smaller than 0.05, it was concluded that PSP significantly affects the sustainability of improved water sources. The R^2 value of 0.057 (5.7%) that was obtained also confirmed that PSP in water supply affects sustainability.

Interviews held with respondents regarding the need for operations of HPMs and availability of spare parts dealers all indicated a positive relationship with sustainability of improved water sources.

These findings lead to a conclusion that the two variables are interlinked. Any improvement and increment in PSP in water supply is likely to enhance the sustainability of improved water sources in Arapai Sub County.

The key lesson learnt is that, competent private sector (in the form of trained and well equipped hand pump technicians and spare parts dealers) are key for CBMS in delivering the sustainability of water sources.

5.4.3 The effect of government back-up support on the sustainability of water sources

Sustainability of water sources in Sub Arapai County as revealed by both qualitative and quantitative results of this study has a weak but positive relationship with government back-up support. This means that the alternative hypothesis that government back-up support in community water supply systems does not affect sustainability of improved water sources was not supported by these findings and was accordingly rejected. The null (h_0) hypothesis that "government back-up support in water supply affects sustainability of water sources in Arapai Sub County" was instead accepted.

The p value was found to be smaller than 0.05 and it led to a conclusion that government back-up support significantly affects sustainability of improved water sources in the study area. The R^2 value of 0.005 (0.5%) that was obtained also confirmed that government back-up support affects sustainability. Interviews held with respondents regarding monitoring of water sources by implementing agencies and HPMs; regulatory measures by government and government's role in building the capacity of CWSMI and HPMs all pointed to a positive relationship with sustainability of improved water sources.

Consequently, based on the findings it can be concluded that the two variables are interlinked and hence strengthening government back-up support is likely to enhance the sustainability of improved water sources in Arapai Sub County.

The key lesson learnt is that it is not possible for community support to entirely substitute external agency support and where external support is weak; sustainability is likely to suffer under CBMS.

5.5 Recommendations

Considering the findings, analysis and in line with the conclusions, the study made the following recommendations following the objectives:

5.5.1 The relationship between CWSMI and sustainability of water sources

The study highlighted that CWSMI have a positive relationship with sustainability of improved water sources. It clearly identified the gaps within the establishment of CWSMIs that can impact negatively on sustainability of improved water sources. To address the identified gaps, this study came up with the following recommendations:

1. Following the study finding that puts women representation in the WUC at less than 50%, it is recommended for sector managers at all levels to show enough commitment and action in devoting resources for carrying out social mobilization to ensure inclusion of all the stakeholders in decision making in order to gain collective effort to sustain water sources. Particular attention should be paid to meaningful involvement of women in water supply affairs.
2. Since study findings reveal that water sources have no bank accounts for keeping O&M funds because WUCs have inadequate knowledge of opening and running such bank accounts, this study recommends implementing agencies to train communities and WUCs in conventional financial management to ensure that the funds that are collected are properly kept and utilized.
3. Owing to the finding that sustainability of water sources in the study area is still a challenge despite the presence of WUCs, this study advocates for more and continuous sustainable efforts to be put in place by public water supply stakeholders to ensure that the CWSMI despite being in place, should also be fully functional.

5.5.2 The relationship between PSP in water supply and sustainability of water sources

From the study, PSP in water supply has been shown to have a positive relationship with sustainability of improved water sources. In the discussion, a number of issues have been raised about PSP in community water supply. Based on these issues, the following recommendations are drawn:

