

**SUSTAINABILITY OF WATER PROJECTS: A CASE OF SELECTED  
PROJECTS IN IRINGA DISTRICT, TANZANIA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULLFILMENT OF THE  
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## ABSTRACT

The study was conducted to examine the factors for sustainability of water projects in Iringa District, Tanzania. Iringa District was selected as the area of study because in spite of many water projects invested at the area, the accessibility of clean water is only 40.7%. The study specifically ought to determine water sources protection strategies adopted at the study area, to assess participation of stakeholders in different stages of water projects development, to analyze the institutional arrangement for water project management and socio-economic and environmental factors influencing sustainability of water projects. A household questionnaire was administered to 180 respondents in three villages for data collection. This was supplemented by discussions with ordinary water users and water attendants. Descriptive statistical methods including frequencies and percentages were used as qualitative analytical techniques. For quantitative data, logistic regression model was used to determine the factors for successful and failure of projects. The collected data were analysed using SPSS software. In order to determine the main factors for water project sustainability binary logistic regression was applied, and the results show that cox and snell ( $R^2$ ) was 0.171 and Nagelkerke ( $R^2$ ) was 0.232. This indicates that the model was fit to explain the change in the dependent variable as a result of change in the independent variable. From the results it shows only two independent variables which are project maintenance per annum and meetings conducted per annum were found to be significant at  $p \leq 0.001$  and  $p \leq 0.010$ , respectively. The findings imply that the positive signs attached to the estimated coefficients of the variables, indicates that the greater the values of these variables the higher the tendency to maintain sustainability of water supply. The negative signs attached to time spent for water collection and economic activities in the water sources indicate also that the greater the value of the variable the lower the probability of

maintaining sustainability of water supply. The increasing rate of water project failure especially in the rural areas should be addressed in order to achieve reliable supply of safe and clean water to the rural populations. Local governments, donors and communities should make sure that both technical aspects and regular follow-ups, capacity buildings to the community and water user association members become a sustainable process for the attainment of water project sustainability.

## DECLARATION

I, JIMSON JOSEPH CHUMBULA,do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own work done within the period of registration and that it has neither been submitted nor being concurrently submitted in any other institution.

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The above declaration is confirmed by

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**DEDICATION**

I dedicate this work to the Almighty God for his love, to my loving and caring parents: the late father Joseph Mdalika Chumbula and my mother Alanzusa Yobu Mgohamwende for the immense sacrifices they made to build a good foundation for my life, my wife Yuster Jeremias Kayombo and my lovely son Jonathan Jimson Chumbula for their encouragement and financial support during the whole period of my studies. My Almighty God Bless you All abundantly.

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## LIST OF ABBREVIATIONS

CBOs	Community-Based Organisations
COWOSOs	Community Owned Water Supply Organizations
DCDO	District Community Development Officer
DCs	District Councils
DPLO	District Planning Officer
DWE	District Water Engineer
DWST	District Water and Sanitation Team
FSPs	Facilitation Service Providers
GDP	Gross Domestic Product
HDR	Human Development Report
IDC	Iringa District Council
LGRP	Local Government Reform Policy
MDG	Millennium Development Goals
NGO	Non Governmental Organisations
NRWSSP	National Rural Water Supply and Sanitation Program
NSGRP	National Strategy for Growth and Reduction of Poverty
NWP	National Water Policy
PEDP	Primary Education Development Programme
PHDR	Poverty and Human Development Reports
POST	Parliamentary Office of Science and Technology
RWSN	Rural Water Supply Network
RWSS	Rural Water Supply and Sanitation Services
SDGS	Sustainable Development Goals



SPSS	Statistical Package for Social Sciences
SWAP	Sector-wide Approach to Planning
THDS	Tanzania Health Demographic Survey
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
URT	United Republic of Tanzania
USD	United States Dollar
VWC	Village water Committee
WATSANs	Water and Sanitation Committees
WHO	World Health Organization
WPs	Water Points
WSS	Water Supply and Sanitation
WUA	Water User Association
WUGs	Water User Groups
WWAP	World Water Assessment Programme

## **CHAPTER ONE**

### **1.0 INTRODUCTION**

#### **1.1 Background of the Study**

Water is an essential component of life, and its availability and quality are crucial. It is projected that by 2025 more than 3 billion people will be living in water – stressed countries and 14 countries will slip from water stress to water scarcity (HDR, 2007). Vastly uneven distribution of freshwater resources, combined with changes due to climate change, is already deepening water-related problems (World Bank, 2010).

A major challenge facing developing countries is how to supply safe drinking water to their citizens. The demand for water is rising at an exponential rate due to increasing population in both urban and rural areas (Akpore and Muchie, 2011). Following this crisis, several stakeholders around the World have joined efforts to address the problem. For example, the World Bank has engaged 142 countries in lending for water (IEG, 2009). The top 10 of those countries have accounted for 579 projects (31 percent), covering 56 percent of total Bank commitments for projects with water activities (IEG, 2009). Lending for water increased by over 50 percent from 1997 to 2007 (IEG, 2009). United Nations launched another global initiative to tackle the ongoing failures of water supply projects in developing countries. In 2000, the UN established the Millennium Development Goals (MDGs) in which target 10 of Goal 7 - ensuring environmental sustainability - set a target to halve the proportion of people in the world who lack access to safe drinking water by 2015 (UNDP, 2011).

Unfortunately, Rural Water Supply Network (RWSN, 2010) indicates that regardless of various efforts and investment towards ensuring access to safe drinking water, many of

water projects in developing countries have failed to operate sustainably. For example, it has been estimated that the hand pump, which provides nearly half of the protected water supplies for Africa's rural population, has an estimated functionality rate of approximately 66%. Across rural Sub-Saharan Africa, an average of 36% of hand pumps is non-operational at any given time, and in some countries, it is estimated that more than 60% of hand pumps are non-operational (WHO, 2011).

Tanzania is among these countries that lent money from the World Bank for water projects. In Tanzania the proportion of people served by the 19 urban water authorities and who use drinking water from improved sources increased from 74% in 2005 to 84% in December 2009 (URT, 2011). Attaining MDG target for water supply service in the rural areas is at risk on Mainland Tanzania although there has been some improvement in recent years - proportion of the population with access to clean and safe water in rural areas increased only from 53.1% in 2005 to 58.7% in 2009 (URT, 2011).

## **1.2 Statement of the Problem**

The percentage of people in Africa using clean and safe water for drinking has increased for most countries, the increases in access for rural citizens, has risen from 35% to 51%. The data for Tanzania however, tells a different story. Overall, in the past two decades access has declined slightly from 55% to 53% and for rural citizens from 46% to 44% (Twaweza, 2014). The failure to increase access to clean and safe water is striking when compared to the significant increases in spending in the water sector (Twaweza, 2014). The government of Tanzania and donors have been committing a lot of money in clean water projects especially in the rural areas.

The collaborative efforts between the Government and the development partners have by June 2012, attracted to water sector the total commitments of about USD 1,299 million, and the actual disbursements have reached USD 789 million (URT, 2012). Regardless of these efforts almost 50% of people in Tanzania do not have access to safe water (Water Aid, 2014). This shortage is due to short life span of water projects in Tanzania. For example, a research done by Kariba (2002) about participatory evaluation of community-based water and sanitation programs in central Tanzania found that, one hundred and nine (109) water projects out of three hundred fifty seven (357) projects in Dodoma Region were not working. This problem is common across the country. The availability of failed projects implies that the projects were not sustainable. This led to general questions of why regardless of the scarcity of the water resource and need of people towards this resource, the projects are not sustainable. This study therefore intends to identify factors that lead to short life span of water projects regardless of the high need of the service to the community.

### **1.3 Justification for the Study**

A large part of Iringa District is semi-arid in which the area experience recurrent drought conditions (Sanders and Fitts, 2011). Having this climatic condition, people living in this area experience the difficulties in getting clean water for domestic use. Despite the effort of the government and donors to address access to clean water problem, the success is very minimal. According to the information from the District Executive Director's office, more than two hundred (200) government and donor funded projects have been initiated in Iringa District (IDC, 2012). Despite this heavy investment in clean water projects, still water shortage problem is high at Iringa District. A study made by Ministry of Finance and National Bureau of Statistics in 2012 revealed that diarrhea ranked at third position

among ten diseases at Iringa Rural District with 17,543 cases in 2011 and 8,937 cases in 2012 (URT, 2013). According to Iringa District economic profile (2013), accessibility of tap water (projects) at the district is 40.7% and other unsafe sources like wells, rivers, ponds, dams, lakes and streams contributes to the remaining 59.3% (URT, 2013). The study findings are helpful to provide the ways forward that will help the government and the concerned community to arrive at the desired targets, but also the findings have to be used by the local government of Iringa District to refine the approaches that have been used for quite a long time in initiating clean water projects at the District.

## **1.4 Objectives of the Research**

### **1.4.1 General objective**

To examine factors for sustainability of water projects in Iringa District.

### **1.4.2 Specific objectives**

- i. To determine water sources protection strategies adopted at the village.
- ii. To assess participation of stakeholders in different stages of water projects development.
- iii. To analyze the institutional arrangement for water project management.
- iv. To analyze socio-economic and environmental factors influencing sustainability of water projects.

## **1.5 Research Questions**

- i. Does the village have by laws and policies for water sources protection?
- ii. How do water users participate in water projects development?
- iii. How does water project managed at the village?
- iv. How do socio-economic and environmental factors influence water projects sustainability?

## **CHAPTER TWO**

### **2.0 LITERATURE REVIEW**

#### **2.1 Theoretical Review**

##### **Stakeholder theory**

The stakeholder theory has been in the management agenda for about thirty years and reservations about its acceptance as a comprehensive theory still remains. It was introduced as a managerial issue by the Labour Party of United Kingdom in 1997 aiming to make public management more inclusive (Gomes, 2006). The term stakeholder first “appeared in the management literature in an internal memorandum at the Stanford Research Institute, in 1963” (Freeman, 1984). The word means “any group or individual who can affect or is affected by the achievement of the organization's objectives” (Freeman, 1984, p. 46). Bryson (1995) proposed a more comprehensive definition for the term: “A stakeholder is defined as any person, group, or organization that can place a claim on an organization's attention, resources, or output or is affected by that output”. The main assumption of the stakeholder theory is that an organization's effectiveness is measured by its ability to satisfy not only the shareholders, but also those agents who have a stake in the organization (Freeman, 1984). The problem with the theory is that, it does not explain thoroughly the complexity of the relationships between an organization and the people, groups and other organizations from its environment.

Stakeholder theory suggests that in order for any project at any organization to succeed and be sustainable, stakeholders should be involved in all stages of project life cycle. Bal *et al.*(2013), identified six steps to a stakeholder engagement process: (i) Project identification; (ii) Relating stakeholders to different sustainability-related targets; (iii)

Project prioritization; (iv) Project management (v) Measuring performance; and (vi) Putting targets into action. Failure to involve stakeholders in project development makes lack of ownership leading to poor performance of the projects. The theory was used in this study by looking at the way different levels of water management at Iringa District engage stakeholders in all stages of water projects development.

## **2.2 The Concept of Sustainability**

The concept of “sustainable development” exploded in the literature after the World Commission on Environment and Development’s landmark report, ‘Our Common Future’ was published in 1987 (Black, 1985). ‘Sustainability’ was soon adopted by those providing water and sanitation services to mean service and “management should be cost effective, taking into account constraints on the resource itself, and on the availability of financial resources” (Black, 1985). Sustainability means to support and maintain a condition so that it continues without interruption, diminution, giving way, fading, or yielding (Conard, 2013). Sustainability might also mean the capacity to endure and adapt, prompting the question of what existing conditions need to and should be maintained (Starik and Kanashiro, 2013).

Safe and clean drinking water supply is sustainable only if, the water consumed is not overexploited but naturally replenished, facilities maintained in a condition that ensures reliable and adequate portable water supply. The benefits for the water supply should continue to be realized over a prolonged period of time (David and Brikke, 1995).

Richard (1999) defined sustainability as a continued delivery of a particular service. The author emphasized on the need to involve all stakeholders in consumption and cost

recovery strategies to ensure delivery of high quality services and sustainable development projects. Abraham (1998) on the other hand, views sustainability of water projects as a continued flow of water at the same rate and quality, as when the supply system was designed. Kimberly (1998) maintains that sustainability in water projects means, ensuring water supply services and interventions continue to operate satisfactorily and they generate benefits over time as expected. The author further pointed out that, sustainability is all about ability to operate and maintain initial project service standards. However, to achieve this it has to be planned from the very beginning of the project, so as to ensure prerequisites for long-term sustainability and strategies are aimed at seeing that sustainable projects are in place and are in good working order.

