

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENT STUDIES**

**A Comparative Study on the Performance of Rural Water Supply Schemes:
the Case of Debatie Woreda, Benishangul Gumuz**

*A Thesis Submitted to the School of Graduate Studies of AAU in Partial
Fulfillment of the Requirements for the Degree of Masters (MA Degree) in
Development studies, Environment and Development*

**By
Abiot Addisu**



**June, 2010
Addis Ababa**



**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
COLLEGE OF DEVELOPMENT STUDIES**

**A Comparative Study on the Performance of Rural Water Supply Schemes:
the Case of Debatie Woreda, Benishangul Gumuz**



*A Thesis Submitted to the School of Graduate Studies of AAU in Partial
Fulfillment of the Requirements for the Degree of Masters (MA Degree) in
Development studies, Environment and Development*

By

Abiot Addisu

Advisor

Abdulhamid Bedri (PHD)

June, 2010

Addis Ababa

**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**COLLEGE OF DEVELOPMENT STUDIES
(CDS)**

Title

*A Comparative Study on the Performance of Different
Rural Water Supply Schemes: The Case of Debatie
Woreda, Benishangul Gumuz.*

**By
Abiot Addisu**

DEVELOPMENT STUDIES

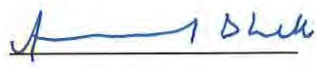
APPROVED BY THE BOARD OF EXAMINERS:

SIGNATURE

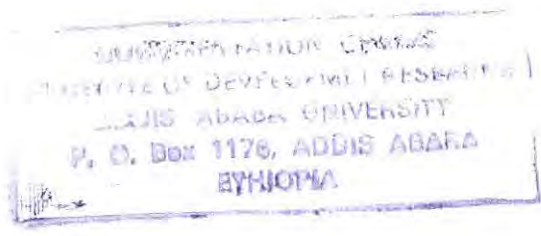
Dr. Belay Simane
INSTITUTE DIRECTOR



Dr. Abdulhamid Bedri
ADVISOR



Dr. Yohannes Aberra
INTERNAL EXAMINER



Acknowledgement

First of all, I thank almighty God for his divine protection, guidance and support throughout my stay time. And the preparation of this research has involved many persons and organizations.

I would like to express my deep whole-hearted indebtedness to my advisor Dr. Abdulhamid Bedri. His critical and constructive comments and suggestions during preparation of proposal and the whole document are worthy enough to be mentioned here. My thanks also go to Dr. Yohans Abera for the important comments on the proposal so as to shape it to this end.

My special thanks go to Research-inspired policy and practice learning in Ethiopia and Nile regions (RIPPLE) for providing financial support to conduct this research and I would like to thank the Benshangul Gumuz water mines and energy resource development Bureau and Debatie Woreda water desk for facilitating the opportunity to pursue my study.

Jebessa Senbeta and Andualeum Sisay thank you for your intellectual contribution in the preparation of this thesis with discussion.

My gratitude goes to my adored parents, for their enduring and optimistic life they showed me in my entire existence. And I would like to express my special thanks to my brother Tilahun Addisu for his comments on the thesis and helped in printing the thesis report.

Most deeply, I wish to express my strong indebtedness to my uncle Wondasa Eticha, for his help in providing laptop computer to the preparation of my thesis up to his accidental death.

Also, my special thanks go to my wife, Mare/Adanech Asho and my son, Abel Abiot, for their love, patience and sacrificed a lot to make me strong in the time I stayed in the school. I also owe them very much.

At last, not least I would like to thank all my respondents and enumerators, my class mates and CDS staff for the cooperation they made during the study period.