1. Implementing agencies need to train more HPMs and strategically organize them in such a manner that the WUs can easily reach them and the HPMs on the other hand can easily monitor the functionality of the water sources. This is because water sources situated further away from the HPM can hardly be reached by him and take more than a week before they are attended to even after the HPM has been informed of their break down, study findings have indicated.
2. Since it emerged from the study findings that HPMs are not facilitated to do monitoring of the functionality of water sources, it is recommended that government, and its partners institute a reward mechanism for HPMs. This is to motivate them to carry out the extra role of monitoring the performance of water sources and eventually produce and share the respective reports. This could close the information gap around O&M of water sources.
3. The study recommends government and its partners to establish a sustainable spare parts supply chain because the findings reveal this as lacking and makes accessibility of spare parts difficult. There is need for government to re-organize WUCs in to WUGs and water user associations to enable them pool resources together so that they can start up spare parts depots at their own convenient locations. Government could impose tax wavers on borehole spare parts to make the business of hand pumps spare parts for water sources more lucrative.
4. Arising from the study findings that HPMs usually hike the charges for repairs and maintenance works due to the increased cost of acquiring spares, this study recommends

implementers to facilitate HPMs to form themselves in to a Handpump Mechanics Association. This is in a bid to increase their bargaining position to access spare parts, tools, and knowledge and to enable them benefit from economies of scale when they purchase spares in bulk, which could reduce their costs.

5.5.3 The effect of government back-up support on sustainability of water sources

From the study establishment, government back-up support for water supply systems has a positive relationship with sustainability of improved water sources. A number of issues have been found to affect government back up support and this study has recommended the following:

1. Government and development partners need to adequately plan and budget for, and implement back-up support activities. These include but are not limited to follow-ups, monitoring visits, training, and re-training of HPMs and WUCs because it was found that monitoring of water supply facilities in Arapai Sub County by government officials was wanting. This study further established inadequate facilitation in form of allowances as the reasons for this failure on the part of government officials.
2. Since communities are not aware of the bracket of levies that the HPMs are supposed to charge, this study recommends that implementing agencies sensitize the water users on the availability of regulations governing the activities of the HPMs in order to close that information gap.
3. Government and development partners need to educate communities on O&M of water sources to enhance their participation e.g. in contribution for O&M of facilities because the O&M funds collected from the users are always inadequate to meet all the repair needs since some users do not want to contribute the agreed fees as established by this study.

5.6 Limitations of the study

The scope and methodology posed some limitations on the study.

Firstly, geographically the study was limited to Arapai Sub County and yet lessons could have been drawn from other neighboring sub counties where CBMS is also practiced.

Secondly, the time allocated for the study was short and therefore, methodologies that require longer durations were tactfully avoided. The study period of 2002-2012 limited the study to water sources constructed within that period and yet there are many more water sources in the study area constructed outside this period bracket.

Thirdly, the study avoided other types of technologies for supplying water to the population in the study area but chose those fitted with handpumps just because of their popularity and dominance amongst people in rural areas. Technologies such as springs, rain water harvesting that equally are known to provide improved water supplies for domestic and other uses were left out.

Fourthly, the cross sectional study design that was used in the study gathers information that represents what is going on only at that time. This does not give the researcher a chance to make follow up of the participants and of any changes in sustainability that could have been achieved especially in the event that the suggested recommendations are implemented.

5.7 Contributions of the study

The study has brought out unique findings on CBMS and sustainability of improved water sources in Arapai Sub County as discussed here below:

The study noted that the establishment of competent, effective, accountable, and all-inclusive CWSMI could enhance the sustainability of improved water sources in the study area. It further

confirmed the relationship between PSP and sustainability of water sources in the study area. It established that, any improvement and increment in PSP in water supply is likely to enhance the sustainability of improved water sources in Arapai Sub County. In addition, the study highlighted how government back-up support affects the sustainability of water sources in the study area. It established that, strengthening government back-up support is likely to enhance the sustainability of improved water sources in Arapai Sub County. This is part of the information that has been inadequate in the study area, which has been brought out explicitly by this study.

Whereas planners and implementers know that having women involved in water supply affairs leads to better facility management, their participation is still inadequate. The study discovered some WUC where women representation was as low as 20% while in others, it was as a high as 80%. It has documented the unique features and practices that surrounded those water sources with WUCs that had a higher women's representation and could form learning points for improvement of female representation all over the study area.