In developing countries, a significant number of projects, including those in the water sector, fail to deliver benefits to society over the long term (Antonio, 2005). The commonly observed fact is that many water and sanitation programmes started in developing countries with the support of international agencies have not “continued to work over time” (Ademiluyi and Odugbesan, 2008).

The widespread failures in water supplies have been attributed to a number of flaws in the project; the intervention was not desired by the community, the capital and/or recurrent costs are too high for the community, lack of ownership results in neglect of maintenance and repairs, the promised benefits don’t materialise, education programmes are too short and trained members of the community move away or lose interest (Carter *et al.*, 1999). Other factors such as the on-going use of traditional sources of water, poor systems of cost recovery and the distaste for the water from the improved source also contribute to undermining sustainability (Parry-Jones *et al.*, 2001). Some factors for sustainability can further be explained.



“Sustainability in this study is defined according to Kasiaka (2004), which refers to the ability of project beneficiaries to maintain and sustain project activities, services and any measure initiated by a project so as to last long after the expiring of the funding period. In water projects, we cannot talk of sustainability without mentioning operation and maintenance issues”.

### **2.2.1 Motivating communities**

Without the motivation of the community to utilize the new source of clean water, sustainability is doomed (Ademiluyi and Odugbesan, 2008). The users must believe that the new source is preferable to their traditional source. Although, this may be a time-consuming activity at the beginning of a programme, it is common for demand, and levels of motivation, to grow rapidly as the benefits of clean water become more visible. A significant further obstacle to the motivation of a community to use a new source may be the change from “free” water to some system of cash payment. Motivation, value, worthwhileness, or self-interest are essential features of the involvement of all stakeholders, not only the individual consumers. Caretakers and committees within the community, Government or non-Government organizations providing back-stopping for maintenance, those organizing revenue collection, local Government, and private sector stakeholders should all perceive participation and the delivery of high quality services in their own interests, financial or otherwise (Ademiluyi and Odugbesan, 2008).

### **2.2.2 Maintenance committee**

Most of water projects fail because of lack of trained people and committees who can take care of them. Trained people or committees for water projects maintenance are essential for their survival. According to WHO and UNICEF report (2000), in order to ensure sustainability of water projects, a clearly structured, resourced, and trained maintenance

organization is necessary. The community appointed caretaker(s) or committees may have an important role in maintenance (for which they need training), but in almost all circumstances they will need backstopping by some district, regional, or national level organization. The Government agency or NGO will also need resources and training. Communication lines between community and backstopping agency need to be clear, and response times need to be rapid. Spare parts and tools, and appropriate forms of transport, must be available (Ademiluyi and Odugbesan, 2008).

### **2.2.3 Cost recovery**

Staffing, training, transport, spare parts, materials, tools, and replacement units all cost money. The World Bank (1993) argues that the pricing of water resources will give users an incentive to pursue efficiencies in utilization. The argument goes that water has hitherto been underpriced as an economic (scarce) resource (Winpenny, 1994). Pricing is also intended to encourage the users of water for low value purposes to conserve water thus freeing up water for transfer to other uses. Pricing is thus conceived as a tool both for increasing economic efficiency and for promoting environmental protection. The problem may arise if the community is not well involved in arranging for the cost. The basis of payment (by volume, or flat rate per household), and the means of administering and accounting for water charges, all have to be decided, preferably by the community (Ademiluyi and Odugbesan, 2008).

### **2.2.4 Continuing support**

Evidence from the literature makes it clear that community enthusiasm for keeping water committees functioning, for adopting improved hygiene practices, and continuing the collection of revenue for recurrent expenses, can decline within two or three years of

construction (Postnote, 2002; Antonio, 2005). It is essential that the supporting Government or NGO maintains responsibility for such follow-up. This is a long term function, with a need to continue until there is such a 'critical mass' of good practice within a community, that there is no going back. This notion of continuing support is to ensuring that community managed water services are sustainable and that adequate institutional support and policy arrangements are put in place to support community management indefinitely (Ademiluyi and Odugbesan, 2008).

### **2.2.5 Commitment to achieving objectives**

Ademiluyi and Odugbesan (2008) noted that, in order to achieve sustainability objectives for water supply and sanitation programmes, the following steps are necessary: Caretakers should be in post and fulfilling their assigned job descriptions, committees should be meeting regularly, keeping minutes, and functioning in a manner acceptable to the community, revenue collection should be taking place in the manner agreed at the construction phase, or in some other effective way, the backstopping agency (Government or NGO) should be in regular and effective contact with the community, usage of water supply and wastewater disposal facilities should be continuing at high levels, physical infrastructure should be fully functional.

### **2.2.6 Community participation**

Conventional wisdom is that without community participation, there is little likelihood of sustainability being realized (Narayan, 1995; Oyesiku, 1998). There is a need for capacity building at the community level as well as at the level of Government or NGO for water projects management. Education in health and hygiene, training in maintenance and the handling of cash, and involvement of women in community institutions and decision-making, are key activities needed to create local capacity to manage. On the part of

Governments and NGOs, listening and learning from the community, developing respect for existing methods of organization, problem-solving, conflict-resolution, and decision-making, are essential components of such capacity-building work. This exposes the need for a cadre of staff in the Government or NGO which can fulfill these external support and capacity building functions (Ademiluyi and Odugbesan, 2008).

### **2.3 Historical Background of Water Sector Development in Tanzania**

The history of the water sector in Tanzania dates back to the 1930s when water supply was confined to urban areas and farming settlements owned by settlers (Doering, 2005). In order to redress the urban bias in water supply service provision, the government of Tanzania proclaimed a 20-year (1971-1991) Rural Water Supply Programme that aimed at providing access to adequate, safe, dependable water supply within a walking distance of 400 metres from each household. Under this programme, water was to be provided freely by the government. However, this programme largely failed to meet its targets due to non-involvement of the beneficiaries, use of inappropriate technologies, use of a top-down approach, and lack of decentralization. In order to arrest this situation, the government adopted the first National Water Policy in 1991, which had a number of deficiencies too, and needed to be revised. The departure from past approaches and the initiation of the current water sector reforms came in the course of the Urban Water Supply Project in Moshi, Tanga and Arusha, where the whole urban water sub-sector started to be reshaped. Simultaneously, a number of Rural Water Supply Projects, mainly in the Kilimanjaro region, helped to break the ground for a major shift in the rural water supply sector towards community ownership and management.

#### **2.3.1 Water policy and legal framework in Tanzania**

Water legislation is one of the instruments used to streamline social behavior towards water resources management. Within the context of its poverty reduction efforts the GOT

has made commendable strides in developing the water and sanitation sector. In 2002 the NWP (National Water Policy) was formulated with a mission of “integrated and sustainable management, development and use of water resources in Tanzania”. NSGRP (National Strategy for Growth and Reduction of Poverty) has recognized that adequate water supply and improved sanitation are necessary ingredients in promoting economic growth and fighting poverty. In order to operational the NWP and to achieve the MDGs for water supply and sanitation, GOT formulated NRWSSP (National Rural Water Supply and Sanitation Program). The NRWSSP aimed at 69 % coverage for rural water supply and adequate sanitation by 2010 and 90% coverage by 2025 (URT, 2006). The national water sector development strategy has been developed to support re-alignment of the water related aspects of other key sector policies (for example, energy, irrigation, industry, mining, and the environment) with the NWP, and to provide a focus on specific roles of the various actors through clearly defining roles and responsibilities and hence the removal of duplications and omissions.

The National Water Sector Development Strategy was, therefore, a blueprint for prioritized timely and appropriate interventions to address the Water Sector challenges in the process of achieving all the targets narrated in the national strategy for growth and reduction of poverty by 2010, the MDGs by 2015, and contribute towards achieving the Tanzania development vision targets by 2025. Furthermore, the strategy led to reshaping and increasing sector financing through a smooth and manageable institutional arrangement.

The Government of Tanzania (GoT) in 2002 adopted the policy recommendations contained in NWP which has a whole part dealing with rural water supply and sanitation.

Tanzania has since 1974 been governed by the water utilization (Control and Regulation) Act, 1974. Since then new concepts and approaches to governance and utilization of water resources have emerged that need to be taken on board. NWP replaces the Water Sector Policy of 1991 which addressed sources, use of water in the urban and rural areas, planning and quantity of water supply, financing and maintenance of water operations, authorities responsible for water, and enforcement and coordination policies of the water sector (Kabudi, 2005).

Furthermore the regulatory and institutional framework for water resources management is provided for under the water utilization (Control and Regulation) Act. No.42 of 1974 as amended by the Water Laws (Control and Regulation) Act of 1997 and the Water Laws (Miscellaneous amendments) Act of 1999. They stipulate that all water issues in Tanzania is vested on GoT and the Minister responsible for water development is empowered to regulate the use of water from any source in any area of the country on a national basis, to declare such a source to be a national water supply for the purpose of the Act. The Law sets conditions on the use of water and appoints the principal waterofficer, to be responsible for setting policy and allocation of water rights at the national level.

## **2.3.2 Water projects sustainability and other sectorial policies in Tanzania**

### **2.3.2.1 Environmental policy**

The environmental Policy objectives in the water and sanitation sector are geared towards achieving the planning and implementation of water resources and other developments in integrated manner and in a way that protects water catchment areas and their vegetation (URT, 1997).

### **2.3.2.2 Local government reform policy**

The overall objective of the Local Government Reform Policy (LGRP) is to improve service delivery by making local authorities more democratic and autonomous within the framework established by the central government. The policy identifies provision and facilitation of water services as an important responsibility of local government. Reforms will not only confirm the legitimacy of local authorities, but will help them generate more revenues, reduce costs and operate water services more efficiently (URT, 1996).

### **2.3.2.3 Rural development strategy**

The Rural Development Policy (2001) acts as a platform on which sector ministries policies are coordinated, harmonized, and integrated to give rural development process a holistic view. In the case of the water sector, the Rural Development Policy states that;

- i. Central government and local governments will pursue and/or promote an integrated approach to rural water supply and sanitation, productive activities and human consumption;
- ii. Central government, local governments and other stakeholders will mobilise funds and attract private resources to ensure increased supply of safe water within household proximity; and
- iii. The central government will set or create a conducive environment for private sector participation in developing rainwater-harvesting technology appropriate for rural areas (URT, 2001).

### **2.3.2.4 Land and settlement policy**

The Land and Settlement Policy (1997) recognize the existence of unplanned settlements in most urban areas in Tanzania. It calls for upgrading of those settlements by providing

them with basic infrastructure services such as roads, water supply, and sanitation (URT, 1997).

#### **2.3.2.5 Forestry policy**

Forestry Policy (1998) recognizes that water sources are one of the key pre-requisite for local and international development. The policy emphasizes that population pressure and inefficient forest management and protection have contributed to the deterioration of catchment forest areas causing water shortages. The policy advocates the establishment of new catchment forest reserves for watershed management and soil conservation in critical watershed areas (URT, 1998).

#### **2.3.3 Watersector management and the Tanzania 2025 development vision**

The Tanzania development vision 2025 aims at achieving a high quality livelihood for its people attain good governance through the rule of law and develop a strong and competitive economy. Specific targets include: a high quality livelihood characterized by sustainable and shared growth (equity), and freedom from abject poverty in a democratic environment. Specifically the vision aims at: Food self-sufficiency and security, Universal access to primary health care, 75% reduction in infant and maternal mortality rates, Universal access to safe water, increased life expectancy, absence of abject poverty and a well-educated and learned society.

#### **2.3.4 Water access and international development targets**

The UN (2000) set a Millennium Development Goal to halve the proportion of people who are unable to reach or to afford safe drinking water by 2015. In 2000, this target was realized for the 82% of the global population who had improved water source within one



kilometer of their home or a household connection to a water supply. The remaining 18% (equivalent to about 1.1 billion people) were in the category of no access and were found largely in Asia and Africa and particularly in rural populations which are typically less well served than urban populations (WHO and UNICEF, 2000).

Globally, 2.6 billion people have gained access to an improved drinking water source since 1990. In most regions, over one third of the 2015 population gained access during the MDG period. Developing regions with low baselines and those experiencing rapid population growths have had to work much harder to maintain and extend coverage. Although sub-Saharan Africa missed the MDG target, over 40 per cent of the current population gained access since 1990. In 2015, it is estimated that 663 million people worldwide still use unimproved drinking water sources, including unprotected wells and springs and surface water. The majority of them now live in two developing regions. Nearly half of all people using unimproved drinking water sources live in sub-Saharan Africa, while one fifth live in Southern Asia (UNICEF and WHO, 2015).