Table of Contents

	Page
Acknowledgement.....	i
Table of Contents	ii
Lists of Annexes	iv
List of tables	v
List of Figures.....	vi
Operational Definitions	vii
List of Acronyms.....	viii
<i>ABSTRACT</i>	x
CHAPTER ONE	
1. INTRODUCTION.....	1
1.1 Background.....	1
1.2 Statement of the Problem	2
1.3 Objectives and Research Questions.....	4
1.4 Significance of the Study.....	4
1.5 Scope and Limitation of the Study	5
1.6 Organization of the Study.....	5
CHAPTER TWO	
2. LITERATURE REVIEW.....	6
2.1 An Overview of Common Rural Water Supply Schemes	6
2.1.1. Evaluation of Choice of HDW and Machine Drill SW	8
2.2. Factors affecting the performance of Rural Water Supply Schemes	9
2.2.1 Community Factors	9
2.2.2 Technical Factors.....	12
2.2.3 Financial/Economic Factors	13
2.2.4 Institutional and Legal Factors	15
2.2.5 Environmental Factors.....	16
2.3. Review of Related Works.....	17
2.4. Performance Indicators and sustainability Aspects for Water Supply Schemes	19
2.5. Conceptual Frameworks	19
2.6. Water supply and schemes functionality status in Ethiopia	22

2.7. Water Supply and Sanitation Policy in Ethiopia	23
CHAPTER THREE	
3. RESEARCH METHODOLOGY	24
3.1. Description of the Study Area	24
3.2. Research Design	28
3.3. Sampling Techniques and Procedure	28
A. Selection of Sample Kebeles	28
B. Selection of Water Supply Schemes	28
C. Selection of Sample Households	29
3.4. Data Sources and Type	29
3.5. Methods of Data collection	30
3.6. Data Analysis and Presentation	32
CHAPTER FOUR	
4. RESULTS AND DISCUSSION.....	33
4.1. Demographic and Socio-Economic Characteristics of the Sample Respondents.....	33
4.1.1 Demographic Characteristics of the Respondents.....	33
4.1. 2. Socio-Economic Characteristics of the Respondents	36
4.2. Existing Water Supply Handpump Schemes Situation in the Study Area	37
4.2.1. Overview of Common Rural Water Supply HP Schemes.....	37
4.2.2. Current Water Supply Situation of Respondents.....	39
4.3. Factors Affecting the Performance of Rural Water Supply Schemes	44
4.3.1. Community Factor.....	44
A. Community Participation.....	44
B. Community Management	48
C. Communities Sense of Ownership.....	50
4.3.2 Financial Related to Factors	51
A. Existence of User Payments and its Adequacy for O & M	51
B. Ability and Willingness to Pay (Per HH/month)	54
C. Financial Management System.....	55
4.3.3 Technical Related Factors	56
A. Technology/Scheme Type Selection	56

B. Baseline Survey for Suitable Scheme Selection	57
C. Operation and Maintenance Problems	58
D. Availability of Tools and Spare Parts	60
E. Construction Quality of Handpump Schemes	62
4.2.4 Institutional Related Problems	64
A. Institutional Capacity of Woreda Water Desk	65
B. Institutional Support for Community Management	67
4.2.5 Environmental Related Problems	68
4.4. Comparative Analysis on the Performance of the Handpump Schemes.....	70
A. Functionality with Respect to Water Supply HP Schemes.....	70
B. Water Supply HP Scheme Simplicity to Operate and Suitability to Use	72
C. Problems to Non Functionality of HP Water Supply Schemes	73
D. Consistency of Service Delivery of Water Supply HP Schemes.....	75
E. Adequacy of Water Supply Handpump Schemes	76
F. Water Quality with Respect to Water Supply HP Scheme Type	77
G. Main Technical Problems with Respect to HP Schemes.....	79
H. External Support Requirement of HP Schemes.....	80
4.5 Measures to be taken to Ensure Better Performance of Rural Water Supply Schemes	82
CHAPTER FIVE	
5. CONCLUSION AND RECOMMENDATION	83
5.1 Conclusion.....	83
A. Existing Water Supply Situation	83
B. Factors Affecting of the Performance of Water Supply Schemes	83
C. Comparative Analysis on the Performance of Water Supply Handpump Schemes	85
5.2 Recommendation	87
REFERENCES	90