The findings, conclusions, and recommendations of this study particularly on women's involvement in CWSMI; establishment of sustainable supply chains for spare parts; and back-up support by implementing agencies are useful in informing policy processes at all levels of governance.

The knowledge base created by this research is a foundation stone for further research by scholars and other interested parties in the provision of clean safe water to low income communities.

5.8 Areas recommended for further research

Time, other resource limitations, and the need to be focused, made it difficult for this study to exhaust all the important areas of sustainability of water sources. Some of those areas are listed below:

1. One area that needs further research is the effect of community participation on sustainability of water sources.
2. There is also need to explore the effect of a particular water supply technology on the sustainability of water supply facilities resulting from such a technology.
3. The other aspect is the influence of socio-economic, political, and demographic factors on the sustainability of water sources.
4. Another area recommended for further research is the relationship between the quality of construction/workmanship (including location of the new water supply facilities) and sustainability.
5. It is also recommended to do a study to establish whether the availability and choice of alternative sources of water supply in the study area have an effect on the sustainability of improved water supply facilities in that area because this study dealt with only one option i.e. hand pumps.

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APPENDICES

1. Survey questionnaire
2. Interview guides
3. Documentary guide
4. Statistical tables

1. SURVEY QUESTIONNAIRE

COMMUNITY BASED MAINTENANCE SYSTEM AND SUSTAINABILITY OF WATER SOURCES

Dear sir/madam,

This is a study being conducted by a participant of Uganda Management Institute; Kampala seeking to establish the relationship between community-based maintenance system and sustainability of water sources (boreholes and shallow wells fitted with hand pumps) in Arapai sub county, Soroti district. This questionnaire is intended for water user committee members and you have been identified as a respondent to provide useful information for the study. Kindly fill in the questionnaire using the guidelines provided. Your participation is voluntary and your responses will be treated with utmost confidentiality. This is purely for academic purposes.

Many thanks are extended to you in advance for accepting to respond to this questionnaire.

Yours faithfully

Thomas Epeet
Researcher

Section A: BACKGROUND INFORMATION *(tick as appropriate in the box provided)*

1) Age
   i) 10-19 [ ] ii) 20-29 [ ] iii) 30-39 [ ] iv) 40-49 [ ] v) 50-59 [ ] vi) 60-69 [ ]

2) Gender

   i) Male [ ] ii) Female [ ]

3) Level of education

   i) Primary [ ] ii) Secondary [ ] iii) Certificate [ ] iv) Diploma [ ] v) Degree [ ]

4) Your position in the Water User Committee

   i) Chairperson [ ] ii) Treasurer [ ] iii) Caretaker [ ] iv) Secretary [ ]

   v) Member [ ] vi) Vice Chairperson [ ]

Section B: COMMUNITY BASED MAINTENANCE SYSTEM *(please tick as appropriate)*

In this section, please tick the appropriate option available to you. The scale score is that: 5 – Strongly Agree (SA), 4 – Agree (A), 3 – Not Sure (NS), 2 – Disagree (D), 1 – Strongly Disagree (SD)

No	Statement	SD	D	NS	A	SA
		1	2	3	4	5
B.1	**Community-level water supply institutions**					
5	All the members of the water user committee were elected by the general assembly of the users					
6	Half of the members of our Water user committee are women					
7	Women are willing to be part of the Water User Committee					
8	Women in our committee hold executive positions (Chair-person, vice chairperson, secretary, treasurer)					
9	Women's participation in the committee is not interfered					
10	Having women in the committee leads to better facility management					
11	The water user committee has made a register for all water users					
12	The water user committee collects maintenance funds from the water users					
13	Having a water user committee helps to keep the water source working					
14	**Private sector participation in water supply**					
B.2	Hand pump mechanics are readily available to repair the water source					
15	Hand pump mechanics always do a good job for us					
16	Hand pump mechanics train caretakers on minor repairs of hand pumps					
17	Hand pump mechanics visit our water source always to check for faults					
18	Charges by Hand pump mechanics for repair works are affordable					
19	Hand pump mechanics have enough tools to carryout repair works					
20	We buy borehole spares from the hard-wares in the sub county					
21	The cost of the spares is affordable					
22	**Government backup support systems**					
B.3	Government officials visit to check on major issues related to the water source					