### **2.3.5 Water sector management and the universal sustainable development**

#### **goals(SDGs)**

The Sustainable Development Goals (SDGs) are intended to be universal in the sense of embodying a universally shared common global vision of progress towards a safe, just and sustainable space for all human beings to thrive on the planet. They reflect the moral principles that no-one and no country should be left behind, and that everyone and every country should be regarded as having a common responsibility for playing their part in delivering the global vision. Goal six in the SDGs is to ensure availability and sustainable management of water and sanitation for all. The six targets under this goal are (6.1) to achieve universal and equitable access to safe and affordable drinking water for all by

2030, (6.2) to achieve access to adequate and equitable sanitation and hygiene for all, and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations by 2030, (6.3) to improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and increasing recycling and safe reuse by x% globally by 2030, (6.4) to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity by 2030, (6.5) to implement integrated water resources management at all levels, including through trans boundary cooperation as appropriate by 2030, (6.6) to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes by 2020. The other targets: (6a) by 2030, expand international cooperation and capacity-building support to developing countries in water and sanitation related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies, (6b) support and strengthen the participation of local communities for improving water and sanitation management (Osborn *et al.*, 2015).

## **2.4 The Water Management Constraints in Developing Countries**

Unsustainable development pathways and governance failures have generated immense pressures on water resources, affecting its quality and availability, and in turn compromising its ability to generate social and economic benefits (WWAP, 2015).

### **2.4.1 Discrimination and inequalities in access to drinking water and sanitation services**

Socio-economic inequalities, and the lack of policies to effectively address them, were among the main obstacles to the achievement of MDGs in general and improved access to

sanitation and safe drinking water in particular (Donat Castelló *et al.*, 2010). Many people around the globe including women, children, the elderly, indigenous peoples and people with disabilities have lower levels of access to safe drinking water, hygiene or sanitation facilities than other groups (WHO and UNICEF, 2014). While access to safe drinking water and sanitation is recognized as a basic human right, discrimination based on ethnicity, religion, economic class, social status, gender, age or physical abilities often restricts people from accessing land and water resources and related services. Such exclusion has long-term social and economic effects, as the disadvantaged are more likely to remain poor, lacking opportunities for education, employment and social engagement. In the rural context, which require different systems to those generally found in urban settings, providing adequate drinking water and sanitation is also challenging. The lack of infrastructure and services means that many people do not have access to adequate sanitation and must rely on unsafe water supplies. The lack of access to safe drinking water coupled with other shortages of basic services, scarce resources and limited income-generating possibilities, can further entrench vulnerability (WHO and UNICEF, 2014).

#### **2.4.2 Insufficient and unsustainable financing for water resources management and services**

Water services remain rather low on the scale of policy priorities, despite well-documented contributions to human and economic development. When compared with other development sectors, particularly education and health, sanitation and drinking water services receive a relatively low priority for both official development assistance (ODA) and national expenditure (UNDESA, 2013). This under-prioritization of water directly contravenes a State's obligation to expend maximum available resources to promote the progressive realization of the human right to water and sanitation for all persons, without

discrimination. Financing for water resources management is also usually a low priority, in spite of it being a cornerstone of economic growth (SIWI, 2005).

In most countries, funding for water infrastructure comes from government allocations, although many developing countries still depend on external assistance to fund water resources management and utilities. This is neither adequate, nor sustainable. Most countries report that information required for adequate financial planning in the water services sector, such as information on users and their potential contributions, is insufficient. Costs of infrastructure operation and maintenance are often neglected or not well factored into water mobilization projects. As a result, many water systems are inadequately maintained, leading to damages, losses, unreliability, and decreasing quality and quantity of service to users. Financing is reported to be particularly inadequate for sanitation, with drinking water absorbing the majority of funding available particularly in developing countries (WHO, 2012).

#### **2.4.3 Shortage of data and information in water sector**

Monitoring water availability, use and the related impacts, represents a massive and persistent challenge. Reliable and objective information about the state of water resources, their use and management is often poor, lacking or otherwise unavailable. Worldwide, water observation networks provide incomplete and incompatible data on surface and groundwater quality and quantity, and no comprehensive information exists on wastewater generation and treatment (WWAP, 2009). Various studies and assessments provide a snapshot of the state and use of water resources at a given time and place, but generally do not provide a broader, more complete picture of how different dimensions of water are changing over time in different parts of the world.

In the context of sustainable development, where water is often a key driver – and a potential limiting factor – for economic growth, human well-being and environmental health, this lack of information and knowledge creates barriers to cohesive policy formulation and sound decision making on developmental objectives. For example, there are often too few reliable metrics on which to track the outcomes of water productivity improvement measures (WWAP, 2014). From an economic perspective, there is a need to couple data and information on water resources and their use with indicators of growth in various economic sectors in order to assess its role and contribution in terms of economic development, and to garner a better understanding of its consequences on the resource and different users.

#### **2.4.4 Persistent poverty**

Persistent poverty is usually the result of a vicious cycle in which limited income converges with limited access to resources. Safe water and sanitation are precursors to health care, education and jobs (WWAP, 2015). For the last 15 years, eradication of extreme poverty and hunger has been the number one priority under the MDGs. Nevertheless, as of 2012, 1.2 billion people still lived in extreme poverty (Lockhart and Vincent, 2013), the majority located in slums, often lacking adequate drinking water and sanitation services (UN-Habitat, 2011).

Women and youth are disproportionately impacted both by water scarcity and the lack of safe drinking water, increasing the vulnerability associated with persistent poverty. Water policies are often based on generalized perspectives that lack gender perspectives and local knowledge (WWAP, 2012). By failing to integrate gender considerations in water resources management and also in sectors such as agriculture, urban water supply, energy

and industry, gender inequities will persist, preventing the adoption of innovative solutions that may be put forth by women (WWAP, 2014).

## **2.5 Factors Influencing Sustainability of Water Projects**

Parameswaran (1999) argues that a range of characteristics such as technology used to implement project activities can be effective to Community Participation. The more complex the technology, the less participation. The question of technology has direct link with sustainability of project services especially when operational and maintenance costs are to be met by the beneficiary communities. Another factor according to Parameswaran (1999) is on human and financial resources, as they are vital when it comes to meeting operational and maintenance costs. Furthermore, transparency accounts for the degree of Community Participation. For this matter community members will actively participate if benefits are clearly articulated and obtained immediately at the beginning of the project design. For the case of the water project, people expect to see domestic water points installed or boreholes drilled and in operation. Moreover, administration structure is equally important. Thus, if projects allow users' contribution and if they are flexible, well-coordinated and managed well at the local level, with free flow of information then people will automatically participate.

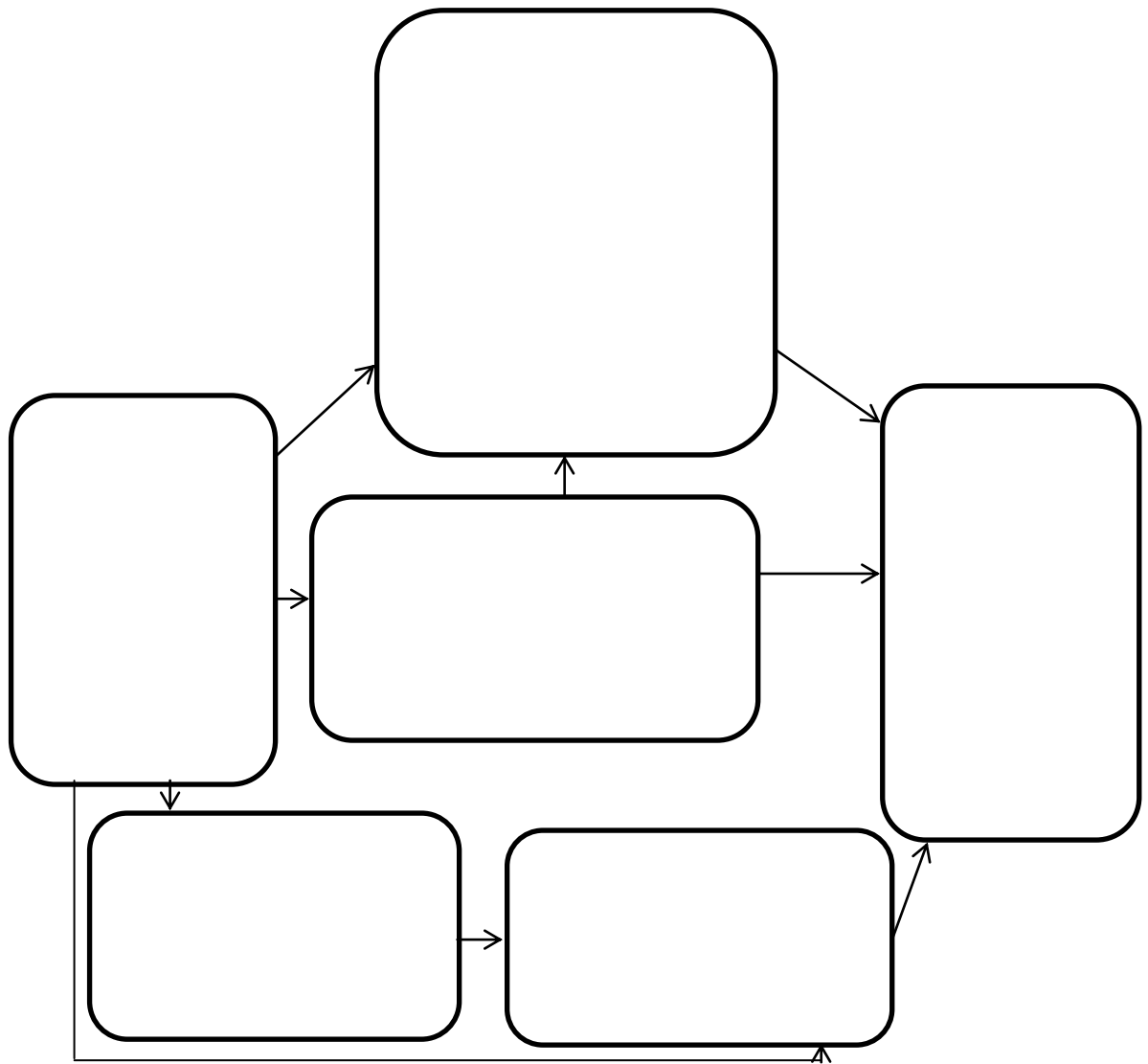
Women's involvement in project activities and capacity building are also essential to sustain project-initiated services. This is because in water projects women are the main stakeholders. Therefore, women participation and leadership positions in Water Committee are inevitable for sustainable water projects (Mbugua *et al.*, 1993: 14). Brikke (1997) argues that sustainability of project services are to be realized if water sources are not overexploited, facilities for operation and maintenance are in place, and funds are readily available. And that both women and men are involved in the design, planning and

management of the scheme, and technology choice corresponds to needs desires. Also projects are culturally accepted, spare parts are available and affordable, and support system is in place. Others include capacity building, technical assistance and availability of well-established institution for legal framework. Areas where these factors are not part of the system, faces problematic in sustainability of projects.

Sustainability of rural water supplies is a major challenge in Tanzania. Water point Mapping (WPM) surveys conducted in 51 districts in Tanzania mainland found that only 54% of all public improved water points are functional. Even very new water points (WPs) have a problem: the same surveys found that just two years after project completion, already a quarter are no longer functioning (Water Aid, 2009).

## **2.6 Conceptual Framework**

The conceptual frame work used in the study is based on the Functionalism theory (Talcot, 1975), the study assumes that sustainability of water projects depends on effective management of the system which considers such aspects as operations and maintenance, as key instruments for project functionality. The conceptual framework shows that sustainability of water projects depend on both stakeholders' participation and effective management of the system which includes: Operation and maintenance, setting of water charges and effective use of water funds. Apart from the indicators of management, sustainability also depends on the inter-linkage of indicators between economic, environmental and social dimensions (Juwana *et al.*, 2012). Social factors like awareness of people towards environmental conservation affect the way they comply with the rules and regulations for environmental protection. Economic factors where people employ themselves by carrying out economic activities around water sources like farming activities, making bricks, grazing animals pollutes the sources hence affect the availability of water. More details are summarized in Fig. 1.



**Figure 1: Conceptual framework showing factors influencing sustainability of clean water project**



## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Description of the Study Area**

##### **3.1.1 Geographical location**

The study was conducted in Iringa District Council which is among the Four Districts Council in Iringa Region. The District borders with Mpwapwa District (Dodoma Region) to the North, Kilolo District to the East, Mufindi district to the South, Chunya District (Mbeya Region) to the west and Manyoni District (Dodoma Region) to the North West. The headquarters is located in Iringa Municipal along Dodoma road. In terms of international identification, the district lies between latitudes 7°0' and 8°30' south of the Equator and between longitudes 34°0' and 37°0' east of Greenwich. Administratively Iringa District Council is divided into 6 divisions, 25 wards, 123 villages and 718 hamlets. The Council has two (2) Parliamentary Electoral constituencies namely; Ismani and Kalenga.

Iringa Rural District has a total area of 20413.98 sq. kms which is about 34.9 percent of the total area of Iringa region most of which is plain land with very few hills or valleys. Only 9857.5 sq.km are habitable, leaving the remaining land either as national parks, rocky mountains or water bodies. About 9437.5 sq. kms covered by Ruaha National Park and 1119 sq. km by water bodies. The arable land available is 479258 hectares or about 23.5 percent of the district area. Out of the arable land in the district, only 184 465 hectares are cultivated annually (Fig. 2).

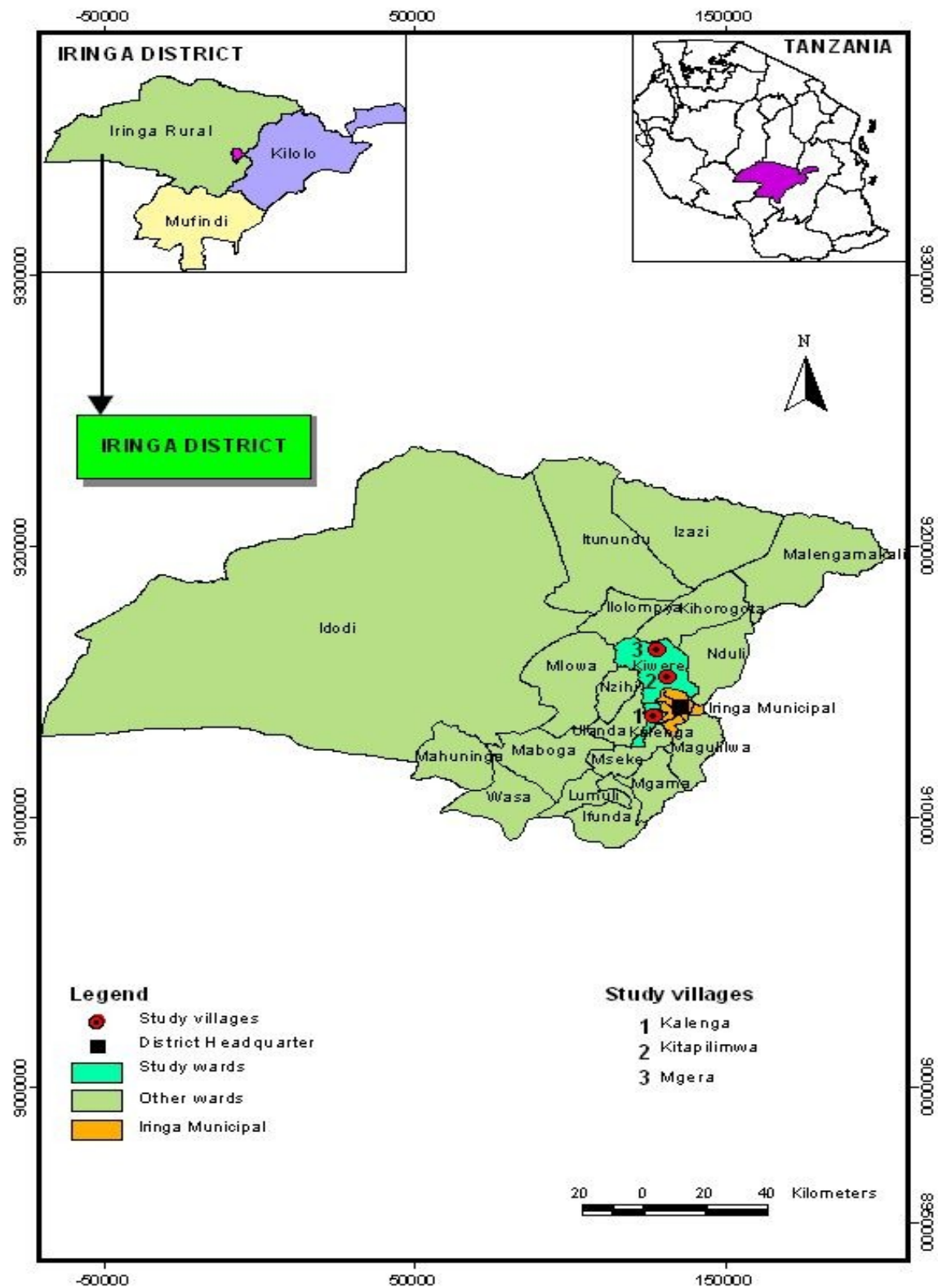


Figure 2: The map of Iringa District, Tanzania, showing the study area

### **3.1.2 Climate and soils**

The district climate varies with altitude and closely associated with two distinctive landscape zones namely the midland and the lowlands. The midland zone is characterized by an undulating topography with scattered mountain hills and plateau at an altitude of 1200 metres and 1600 metres above the sea level. The District experiences moderate mean rainfalls, ranging from 600 mm and 1000 mm annually with mean temperature being 15°C – 20°C. Most of the soils in this zone have high nutrient contents and are considered suitable for a wide range of food and cash crops and therefore have the potential for profitable cultivation.

The lowlands zone lies between altitudes 900 and 1200 metres above the sea level. It is semi-arid or commonly known as the marginal area, due to low mean rainfalls which range from 500 mm – 600 mm and relatively hot with temperatures ranging between 20°C – 25°C, of which the higher temperatures are experienced from September to October. The zone has very rich soils suitable for agriculture but the agricultural production level is low due to agronomical factors especially unreliable rainfall.

### **3.1.3 Population**

According to the 2012 Tanzania national census, the population of Iringa District was 254 032 (138 284 or 56.4 percent females) with a growth rate of 1.3% (URT, 2013). The average population density of Iringa District increased slightly from 12.0 persons per sq. km in 2002 to 12.4 persons per sq. km in 2012. Iringa Rural is the least densely populated district in Iringa Region and it is below the regional average population density of 23.4 persons per sq. km in 2002 and 26.3 in 2012. Among other reasons, the relatively small population density of Iringa Rural District has been caused by its relatively large land area. Its average household size was 4.2 persons per household.

### **3.1.4 Economic activities**

Iringa Rural District economy continues to be dominated by the agriculture sector. Both cash and food crops are produced, with the latter dominating. According to the results of the 2008 Regional Gross Domestic Product Survey, agriculture sector contributes close to 99 per cent of the district's GDP, of which crop production sub sector contributed about 83.9 percent followed by livestock 14.8 percent while hunting, forestry and fishing accounted for less than a percent. Services and industry sectors account for about 0.8 and 0.2 percent respectively. Cereals are the main crops grown in the district with maize being the dominant, followed by paddy. Other crops grown are finger millet, sorghum and barley.

### **3.1.5 Access to clean drinking water**

There is insignificant variation in the sources of water during wet and dry seasons. Data from the National Sample Census of Agriculture 2007/08 show that the piped water contributes to 40.7% as source of drinking water in Iringa Rural District followed by other unreliable sources: surface water, including rivers, dams, streams and lake (21.7%), unprotected well (9.6%), unprotected springs (9.4%) while a small percentage (9.1%) used protected well.

## **3.2 Research Design**

A cross - sectional research design was used. According to Kothari (2004), this design allows data to be collected at a single point in time. The design allows for a descriptive analysis, interpretation, as well as for determination of relationship between variables (Bailey, 1998).

### **3.3 Sampling Procedure and Sample Size**

Three villages, namely Kitapilimwa, Mgera and Kalenga were randomly selected within Iringa rural district. The criterion for village selection was on availability of water project. The study involved; Kitapilimwa water project, Mgera water project and Tanangozi-Kalenga water project. Therefore three projects were used by the study. Sixty (60) households benefiting from the project were randomly selected getting a total of one hundred and eighty (180) households. Nine (09) Key informants, six from village level and three from district level were purposively selected for obtaining more information. These were: Village chairperson and project leaders from village level, District Planning Officer, District Water Engineer and the District Community Development Officer (DCDO) at District level. This was focused on their experience on water availability (water sources, supply challenges, distance and time), participation of people on water projects development, gender issues on water management, resource allocation for project infrastructure maintenance. The essence of using key informants was to supplement the information collected through observation and structured questionnaire surveys. The ground for choosing 180 households as a sample size was adhering to Matata *et al.* (2001) who argued that having 80-120 persons are adequate for most socio-economic studies in Sub-Saharan Africa.

### **3.4 Data Collection Methods**

#### **3.4.1 Data collection for qualitative variables**

Qualitative data were gathered through key informant interview, focused group discussions where checklists of items were used to guide the interview and discussions respectively. Field observation methods through personal observation were also employed. The groups used in focus group discussions comprised 7-12 participants. During the focus group discussion, a checklist was provided to guide the discussion. The collected

information in Focused group discussions included: water sources, the establisher of the water sources, awareness of people during project development, availability of water committees, gender considerations in water committees, availability of meetings to discuss water issues and the democratic ability of people to speak on village meetings on water issues.

Personal or Participant observation was used to collect qualitative data such as observation of water sources and their status, means of water collection and containers used to carry water from the source, distance from water source to the households, people gestures when talking of water issues. These required direct observation at the field. The method enabled to connect together different information collected by other methods.

### **3.4.2 Data collection for quantitative variables**

Quantitative data were collected through interview where a structured questionnaire (Appendix 1) with both close and open-ended questions was used in order to obtain information on; age, education, attitude, experience of respondents as background information, institutional arrangements, social factors, economic factors and environmental factors affecting sustainability of water projects as independent variables and factors for project sustainability as dependent variables. A questionnaire was administered to the heads of selected households using personal in-depth approach. In the absence of the heads of households, any member of the households represented provided that he or she was in position of providing required information.

## **3.5 Data Processing and Analysis**

### **3.5.1 Data analysis for qualitative variables**

Data from FGDs and field observations were analyzed using content analysis. Information obtained from key informants and FGDs using semi structured interview was broken down

into smallest meaningful units. This enabled the researcher to ascertain values and attitude of the respondents (Bernard, 1994).

#### **3.5.1.1 Measurement of participation**

Index scale was used to measure perception toward community participation levels on water projects development among respondents under objective number two, and the scale had 10 statements. Every respondent was asked to indicate whether the participation level was Information (1), Consultation (2), Decision (3), Acting (4) or Control (5) with each item of the scale. The responses were grouped into three categories: Information, Consultation and Decision. Acting and control were regrouped as Decision simply because if a respondent was able to decide then has power to act and control.

#### **3.5.1.2 Mapping method**

Mapping method offers different frameworks for organizing ideas and providing insight into qualitative data. It is also used to express and explore the relationship between different variables in the data, to explore the causal and other relationships expressed in the data, and highlight actions and their consequences (Brightman, 2003).

In this study mapping of institutional arrangements for water project management was done so as to show the type and roles of the institutions in ensuring sustainability of water projects at the villages. Institutions from water users' level to the district level were identified and their roles explained.

#### **3.5.2 Measurement of sustainability**

In measuring sustainability of projects, five statements were used in the index scale to measure the perception of people on water projects sustainability at their villages. The five

statements were: (1) Availability of water committees at the villages. Water committee is essential in strengthening and sustaining established water structures and service. Water committee is important to enable detailed monitoring and finding solutions to various problems confronting proper functioning of the installed water infrastructures. (2) Feedback about project progress. This statement was used to explore the information on whether there were proper communication between respondents and their water projects leaders. (3) Participation in inspection of water facilities. This statement was used to know whether respondents were involved in checking up the projects facilities. This is important because it creates the sense of ownership of the projects to the community. (4) Decision on construction of water projects at their villages. The statement was used to know whether the respondents demanded the projects. If the projects were from community's priorities then the likeness of sustainability is high. (5) Setting service prices. The statement used to know if setting of water service prices involved water users. The total score from the index was computed. From the total score, mean, maximum and minimum scores were computed. From the scores, decision was made where all scores above mean indicated the chances of project sustainability of while scores below mean indicated unsustainability of the projects. The Table 1 below shows statements/factors for sustainability and their measurement levels.