No	Statement	SD	D	NS	A	SA
		1	2	3	4	5
23	Communities were educated on water issues by government					
24	Government has set the maximum repair charges by the hand pump mechanics					
25	The water user committee was trained					
26	Government gives refresher training to the hand pump mechanics					
27	Tools used by the hand pump mechanics were provided by government					
28	The Hand pump mechanics are facilitated to monitor water sources					

Section C: SUSTAINABILITY OF THE WATER SOURCE *(Please tick as appropriate)*

SN	Statement	SD	D	NS	A	SA
		1	2	3	4	5
C.1	**Financial dimensions**					
29	Water users are willing to pay fees for repairing the water source					
30	The user fee is decided by all the water users					
31	The fees collected from the water users is enough to meet all the repair costs					
32	Hand pump mechanics are paid immediately after their work					
33	The water users are given accountability of the collected money					
34	It takes less than one week for the water source to be repaired after breakdown					
35	**Technical aspects**					
C.2	Our water source breaks down after every six months					
36	Technical problems are reported to the hand pump mechanic immediately they occur					

SN	Statement	SD	D	NS	A	SA
		1	2	3	4	5
37	The spare parts for the water source are within easy reach					
38	**Institutional factors**					
C.3	The water user committee holds meetings regularly					
39	We have developed a maintenance plan for our water source					
40	We have by-laws governing the affairs of our water source					
41	The by-laws were agreed upon by the entire water users					
42	The by-laws were approved by the Local council/government					
43	The water user committee enforces the by-laws					
44	**Environmental aspects**					
C.4	The water yield from our water source meets our water needs					
45	We are satisfied with the quality of water from our water source					
46	We have arrangements for cleaning around our water source					
47	Our water source is fenced					
48	There is a soak pit for our water source which prevents flooding					

Thank you for your time

2. INTERVIEW GUIDE FOR LC1 CHAIRPERSONS

Introduction

Dear sir/madam,

My name is Thomas Epeet, a Participant in Uganda Management Institute pursuing a Masters Course in management studies. My area of interest is to investigate the relationship between community based maintenance system and sustainability of improved water sources (boreholes and shallow wells fitted with hand pumps) in Arapai Sub County. You have been identified as a resourceful person to provide vital information for this study. The views provided by you will be treated with utmost confidentiality and are purely for academic purposes.

Section A: General information

5) Gender
   ii) Male [ ] ii) Female [ ]

6) Age
   i. 10-19 [ ] ii) 20-29 [ ] iii) 30-39 [ ] iv) 40-49 [ ] v) 50-59 [ ] vi) 60-69 [ ]

7) Level of education
   ii) Primary [ ] ii) Secondary [ ] iii) Certificate [ ] iv) Diploma [ ] v) Degree [ ]

8) Name of village ……..

Section B: Village-level water supply management institutions

Please provide your answers to the following questions:

9) How was the water user committee selected?

   ……

10) Do you agree that the water user committee collects operation and maintenance funds from the water users? Please explain.

    ……C

    omment on the current composition of your area water user committees with respect to women representation

    ……

    Do you think women involvement in the committee is leading to better facility management?

Please explain.

……

11) Are water user committees in your area legally registered? Please explain.

……

12) In your own view, can having a water user committee help to keep the water source working? Please explain.

……

Section C: Private sector participation in water supply

13) How is the response of Hand pump mechanics whenever they are called upon for repair work? Are they always readily available? Please explain.

……

14) How do water users acquire spare parts for repairing their water sources?

……

15) Do Hand pump mechanics visit water sources to check for faults? Please explain.

…….....

16) Comment on the Charges levied by Hand pump mechanics for repair works?

……

Section D: Government backup support systems

17) Do government officials visit to check on major issues related to the water sources? Please explain.