**Table 1: Statements/ factors for water project sustainability**

<b>Factors</b>	<b>Question</b>	<b>Measurement</b>
Availability of water	Do you have water	1= yes
committees at the villages	committee at your village?	0 = no
Feedback about project	Do you get any feedback	1 = yes
progress	about project progress from your water committee?	0= no
Participation in inspection	Are you involved in	1 = yes
of water facilities	inspection of project facilities?	0 = no
Decision on construction of	Were you involved for the	1 = yes
water projects	decision of water project construction?	0 = no
Setting service prices	Were you among the	1 = yes
	deciders for the water service price?	0 = no

### 3.5.3 Data analysis for quantitative variables

Descriptive statistics such as frequencies and percentages were used to determine distributions and magnitudes of variables among the respondents for variables such as sex, education, marital status, occupation and age. Also binary logistic regression model was used to determine the factors for sustainability of the project. The model was necessary to explain the prediction of factors likely to determine an outcome variable (sustainability) which is based on values of a set of values and the sustainability was dichotomous variable with two values, 1 if the projects were perceived to be sustainable and 0 otherwise, (Hosmer and Lemeshew, 1989). The model is presented in the following equation:

$$\text{Log} = [p / (1-p)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon_i$$

Whereby;

$\text{Log} = [p / (1-p)]$  = a logarithm of sustainability of water projects

P = Chance that water projects are sustainable

$\beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$  = Constant coefficients for the independent variables

$\varepsilon$  = Error term representing a proportion of the variance in the dependent variable that was unexplained by the regression equation.

$X_1 = X_n$  = Predictors

$X_1$  = Maintenance per annum (1 = if done, 0 = if not done)

$X_2$  = Meetings per annum (1 = if done, 0 = if not done)

$X_3$  = Spare parts replacement per five years (1 = if done, 0 = if not done)

$X_4$  = Water management trainings per annum (1 = if 2 or more, 0 = if less than 2)

$X_5$  = Time spent for water collection (measured in minutes) (1 = if less than 30 minutes, 0 = if more than 30 minutes)

$X_6$  = Water consumed per day (measured in liters) (1 = if satisfying, 0 = if not satisfying)

$X_7$  = Activities in the water sources (1 = if not done, 0 = if done)

$X_8$  = User fee (1 = if paid, 0 = if not paid)

$X_9$  = Gender balance in water committee (1 = if committee is gender sensitive, 0 = if not).

## CHAPTER FOUR

### 4.0 RESULTS AND DISCUSSION

#### 4.1 Demographic and Socio-economic Characteristics of Respondents

##### 4.1.1 Age of respondents

Age of respondents plays an important aspect in social analysis due to the fact that different age groups perform different sets of activities almost in all the societies. Overholt *et al.* (1991) explains that age can be seen as a function of knowledge and experience as well as the measure of maturity of an individual. The results show that majority of respondents (32.8%) were in the age category (18-35 years) followed closely by those with the age between 36-45 years (31.1%). The other category (19.4%) shows age ranging between 46-55 years and the last was those under category of above 55 years (16.7 %) as shown in Table 2.

**Table 2: Demographic and Socio-economic Characteristics of Respondents (n = 180)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Age of respondents (n= 180)</b>		
18-35	59	32.8
36-45	56	31.1
46-55	35	19.4
Above 55	30	16.7
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Education level of respondents (n= 180)</b>		
No formal education	29	16.1
Primary	121	67.2
Secondary	24	13.3
Diploma	6	3.3
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Sex of respondents (n = 180)</b>		
Male	80	44.4
Female	100	55.6
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Marital status of respondents (n = 180)</b>		
Single	25	13.9
Married	149	82.8
Divorced	3	1.7
Separated	1	0.6
Widower	1	0.6
Widow	1	0.6
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Relationship with Household Head (n= 180)</b>		
Household head	68	37.8
Spouse	87	48.3
Brother/Sister	4	2.2
Own child	16	8.9
In laws	2	1.1
Grandsons	3	1.7
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Occupation of respondents (n= 180)</b>		
Farmer/crop producer	109	60.6
Farming & livestock keeping	48	26.7
Pet trader	4	2.2
Wage laborer	16	8.9
Self employed	3	1.7
<b>Total</b>	<b>180</b>	<b>100.0</b>

#### **4.1.2 Level of education**

Understanding the educational levels of the participants of targeted communities was an important factor in assessing their skills and knowledge for judging about different issues about water projects. The results show that majority of respondents (67.2%) were those who attended primary education followed by those with no formal education (16.1%) and more than thirteen percent (13.3%) had secondary education while only three percent (3.3%) had diploma. The reasons behind for high level of primary education in the study area might be due to deliberate effort made by the government in 1978 to expand primary education in the country which was made compulsory for all children of 7-14 years (URT, 1996) and the Primary Education Development Programme introduced in 2000s increased enrolment for primary school children (URT, 2009). The low number of respondents who had secondary and diploma education could be explained by the fact the awareness of people of Iringa district was low about schooling. After completing primary education, most girls went to town for house maid jobs and boys remained at home helping their parents in agricultural activities. This was explained by Mr. Golwike, the District Community Development Officer of Iringa district who was one of key informants.

#### **4.1.3 Sex of respondents**

The result reveals that about 56% of respondents interviewed in the study were women and nearly 44% were men (Table 2). According to findings, men were few due to the fact that most men who were the household heads delegated the responsibility to their wives to provide information by claiming that they were not very much aware of water issues because it is the responsibility of their wives to ensure water is available at their households.

#### **4.1.4 Marital status of respondents**

Table 2 below shows that most of respondents (82.8%) were married, others were single, widowed, separated and divorced. This implies that most of the respondents interviewed in the study area were mature and responsible for taking care of their families in terms of social and economic welfare.

#### **4.1.5 Relationship with the household head**

Data reveal that about 40% of people interviewed were household heads while about 48% were the spouse. For both married couples interviewed, the head of the household were men in this case the spouse in these findings are wives of the household heads. Therefore as shown in Table 3, the proportion of spouse interviewed exceeds that of other categories. This implies that most men do not care much about reproductive roles especially the issue of making sure water is available for domestic use. But information obtained with this data is that, the information was gathered from the right people who know the burden of missing water at their homes.

#### **4.1.6 Occupation of respondents**

As for the main occupations of the respondents the study found that about 87.3% of the respondents in Iringa District are crop producers and animal keepers. Among these 60.6 % are engaged in crop production while 26.7% are engaged in both farming and livestock keeping. According to Mbwambo (2007), about 80% of the people in Tanzania are living in the rural areas and their main income generation activities include small scale agriculture or peasantry. As a study by Mbwambo (2007) reveals, nearly two third of the population work as farmers and the rest combine farm and off-farm activities including petty trade and carpentry just to mention few. The results in Table 2 also show that 8.9%

of the population comprises workers and 3.9% of the population comprises business and other self-employed income generating activities.

#### **4.2 Water Sources Protection Strategies**

Effective and sustainable management of water resources is vital for ensuring sustainable development. Different institutions have different strategies for ensuring water sources are protected around their areas. At the study area, village bylaws and regulations and penalties were seen to be the strategies used to protect water sources.

##### **4.2.1 Village bylaws and regulations**

The results in Table 3 reveal that nearly 93% of respondents were aware of the village bylaws and regulations for environmental protection. Only 6.7% of respondents were not aware of these bylaws and regulations. This implies that the village and water committee leaders at the project areas play their roles accordingly of educating people on protecting their environment especially water sources areas.

**Table 3: Presence of bylaws and regulations for water sources protection (n = 180)**

<b>Responses</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	168	93.3
Not aware	12	6.7
<b>Total</b>	<b>180</b>	<b>100.0</b>

Human activities that are conducted near water resources affect the water resources management, river ecology and the quality of water through pollution and silt sedimentation. In order to minimize the impact, the villages at the study area have enacted by-laws that limit people from doing economic activities around water sources. This

resembles to what is done to the rural areas of Mwanza Region where in most villages, the communities effected by-laws to limit human activities like bathing and washing clothes close to the sources of drinking water (Dungumaroet *al.*, 2003).

### **Knowledge of respondents on the bylaws and regulations**

Table 4 shows the knowledge of respondents on the contents of the village bylaws for environmental protection. When respondents were asked to explain what is the bylaws stipulate, 74.4 % of respondents managed to recall farming restriction around water sources as one of the substance. About 6% of respondents mentioned keeping animals around water sources as activity not allowed according to their bylaws. Nearly 13% were able to mention two restrictions namely; farming and keeping animals around water sources are not allowed as according to their village bylaws. Only 6.1% of respondents were not able to mention what is inside village bylaws for environmental protections.

**Table 4: Knowledge of respondents on the bylaws and regulations (n = 180)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
Farming is restricted around water sources	134	74.4
Keeping animals around water sources is not allowed	11	6.1
Farming and keeping animals are restricted	24	13.3
Not aware	11	6.1
<b>Total</b>	<b>180</b>	<b>100.0</b>

The aim of getting this information was to know if people were able to mention specifically what were inside village environmental protection by-laws. Having this awareness will help the community to avoid engaging in activities that go against their by-laws hence environmental protection is ensured.



#### **4.2.2 Punishments on environmental destruction**

When respondents were asked to explain the punishment associated with failure to observe bylaws it was revealed that; 85.6% had a positive answer, while about nine percent (9%) of respondents had negative answer. When the respondents were asked about the type of punishment given, nearly 70% indicated a penalty of 50 000Tshs being paid by those who pollute the water source environment for whatever activity done. Nearly 11% of respondents indicated 30 000Tshs as the penalty for people polluting the environment around their areas. Punishment is used to teach, reform, and persuade individuals to accept what members of society view as acceptable or tolerable behavior (Vaden, 2004). Through punishment the chances for destruction of the water sources at the study area will be minimized.

Payment receipts are very important in any business or service; receipts are used to show that a payment has been made and generally specifying the purpose of the payment. In the current study, when respondents were asked if when those found guilty for polluting the environment received any receipt when paid for the penalty, the response was negative with 82.8% of the respondents admitting that receipts were not being issued for payments made. The findings indicate that the penalties are given to people without receipts which verify the payments made. Thus, therefore without receipts village leaders are likely to misuse water funds as the auditing of the real expenditures will be difficult without payment vouchers or receipt concerning project funds. Also these leaders may not be serious in restricting people to pollute the environment so that they continue benefiting from these penalties.

**Table 5: Awareness, type of punishment and receipts after penalty (n = 180)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
<b>Awareness of people on punishment</b>		
Yes	154	85.6
No	17	9.4
Not aware	9	5.0
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>The type of punishment given to people who destroy the environment (n =180)</b>		
Penalty of 50 000Tshs	120	66.7
Penalty of 30 000Tshs	19	10.6
Destroy properties	15	8.3
Not aware	26	14.4
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Receipts after penalty (n =180)</b>		
Yes	4	2.2
No	149	82.8
Not sure	27	15.0
<b>Total</b>	<b>180</b>	<b>100.0</b>

#### **4.2.3 Economic activities around water sources**

The research findings in Table 6 reveal that about 96% of respondents admitted that people at project areas engage themselves in economic activities around water sources. Only 3.9% of respondents had of the opinion that people are not engaging in economic activities around water sources at their area. This happens despite of the high knowledge of people on environmental protection as according to Table 4 and 5 of this report. When the village chairman of Kitapilimwa village was asked about this problem, he replied that it is because the area experience drought condition most the time therefore the farmers and pastoralist use the water sources areas for gardening and feeding their cattle/animals.

**Table 6: Economic activities around water sources (n = 180)**

<b>Response</b>	<b>Frequency</b>	<b>Percentage</b>
Done	173	96.1
Not done	7	3.9
<b>Total</b>	<b>180</b>	<b>100.0</b>

#### **4.2.4 Types of economic activities carried out around water sources**

Table 7 reveals that nearly 33% of respondents argued that agricultural activities prevail around water sources at their areas. About 18% of respondents replied that keeping animals is one of the economic activities taking place around water sources at their areas. Bricks making also appeared to be among the economic activities done around water sources having recommended by 10% of respondents. Nearly 34% of respondents mentioned both three activities: Farming activities, Keeping animals and Making bricks as the activities undertaken by people around water sources at their areas. These activities cause clearing of vegetation around water sources hence drying of sources. Polluting the water sources is another effect causing poor quality of water.

**Table 7: Types of economic activities carried out around water sources (n =180)**

<b>Activity</b>	<b>Frequency</b>	<b>Percentage</b>
Farming activities	60	33.3
Keeping animals	33	18.3
Making bricks	18	10.0
Both three activities	62	34.4
Not aware	7	3.9
<b>Total</b>	<b>180</b>	<b>100.0</b>

#### **4.3Community Participation in Project Development**

Index scale was used to measure perception toward community participation levels on water projects development among respondents, and the scale had 10 statements with five categories, Information, Consultation, Decision, Acting and Control as seen in Table 8.

#### 4.3.1 Stages of people's participation in project implementation cycle

**Table 8: Index scores of Community participation in project development (n= 180)**

Participation statements	I		C		D		A		Co	
	F	%	F	%	F	%	F	%	F	%
Participation level at proposing the project	81	45	4	2.2	19	10.6	31	17.2	45	25
Participation level at prioritizing the project	81	45	4	22.2	20	11.1	36	20	39	21.7
Participation level at setting objectives	81	45	6	3.3	33	18.3	41	22.8	19	10.6
Participation level at collecting project information	83	46.1	13	7.2	37	20.6	32	17.8	15	8.3
Participation at analyzing project information	87	48.3	19	10.6	44	24.4	25	13.9	5	2.8
Participation level at capacity building	88	48.9	27	15	40	22.2	20	11.1	5	2.8
Participation level at developing action plan	94	52.2	42	23.3	25	13.9	12	6.7	7	3.9
Participation level at implementing the action plan	94	52.2	46	25.6	21	11.7	12	6.7	7	3.9
Participation level at contributing for the project (cash, inkind)	109	60.6	34	18.9	16	8.9	14	7.8	7	3.9
Participation level at evaluating project progress	123	68.3	26	14.4	12	6.7	10	5.6	9	5

I= Information, C = Consultation, D = Decision, A = Acting, Co = Control

A total of ten (10) statements were formulated and used in collecting information on the perception towards community participation in different levels of project development. With exception of the first statement (participation level of people at proposing the project) which scored 42.2% at higher level participation, the remaining statements scored more less percentages at higher and medium participation levels compared to the percentage scores at low participation levels. The results implies that development of water projects at Iringa District does not take into consideration the concept of involving the community at all levels of project development. Involving the community at matters of their own development has more benefits than drawbacks. Dungumaro *et al.* (2003) asserts that, the emergence of participatory approaches demonstrates the importance of local

communities consent in taking part in public decision-making processes, especially on issues that directly affect their welfare. In this context, the local community participation could provide an important database, experience and ideas that could lead to practical, relevant, achievable and acceptable solutions to water related problems. Sustainability of water projects at Iringa District is endangered by the failure to involve the community in all the processes of projects development.

**Table 9: Combined index scores of Community participation levels in project development (n= 180)**

Participation statements	Low level participation		Medium level participation		Higher level participation	
	F	%	F	%	F	%
Participation level of at proposing the project	85	47.2	19	10.6	76	42.2
Participation level at prioritizing the project	85	67.2	20	11.1	75	31.1
Participation level at setting objectives	87	75.3	33	18.3	60	33.4
Participation level at collecting project information	96	53.3	37	20.6	47	26.1
Participation at analyzing project information	106	58.9	44	24.4	30	16.7
Participation level at capacity building	115	63.9	40	22.2	25	13.9
Participation level at developing action plan	136	75.5	25	13.9	19	10.6
Participation level at implementing the action plan	140	77.8	21	11.7	21	10.6
Participation level at contributing for the project (cash, in-kind)	143	79.5	16	8.9	21	11.7
Participation level at evaluating project progress	149	82.7	12	6.7	19	10.6

#### 4.3.2 Stages of people participation during project development

Findings in the Table 10 below reveal that participation of people to project development differs at different stages. Project development was put into four stages: initial meeting to

discuss project, meetings after approval of the project proposal, in provision of labor to implement project and contributions of money resource for project implementation. More than 40% of respondents responded negatively to the question, indicating that they had never been participated at any stage of project development. Nearly 30% admitted to be participated in all stages of project development. The remaining respondents participated at initial meetings to discuss project, these form about 12% of them. 6.7% of respondents participated during the third stage of project development which is provision of labour in project execution. Only 5.6% of respondents were able to contribute money to implement the project. The other respondents participated on the second stage of project development which is meetings to approve the project proposal and these form 2.8% in total.

**Table 10: Stage of people participation during project development (n= 180)**

<b>Stages</b>	<b>Frequency</b>	<b>Percentage</b>
Initial meeting to discuss project	22	12.2
Meetings after approval of the project proposal	5	2.8
In provision of labour to implement project	12	6.7
Contributions of cash	10	5.6
All four stages	58	32.2
None	73	40.6
<b>Total</b>	<b>180</b>	<b>100.0</b>

Participation of stakeholders in this case was not done accordingly. The communities were to be involved in the whole process of project development equally. This is supported by Juwana *et al.* (2012), water is an essential resource, to be used and managed appropriately, and all relevant stakeholders should be involved in its development and management.

#### **4.3.3 Participation in the inspection of the project facilities**

The whole community has the responsibility of protecting the project against any damage or destruction which is likely to affect the project. Through the inspection of the project

facilities, the community is able to identify any damage on the project machinery and which might affect the proper functioning of specific project. Therefore, when the respondents were asked to indicate the person responsible in participating in the inspection of the project facilities, the results in Table 11 show that about 45.6% of the respondents mentioned district water technician as having the responsibility of inspecting the project facilities. Furthermore, about 27.2% of the respondents were not aware of who was responsible for inspecting the project facilities, while about nine percent (9.4%) of the respondents indicated water user association leaders, seven percent (7%) of the respondents indicated village council, seven percent (7%) of the respondents indicated the whole community and four percent (4%) of the respondents indicated water attendants as responsible for inspecting project facilities. The findings reflect the fact that communities do not feel as part and parcel in protecting project facilities and this in one way or another affects the water project.

**Table 11: Responsible person for inspection of project facilities (n= 180)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
District water technician	82	45.6
The whole community	13	7.2
Water attendants	7	3.9
Water user associations	17	9.4
Village council	12	6.7
I do not know	49	27.2
<b>Total</b>	<b>180</b>	<b>100.0</b>

#### **4.3.4 Awareness of the community during development and implementation of the project**

Results in Table 12 show that almost 97% of respondents were not aware of water projects development at their villages. During Focus Group Discussion, respondents admitted that they were not well informed during establishment of water projects at their villages. They

said their village leaders just informed them about the project but they didn't ask them to give out their views about how things should go about the project. Nearly three percent of respondents admitted to be aware of the establishment of water project at their villages.

When they were asked about the establisher of the water source where they obtain water from, nearly 78% of respondents admitted that the water project was established by donors. This was also supported by key informants at both projects, the village chairman of Kitapilimwa village admitted that the water project at their village was established by sisters of Roman catholic church (donors). The Tanangozi-Kalenga project which supplies water at Kalenga village, was also established by donors. This was admitted by Eng. Madaha who is the District Water Engineer at Iringa District. The same to Mgera water project which use Petrol machine to pump water from Ruaha River to the village, and all infrastructures were set up by Donors. About 21% claimed the source to be natural. Most of these respondents are the ones who get water direct from the river Ruaha. Only one percent (1%) of respondents claimed that villagers were the establisher of the project.

**Table 12: Awareness of the community during development and implementation of the project (n= 180)**

<b>Awareness</b>	<b>Frequency</b>	<b>Percentage</b>
Aware	6	3.3
Not aware	174	96.7
<b>Total</b>	<b>180</b>	<b>100.0</b>
<b>Establisher of the water source (n= 180)</b>		
Donor	141	78.3
Villagers	2	1.1
Natural source	37	20.6
<b>Total</b>	<b>180</b>	<b>100.0</b>



According to these findings, it is revealed that development partners do ignore the grassroots when trying to help them. They just think nothing good can be obtained from these people. When the grassroots are well engaged in their own development, they will have ownership hence sustainable development.

#### **4.3.5 Feedback about project progress**

Investigation was made to see whether people at the study area got feedback from their water user association's leaders on project progress. Through feedback community would be able to know whether actions were taken on the agreed points and recommendations during the public meetings. The study revealed that the majority of respondents were not satisfied with the way they communicate with their project leaders. The findings indicate that 42.8% were not aware of whether feedback was given or not. 42.8% gave negative response indicating that feedback was not provided by their water association leaders. Only 14.4% of respondents responded positively to the question indicating that feedback was given about water project progress.

**Table 13: Feedback about project progress from water user association (n= 180)**

<b>Category</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	26	14.4
No	77	42.8
Not aware	77	42.8
<b>Total</b>	<b>180</b>	<b>100.0</b>

The findings imply that, there is no proper communication between water users and their leaders at the study area. Communication is a two way traffic process therefore as water users give out their views on how water projects should be developed at their area, the same to leaders should give back information on progress of their projects.

#### 4.3.6 Women representation in water committees

When the respondents were asked to mention the number of women belonging to village water committees, the findings in Table 14 reveal that about 62.8% of the respondents reported that there were not aware about women representations in the water committee while 30%, 5% and 2.2% of the respondents mentioned to have two women, four women and six women representation respectively. When the same question was asked to the water committees' chairpersons at Kitapilimwa, Mgera and Kalenga villages who both were men, the answers were two women among seven members, four women among eight members and two women among eight members respectively.

**Table 14: Representation of women in the water committee (n= 180)**

Category	Frequency	Percentage
Two women members	54	30
Four women members	9	5
Six women members	4	2.2
Not aware	113	62.8
<b>Total</b>	<b>180</b>	<b>100.0</b>

The results indicate that in the study area, men are the ones who manage and operate the water projects, while women are left behind. The situation is likely to affect the water project because it is probable that women's ideas and decision are not included in the whole process of planning and management of the water projects. This is supported by Juwana *et al.* (2012) who said, "The central role of women in the provision, management and protection of water resources is recognized and acknowledged, and Economic value of water in all uses should be emphasized and taken into account in the decision making".

#### 4.4 Mapping of Institutional Arrangements for Water Project Management

For the purpose of this study, institutions in water management are the organisations and stakeholders at the national and local levelsthat enable effective and efficient provision of

water services at the study area. Building of appropriate institutional structures for administration of water services is yet another crucial aspect to achieve water projects sustainability (Mwakila, 2008). These may be in the form of district authority, village water committees, community-based organizations (CBOs) or water user groups. Management of water projects at Iringa District is put into four levels: District level, Village level, Water user associations level and Water users.