……

18) What kind of support does government or any other organizations provide which is necessary for the sustainability of village water sources?

……

Section E: Sustainability of the water source

19) What is the perception of water users towards payment of user fees for the water source?

……

20) Have you ever registered complaints from the water users on mismanagement of maintenance funds? Please explain.

……

21) Are there by-laws governing the operation and maintenance of your village water sources? Please explain.

……

22) Have you ever registered any cases of defaulters of the by-laws? Please explain.

……

23) What would you consider as the best practices for the stakeholders to improve on the sustainability of water sources in villages?

……

We have come to the end of this interview. Thank you very much for your time and information shared.

3. INTERVIEW GUIDE FOR HAND PUMP MECHANICS

Introduction

Dear sir/madam,

My name is Thomas Epeet, a Participant in Uganda Management Institute pursuing a Masters Course in Management Studies. My area of interest is to investigate the relationship between community based maintenance system and sustainability of improved water sources (boreholes and shallow wells fitted with hand pumps) in Arapai Sub County. You have been identified as a resourceful person to provide vital information for this study. The views provided by you will be treated with utmost confidentiality and are purely for academic purposes.

Section A: General information

24) Gender
iii) Male [ ] ii) Female [ ]

25) Age
i. 10-19 [ ] ii) 20-29 [ ] iii) 30-39 [ ] iv) 40-49 [ ] v) 50-59 [ ] vi) 60-69 [ ]

26) Level of education
iii) Primary [ ] ii) Secondary [ ] iii) Certificate [ ] iv) Diploma [ ] v) Degree [ ]

Section B: Village-level management institutions

Please provide your answers to the following questions:

27) Do you agree that the water user committees collect operation and maintenance funds from the water users? If yes, are the funds normally enough to cater for repairs and spare parts?

……

28) Comment on the current composition of water user committees in the sub county with respect to women representation.

……

29) In your own analysis, do you think women involvement in the committee is leading to better facility management? Please explain.

……

30) Are there by-laws governing the operation and maintenance of the village water sources in the sub county? Please explain.

……

31) Can having a water user committee help to keep the water source working? Please explain

……

Section C: Private sector participation

32) How do water users acquire spare parts?

……

33) What would be the best method of increasing access of spare parts to the community?.....

34) Who pays for your services? Are you promptly paid after work? Please explain.

……

35) How often do you submit reports to the district or sub county? Do you get feedback?

……

Section D: Government backup support systems

36) What kind of support does government or any external organizations provide which is necessary for the sustainability of water sources in the sub county?

……

37) When did you receive the last training? Who trained you?

……

Section E: Sustainability of the water source

38) What is the perception of water users towards payment of user fees for the water source?

……

39) What would you consider as the best practices for the WUCs to improve on the sustainability of water sources in the sub county?

……

We have come to the end of this interview. Thank you very much for your time and information shared.

4. INTERVIEW GUIDE FOR DISTRICT KEY INFORMANT

Introduction

Dear sir/madam,

My name is Thomas Epeet, a Participant in Uganda Management Institute pursuing a Masters Course in Management Studies. My area of interest is to investigate the relationship between community based maintenance system and sustainability of improved water sources (boreholes and shallow wells fitted with hand pumps) in Arapai Sub County. You have been identified as a resourceful person to provide vital information for this study. The views provided by you will be treated with utmost confidentiality and are purely for academic purposes.

Section A: General information

40) Gender

iv) Male [ ] ii) Female [ ]

41) Age

i. 10-19 [ ] ii) 20-29 [ ] iii) 30-39 [ ] iv) 40-49 [ ] v) 50-59 [ ] vi) 60-69 [ ]

42) Level of education

iv)Primary [ ] ii) Secondary [ ] iii) Certificate [ ] iv) Diploma [ ] v) Degree [ ]

Section B: Village-level management institutions

Please provide your answers to the following questions:

43) How are community-level water supply institutions established in the district?