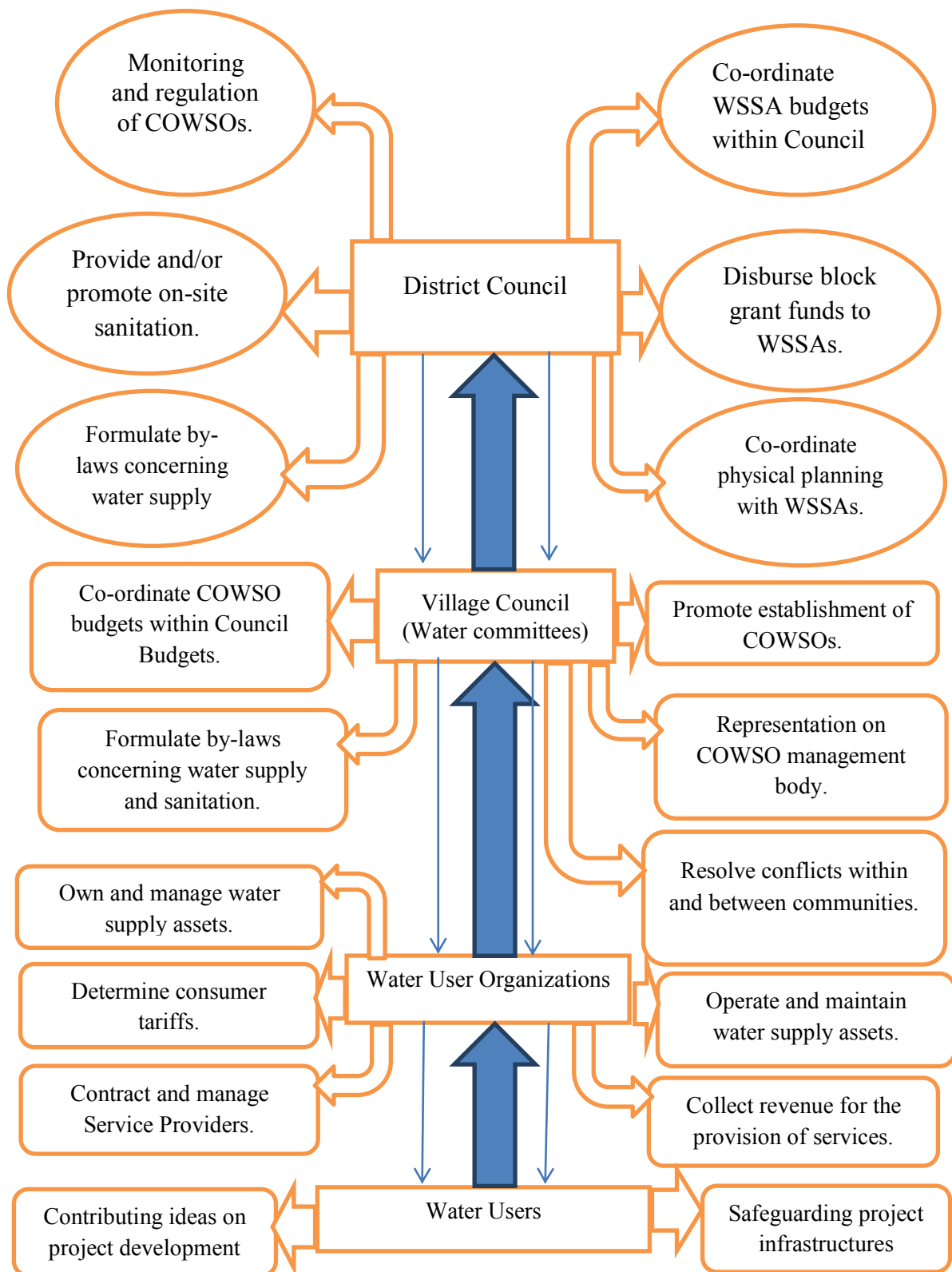
#### **4.4.1 District council authority**

District Council and District water and sanitation team (DWST) facilitate needs identification and preparation of community plans through participatory planning. They prioritize sub-projects and annually prepare a district plan and budget through Sector-wide approach to planning (SWAP). National Rural Water Supply and Sanitation Programme (NRWSSP) funds are released to DCs on the basis of these plans and budgets. The DWST implements the NRWSSP at district level. It provides technical and financial support to communities in planning, implementing, operating, and maintaining water facilities, and is a linkage between water basin offices, village water and sanitation committees (WATSANs)/ community owned water supply organizations (COWSOs), Water User Groups (WUGs) and other Water User Entities, the private sector and NGOs. The DWST also oversees and coordinates NRWSSP activities within the district, and leads in the preparation of annual district water and sanitation plans.

#### **4.4.2 Village council (water committees)**

The village council is formed by different committees of various sectors of concern. Each committee is responsible to take care of all matters falling under a particular sector. Water committee is essential in strengthening and sustaining established water structures and service. Water committee is important to enable detailed monitoring and finding solutions

to various problems confronting proper functioning of the installed water infrastructures. In this perspective Water committee members are elected to manage projects on behalf of the whole community. The roles of water committees in management of water are: promoting establishment of community owned water supply organizations (COWSOs), coordinating COWOSO budgets within Council budgets, representation on COWSO management body, formulating by-laws concerning water supply and sanitation services, resolving conflicts within and between communities concerning water services and all other matters pertaining water sector (Fig. 3).



**Figure 3: Actors involved in management of water projects at the study area**

#### **4.4.3 Water user organizations**

Water user entities and user groups are the lowest appropriate management level for Rural Water Supply and Sanitation services (RWSS). COWSOs and WATSAN committees, established in villages are responsible for the planning, management, and Operation and Maintenance (O&M) of the facilities. This includes designing sub-projects and preparing proposals, getting approval and subsequent funding, monitoring construction, setting tariffs, collecting revenue, and providing reliable services to the consumers. Community management of water and sanitation services can take different legal forms. There are several options for rural water supply and sanitation management systems for both small scale and large schemes. These COWSOs may be in the form of a Water User Group (WUG), Water User Association (WUA), Company limited by guarantee, Company limited by share, Board of Trustees or Cooperative Society. At the study area, they opted for Water User Associations. The Facilitation Service Providers (FSPs) from district level assists communities to draft constitutions for appropriate legal entities to manage their water projects.

#### **4.4.4 Water users**

This category is not in the form of organizations but is an important category of actors for water management at the study area. Water users are the common people who benefit from the project service. These are stakeholders who are the reason for the existence of the project. Their roles are to ensure the project infrastructures are kept safely by safeguarding them and reporting for any problem detected with the project but also are ones responsible for contributing ideas on the development of projects at their villages.

The present institutional framework for management of water supply and sanitation services in rural areas has led to overlapping roles among the various institutions;

inadequate coordination among the various agencies and inadequate communication and awareness building between these agencies and local organisations and water users. It has also caused “conflict of interest” as responsibility for regulation and performance monitoring of the provision of WSS services is vested in the same organisation that is responsible for service delivery and investment financing. The Government has all along continued to be the owner and in some cases the operator of schemes. These approaches have led to a lack of commitment by the beneficiaries to safeguard the facilities, and an unwillingness to contribute to the cost of operation and maintenance let alone the investment costs. The result of all this is poor performance; lack of proper management; lack of ownership; and poor delivery of services.

#### **4.5 Socio-economic and Environmental Factors Affecting Sustainability of Water**

##### **Projects**

A logistic regression model was developed and a number of factors (maintenance, spare parts, time, training, meetings, gender balance in water committees, user fee, daily water intake and economic activities in water sources) were modeled against the dependent variable (perceived sustainability of water projects). The data in Table 15 define and provide the descriptive statistics of the variables used in the Logistic regression model.

**Table 15: Binary logistic regression results presenting Socio-economic and environmental factors affecting sustainability of water projects**

<b>Factors</b>	<b>B</b>	<b>S.E.</b>	<b>Wald</b>	<b>Sig.</b>	<b>Exp(B)</b>
Project maintenance per annum	-1.566	0.171	15.976	0.001	0.209
Times of spareparts replacement per five years	0.635	0.810	1.325	0.250	1.887
Time spent for water collection	-0.335	0.326	0.410	0.522	0.715
Amount of water consumed per household per day	0.597	1.229	0.619	0.431	1.817
Economic activities in the water sources	-0.409	0.945	0.597	0.440	0.664
Affordability of water user fee	-1.416	0.470	2.192	0.139	0.243
Gender balance in water committees	-0.731	0.951	3.390	.066	0.481
Meetings conducted per annum	-1.713	0.985	12.029	0.010	0.180
Water management trainings per annum	-0.781	0.752	1.220	0.299	0.458
Constant	5.995	1.576	14.480	0.000	40.538

2 Log likelihood =208.465; Cox & Snell  $R^2$  0.171; Nagelkerke  $R^2$ =0.232

In this analysis, the dependent variable (sustainability of water projects) was modeled against independent variables indicated in Table 15. To test the strength of the model Logistic regression model was estimated using ( $R^2$ ), the results show that cox and snell ( $R^2$ ) was 0.171 and Nagelkerke ( $R^2$ ) was 0.232, the results therefore show that the model was fit to explain the change in the dependent variable as a result of the change in the independent variable.

The results show that only two independent variables which are Project maintenance per annum and Meetings conducted per annum were found to be significant at  $p \leq 0.001$  and  $p \leq 0.010$ , respectively. The findings imply that the positive signs attached to the estimated coefficients of the variables, indicates that the greater the values of these variables the higher the tendency to maintain sustainability of water supply. According to WHO and



UNICEF (2000), in order to ensure sustainability of water projects, a clearly structured, resourced, and trained maintenance organization is necessary. Other factors; times that spare parts has been replaced per five years, gender balance in water committee, affordability of water user fee, amount of water consumed per household per day and water management trainings per annum despite not showing significance have influence in sustainability of the water supply.

## **CHAPTER FIVE**

### **5.0 CONCLUSIONS AND RECOMMENDATIONS**

The study reveals that there are direct and indirect factors which affect the functioning of water projects especially in the study area. For instance, the direct factors affecting the rural water projects include lack of project maintenance and lack of spare parts, while the indirect factors include setting of water prices, poor quality of service delivery, absence of payment receipt for the service, long distance from household to the main water source and existence of alternative water sources. Progress toward attaining sustainability of water and projects will require a shift from singularly focusing on expanding infrastructure in areas without service, to dually concentrating on achieving longterm functionality goals through improved operation and maintenance of existing supplies.

#### **5.1 Conclusions**

Based on specific objectives and study findings, the following concluding remarks were arrived at:

Projects failure. In the study area it was revealed that, people carry out economic activities around water sources. This has contributed to increasing failure of water projects which resulted into continuation of fetching water from rivers, streams, bore holes, unprotected dug wells and ponds for domestic water purposes. This situation is attributed to long distances, unreliability, high prices of the water from the project and non-functioning of the water projects in the specific villages. Other factors contributing to water projects failure were; lack of payment receipts, ineffective of community participation and misuse of project funds.

Improper institutional arrangements for water projects management. Building of appropriate institutional structures for administration of water services is yet another crucial aspect to achieve water projects sustainability. The present institutional framework for management of water supply and sanitation services in rural areas has led to overlapping roles among the various institutions. The Government has all along continued to be the owner and in some cases the operator of the projects. This approach has led to a lack of commitment by the beneficiaries to safeguard the facilities, and an unwillingness to contribute to the cost of operation and maintenance. For sustainability of water projects, maintenance of project infrastructures is a crucial aspect. At the study area, this aspect was not done leading to poor functioning of the projects.

In addition the study noted that project maintenance per year, gender balance in water committees and regular meetings observed as significant parameters which strengthen sustainable water projects in rural areas.

## **5.2 Recommendations**

The following recommendations were drawn from the findings of the study:

- i. The increasing rate of water project failure especially in the rural areas should be addressed in order to achieve reliable supply of safe and clean water to the rural populations. Local governments, donors and communities should make sure that capacity buildings for project management to the community and water user association members become a sustainable process for the attainment of water project sustainability.
- ii. In order to enhance transparency among WUG and VWC towards management of water funds, there should be good and timely quarterly progress reports on

expenditures and incomes accrued from water services which should be submitted in the village assemblies so that immediate measures can be taken in cases where operational problems emerge.

- iii. Community participation is a useful means for achieving sustainable development in rural areas. In order to achieve sustainable development, interactive and self-mobilization types of participation are recommended whereby people are actively involved in all stages of project identification, planning, implementation, monitoring and evaluation for sustainable development. In this case the central government, Local governments and donors when planning to initiate a project for the community, they should seek for a really participation of all beneficiaries.
- iv. Proper communication should be ensured between water users and their leaders so as to clarify or rectify any problem happening at early times. There should be clear articulation of the roles for each actor in water management at the study area. Private sector should also be actively involved in the form of public-private partnership so that they become part and owners of the water management at the study area.
- v. Regular maintenance of rural water projects is very important in achieving sustainability. Regular maintenance is facilitated by regular training of the WUGs and village technicians. Therefore, it is recommended that WUG and village technicians should be trained on how to handle minor and major maintenance instead of depending on maintenance workers from outside.

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## APPENDICES

### Appendix 1: Questionnaire for Household Survey

My Name is JIMSON CHUMBULA, a student at Sokoine University of Agriculture. I am working on a research project titled, Sustainability of Water Projects: A Case of Selected Projects in Iringa District, Tanzania. The aim of this project is to identify all factors which affect the sustainability of water projects in Iringa District. I am going to ask you a number of questions on operation and maintenance of the water projects. Information provided by you will be valued and treated confidential, at the end the project will contribute on the knowledge for the factors which affect sustainability of water projects.

#### Section A: Questionnaire Identification

Date of interview.....

Questionnaire No.....

District ..... Ward.....

Village..... Hamlet/Sub village.....

#### Section B: Background Information /Characteristics of the Respondents

In this section i would like to know your background information; therefore, i will ask questions about yourself and your family

1.Age (yrs)	2.Sex	3.Relationship with HH head	4.Marital Status	5.Education Level	6.Occupation
	1. Male ( ) 2.Female()	1.Houshold head () 2. Spouse ( ) 3.Brother/Sister () 4.Own child ( ) 5.In laws ( ) 6.Grandsons ( ) 7.Helper ( )	1. Single ( ) 2. Married ( ) 3. Divorced () 4.Separated () 5.Cohabiting ( ) 6. Widower () 7.Others (specify) .....	1. No formal education ( ) 2. Primary ( ) 3. Secondary ( ) 4. Technical education ( ) 5.Diploma ( ) 6. University ( ) 7. Others (Specify) .....	1.Farmer/crop producer ( ) 2. Livestock keeper ( ) 3.Farming&livestock keeping ( ) 4.Pet trader ( ) 5.Wage laborer ( ) 5.Self-employed ( ) 6. Formal/Civil servant ( )



### Section C: Water projects protection and people awareness

7. Does the village have by laws and regulations for water sources protection?

1 = Yes [    ]    2 = No [    ]    3 = Not aware [    ]

8. Can you explain anything you know about these laws and regulations?

.....

9. Do people carryout economic activities around water sources?

1 = Yes [    ]    2 = No [    ]

10. What type of economic activities being carried out?

1. Farming activities [    ]

2. Keeping animals [    ]

3. Other (specify).....

11. Is there any punishment rendered to people who destroy the water source?

1. Yes [    ]

2. No [    ]

12. If the answer is yes in question 11 above, what kind of punishment are given to them?.....

13. Do people who destroy the environment get receipt after penalty?

1. Yes [    ]    2. No [    ]

14. Is there any importance of conserving the environment?

1. Yes [    ]

2. No [    ]

3. Do not know

15. If the answer is yes in question 13 above, what are the benefits we get for conserving the environment. ....

### Section D: Community participation in project development

16. Where do you get water for your daily use?

1.....

2.....

3.....

17. Who established the water source?.....

18. Were you aware of the development and implementation of the project?
1. Yes ☐ 2. No ☐
19. Who decided for the construction of water project at your village?
1. All villagers ☐ 2. Village leaders ☐ 3. Donor ☐  
4. Government ☐ 5. Others (specify).....
20. Did you participate at any stage of the project in which you are getting water from?
1. Yes ☐ 2. No ☐
21. At which stage did you participate?
1. Initial meeting to discuss project ☐  
2. Meetings after approval of the project proposal ☐  
3. In provision of labour to implement project ☐  
4. Contributions of cash ☐  
5. Any other .....
22. If you participated, what were you required to do?.....
23. Do you have water committee at this village?
1. Yes ☐ 2. No ☐
24. If the answer is yes in question 22 above, how many members of the committee.....
25. How are women represented in the water committee? Mention number of them
1. Two women members ☐  
2. Four women member ☐  
3. Six women members ☐  
4. More than half members ☐  
5. Not at all ☐
26. How often have you attended water meetings?
1. Never ☐  
2. Sometimes ☐  
3. Often ☐  
4. Always ☐  
If the answer is never, explain why.....
27. If meetings are held to discuss management of water project, do you have the feeling that you are able to speak?
1. Yes ☐

2. No [ ]

28. Do any member from your community trained on how to manage water funds?

1. Yes [ ]

2. No [ ]

3. I don't know [ ]

29. How many trainings conducted in your village concerning management of water fund?

1. less than 1

2. 2-3 trainings

3. 4-5 trainings

4. 6-7 trainings

30. Who provided this training?

1. District water technician [ ]

2. Non- governmental organization [ ]

3. Ward extension officers [ ]

4. Private consultants [ ]

31. Who is responsible for inspection of the project facilities

1. District water technician [ ]

2. The whole community [ ]

3. Water attendants [ ]

4. Water user association [ ]

5. Village council [ ]

6. Do not know [ ]

32. What is your participation level at each stage of water project development at your village as indicated in the table below

S/N	Project stage	Levels of participation				
		Information	Consultation	Decision	Acting	Control
1	Proposing the project					
2	Prioritizing the project					
3	Setting objectives					
4	Collecting project					

	information					
5	Analyzing project information					
6	Capacity building					
7	Developing action plan					
8	Implementation action of the plan					
9	Contributing for the project (cash, in-kind)					
10	Meetings to evaluate progress					
11	Total score					

Rating scale: Information =1, Consultation =2, Participation = 3, Acting= 4 Control = 5

### Section E: Institutional arrangements for water project management

33. Do you have water committee at your village?

1. Yes [ ] 2. No [ ] 3. Do not know

34. What are the responsibilities of water committee in water project?

1. To operate and maintain water project [ ]
2. To collect water bills [ ]
3. To conduct meeting on water project [ ]
4. To inform community on project progress [ ]

35. Do you discuss water issues at the village meetings?

1. Yes [ ] 2. No [ ]

36. How many meetings are conducted per annum concerning water project?

1. One meeting [ ]
2. Two meetings [ ]
3. Three meetings [ ]
5. Four and above [ ]

37. When there is a problem with your water project/point whom do you tell or ask for help?

1. Water user association [ ]
2. Project technician [ ]
3. Local government [ ]

4. Maintenance worker from outside [    ]
38. What is the level of performance of the water Committee in your village?
1. Very good [    ]
2. Good [    ]
3. Bad [    ]
39. Do you get any feedback about project progress from your water user committee?
1. Yes [    ] 2. No [    ]

**Section F: Socio-economic and environmental factors affecting sustainability of water projects**

40. Do all villagers get equal access to water service?
- 1 = Yes [    ] 2 = No [    ]
41. If the answer is No in question 33 explain .....
42. Do you contribute some money for water service?
- 1 = Yes [    ] 2 = No [    ]
43. What is the price of water per container of 20 litres?
1. Low price (100-200 Tzsh) [    ]
2. Medium price (300-400 Tzsh) [    ]
3. High price (500 Tzsh and above) [    ]
44. Do you afford to pay the amount put for contributing for water service?
- 1 = Yes [    ] 2 = No [    ]
45. Were you among the deciders for the water service price?
- 1 = yes [    ] 2 = No [    ]
46. Do you get receipts after paying for water service?
- 1 = Yes [    ] 2 = No [    ]
47. Do people give other gifts to water service providers so as to get water service?
- 1 = Yes [    ] 2 = [    ]
48. If Yes in question 37 above, what kind of gifts do they give.....

**Section G: Water supply before and during the project**

49. What were the sources of water before that project?
1. Piped water (    )

2. Bore holes ( )
  3. Unprotected dug well ( )
  4. Hand pump ( )
  5. Rivers, streams, ponds and lake ( )
50. Are those sources (mentioned above) still existing?
1. Yes ( )
  2. No ( )
51. What is daily household water consumptions
1. Less than 20 liters ( )
  2. 20-40 liters ( )
  3. 41-60 liters ( )
  4. 61-90 liters ( )
  5. 91- 150 liters ( )
  6. 151 liters and above ( )
52. After the project started, where do you prefer to collect water from?
1. Piped water ( )
  2. Bore holes ( )
  3. Unprotected dug well ( )
  4. Hand pump ( )
  5. Rivers, Streams, Ponds, Lake and Dam ( )
53. What are the reasons for you to collect water from the mentioned source above?
1. The price is affordable ( )
  2. No cost needed ( )
  3. Short distance from source ( )
  4. Others, mention ( )
54. What is the distance from your household to the main source of water?
1. 50 up to 90 meters ( )
  2. 100 up to 250 meters ( )
  3. 350 up to 400 meters ( )
  4. 500 meters and above ( )
55. How long does it take you to go at your main water source, get water and come back?
1. 30 minutes ( )

2. 60 minutes ( )
  3. 90 minutes ( )
  4. 120 minutes and above ( )
56. Do you pay for water services from the main source?
1. Yes ( )
  2. No ( )
57. Do you think that price is reasonable?
1. Yes ( )
  2. No ( )
58. If no, give the reasons for why you think it is not reasonable
- 1.....
  - 2.....

#### **Section H: Factors for project functionality**

59. Does your water project function?
1. Yes ( )
  2. No ( )
60. In the last two weeks has the water from this source been unavailable for at least one whole day?
1. Yes ( )
  2. No ( )
61. For how many days in a month did you not have water from the project?
1. One week ( )
  2. One month ( )
  3. Five month ( )
  4. One year and above ( )
62. How many times your project has been maintained
1. Less than 2 times ( )
  2. 2-3 times ( )
  3. 4-5 times ( )
  4. 6 times and above ( )

63. How many times spare parts replacement has been done
1. Less than 1 time ( )
  2. 2-3 times ( )
  3. 4-5 times ( )
  4. 6-7 times ( )
  5. 8 times and above ( )
64. What makes your water project to function well?
1. Frequent maintenance ( )
  2. Availability of spare parts ( )
  3. Good project management ( )
  4. Community participation ( )
65. If no, what makes your project not to function?
1. High prices of water ( )
  2. Long distance from the source ( )
  3. Lack of frequent maintenance ( )
  4. Lack of spare parts ( )
  5. Lack of community participation ( )
66. Is water from the project clean?
1. Yes    2. No ( )
67. Is water from the project treated?
1. Yes    2. No ( )
68. How many days you get service from the project per month?
1. Two – three days ( )
  2. Four – nineteen days ( )
  3. Twenty-twenty nine days ( )
  4. Thirty days ( )
  5. Not at all ( )

**Thank you for your cooperation**



## **Appendix 2: A checklist for Key Informants**

### **(a) District Water Engineer**

1. What are the main water sources available in your area?

.....  
 .....

2. How do you describe the area in terms of water availability and supply?

.....  
 .....

3. Is the water available enough to meet the demand?

.....  
 .....

4. Are there any water availability challenges in this district?

.....  
 .....

5. If yes in question 4 above, what are the causes of those challenges?

.....  
 .....

**Thank you for your cooperation**

**(b) District Planning Officer**

1. Is water sector among the priority sectors at this district?  
.....  
.....
2. Do you allocate money resource for maintenance of water projects available at your district?  
.....  
.....
3. If yes, at which interval of time do you disburse the money?  
.....  
.....
4. Do you have a plan for any training for water management at this district?  
.....  
.....
5. If the answer is yes in question 4 above, how many trainings are conducted for 1 year  
.....  
.....

**Thank you for your cooperation**

**(c) District water committee chairperson**

1. What are your roles as a district water committee?

.....

.....

2. How do you ensure fair water service delivery to all people at this district?

.....

.....

3. Is there any challenges encountered on water service delivery among people in this district?

.....

.....

4. How do you deal with those challenges?

.....

.....

5. Do you have a plan for creating awareness on water management at village level?

.....

.....

6. If the answer is yes in question 5 above, how often do you conduct seminars?

.....

.....

**Thank you for your cooperation**

**(d) District Community Development Officer (DCDO)**

1. What is water access status in this area?

.....  
 .....

2. Do people participate in the development of water projects at this district?

.....  
 .....

3. At what level of project development do they participate?

.....  
 .....

4. Do people take care of the water projects developed at their area?

.....  
 .....

5. How is people awareness on environmental protection in this district?

.....  
 .....

6. Do you have a plan for creating awareness on water management at village level?

.....  
 .....

7. If the answer is yes in question 5 above, how often do you conduct seminars?

.....  
 .....

**Thank you for your cooperation**

**(e) Village chairperson and/or project chairperson**

1. How do you ensure fair water service delivery to all people at this village?  
.....  
.....
2. Is there any challenges encountered on water service delivery among people in thisvillage?.....
3. If the answer is yes in question 2 above, how do you deal with those challenges?  
.....  
.....
4. Do you have water committee at your village  
1 = yes [    ]    2= no [    ]
5. How is gender considered in your water committee?.....
6. Is there any written operation and maintenance plan in place? Written by whom?  
1 = yes [    ]    2 = no [    ]  
By whom.....
7. Who makes the final decision concerning the work to be done(operation and maintenance)
  1. District water technicians (    )
  2. The whole community (    )
  3. Water committee (    )
  4. Village chairperson (    )
  5. Project chairperson (    )
8. Is there any inspection annually or seasonal of the project facilities? By whom?  
1. Yes (    )    2. No (    )  
By whom.....

**Thank you for your cooperation**

**Appendix 3: A Checklist for Focus Group Discussion**

1. What are water sources available in this area?
2. Who established these water sources?
3. Were you aware of the development and implementation of the water source?
4. Who decided for the construction of water project at your village?
5. Do you have water committee at this village?
6. Are there women members in your village water committee?
7. Do you attend water meetings?
8. Do you speak when you attend water meetings?
9. What are the main problems facing your water project?
10. What are your opinions to improve the functionality of water project?
11. Why do you think some projects are functioning properly and others not?
12. What do you think are factors which affect sustainability of water project?
13. What are your opinions about achieving sustainability of water projects?

**Thank you for your cooperation**