……

44) What activities do you do to facilitate the sustainability of the water user committees and to help them in the execution of their roles for Operation and Maintenance of water sources?

……

45) What role does the district play to help the hand pump mechanics perform their tasks efficiently and effectively for the sustainability of water sources in the sub county?

……

46) How often does your office do monitoring and evaluation of communities? What issues are covered that is critical to the sustainability of water points under community based maintenance system?

……

47) Do you have a work plan and budget to support activities (6-7)? Please explain

……

48) How does the district ensure that the spare parts needed for repairing the water sources are easily accessible to the water user committees?

……

49) Do communities have by-laws governing operation and maintenance of their water sources? If yes, what percentage is it?

……

50) Do hand pump mechanics submit reports to District water office? If yes, are they given feedback?

……

51) What are the major challenges to the sustainability of water sources under community based maintenance system in the sub counties?

……

52) What is the district doing to address these challenges? Is there any evidence?

……

53) What would you consider as the best practices for the Water User Committees to improve on the sustainability of water sources in the sub counties?

……

We have come to the end of this interview. Thank you very much for your time and information shared.

Documentary review guide on community based maintenance system and the sustainability of water sources in Arapai Sub County

A) General information

54) Name of village ……..

55) Water source name …….

56) Water source year of construction.……

57) Water source functionality status: Functional [ ] ii) Non functional [ ]

58)

B) Documentation check-list

No	Category	Tick	
		Yes	**No**
1.	Water users' register		
2.	Minutes of committee and general meeting		
3.	Financial management records		
4.	Operation and maintenance plan and budget		
5.	Water source maintenance records		
6.	Hand pump repair agreement		

Analysis criteria

1. Check for relevance of content of the document to this study
2. Verify authenticity
3. Identify outstanding issues
4. Extract relevant information

Notes:

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STATISTICAL TABLES

Required Sample Size†

Population Size	Confidence = 95% Margin of Error				Confidence = 99% Margin of Error			
	5.0%	3.5%	2.5%	1.0%	5.0%	3.5%	2.5%	1.0%
10	10	10	10	10	10	10	10	10
20	19	20	20	20	19	20	20	20
30	28	29	29	30	29	29	30	30
50	44	47	48	50	47	48	49	50
75	63	69	72	74	67	71	73	75
100	80	89	94	99	87	93	96	99
150	108	126	137	148	122	135	142	149
200	132	160	177	196	154	174	186	198
250	152	190	215	244	182	211	229	246
300	169	217	251	291	207	246	270	295
400	196	265	318	384	250	309	348	391
500	217	306	377	475	285	365	421	485
600	234	340	432	565	315	416	490	579
700	248	370	481	653	341	462	554	672
800	260	396	526	739	363	503	615	763
1,000	278	440	606	906	399	575	727	943
1,200	291	474	674	1067	427	636	827	1119
1,500	306	515	759	1297	460	712	959	1376
2,000	322	563	869	1655	498	808	1141	1785
2,500	333	597	952	1984	524	879	1288	2173
3,500	346	641	1068	2565	558	977	1510	2890
5,000	357	678	1176	3288	586	1066	1734	3842
7,500	365	710	1275	4211	610	1147	1960	5165
10,000	370	727	1332	4899	622	1193	2098	6239
25,000	378	760	1448	6939	646	1285	2399	9972
50,000	381	772	1491	8056	655	1318	2520	12455
75,000	382	776	1506	8514	658	1330	2563	13583
100,000	383	778	1513	8762	659	1336	2585	14227
250,000	384	782	1527	9248	662	1347	2626	15555
500,000	384	783	1532	9423	663	1350	2640	16055
1,000,000	384	783	1534	9512	663	1352	2647	16317
2,500,000	384	784	1536	9567	663	1353	2651	16478
10,000,000	384	784	1536	9594	663	1354	2653	16560
100,000,000	384	784	1537	9603	663	1354	2654	16584
300,000,000	384	784	1537	9603	663	1354	2654	16586