Lists of Annexes

- Annex-1 Questionnaire for household survey
- Annex-2 Check lists for Focus Group Discussion
- Annex-3 Check lists for Key Informant Interview

Annex-4 Physical Observation Checklist

Annex-5 Status of water supply HP schemes in the sample kebeles

List of tables

Table 1 Sample Kebeles, Gotes and beneficiaries households.....	29
Table 2: Sex composition and age Structure of respondents.....	34
Table 3: Marital status and family size of respondents	35
Table 4: Ethnicity and religion of respondents.....	36
Table 5: Educational levels and major income source of respondents.....	37
Table 6: Current sources of drinking water supply for respondents, those their HP non functional	40
Table 7: Water collection task in the Family.....	41
Table 8: Functionality situations of water supply hand pumps.....	42
Table 9: Frequency distribution of the main problem for the non functionality of the HP schemes.....	43
Table 10: Amount of water consumption and number of water collected per day	44
Table 11: Differences in Community participation in HP schemes development	46
Table 12: Levels of community participation in the HP development.....	47
Table 13: Situations of user contribution for operation and maintenance of HP schemes.....	52
Table 14: Frequency distribution of service fee money from users meant for.....	53
Table 15: Amount users' willingness and ability to-pay for the water supply service.....	54
Table 16: Financial management situation of handpumps	56
Table 17: Situation of community involvement in O & M	60
Table 18: Community access to spare parts	61
Table 19: Households Evaluation of WSSs construction qualities	63
Table 20: Allocated budget to the WWD, (2000-2002)	67
Table 21: Type of handpump scheme with respective scheme functionality Cross tab.....	72
Table 22: Simplicity of handpump scheme to operate and suitable to use	73
Table 23: The main problems for the non functionality of different HP schemes	74
Table 24: The consistency of service delivery with respect to HP water supply schemes	76
Table 25: Adequacy of water with respect to the type of HP scheme.....	77
Table 26: Water quality with respect to types of water supply HP scheme	78

Table 27: Differences in technical problems for water supply handpump schemes	80
Table 28: Requirement of external support with respect to handpump scheme type	81

List of Figures

Figure 1: Conceptual Framework of the Performance of Rural Water Supply Schemes.....	21
Figure 2: Location map of the study area, Debatie Woreda.....	27
Figure 3: Nature of stockholder involvement in technology/type of scheme selection	58
Figure 4: Lack of technician & spare parts to carry out maintenance and poor head work construction problem, Kebelsuk Gote, Berber kebele (MDSW).....	59
Figure 5: Non-functional scheme, Problem of depth and with out fence for HDW, Dugmasefer <i>Gote, Berber kebele</i>	64

Operational Definitions

Community: refers to a group of people in one village using/used water from the same developed water supply source (Brikke F. 2000:163).

Community managed water supply: refers to community takes a full responsibility of management of its water supply schemes(Davis et al.1993:147).

Functional: those HP schemes giving water supply service for a community during HHs survey.

Hand Dug Well: refers to water supply well drilled by hand/human labor.

Handpump: water supply scheme that is operated by hand through protruded handle for Pumping purpose.

Machine Drill Shallow Well: refers to water supply scheme drilled by machine

Maintenance: refers to the activities required to sustain the water supply in a proper working condition (Davis & Brikke 1995:5).

Non-functional: HPs those were not giving water supply service for a community during HHs survey.

Operation: refers to actual running of a service i.e. starting or handling of pumps (Brikke F.2000:42).

Performance: indicates the day to day service delivery with adequate and quality water supply of the handpump scheme for its designed period.

Safe water: refers to drinking water that meets the requirement of MoWR's drinking water quality standard.

Sustainability: refers to water supply schemes being maintained in a condition that ensures a reliable and adequate potable water supply over per longed period of time. (Davis& Brikke 1995:6).

Water committee: refers to a group of people (5-7individuals), elected by users and those serve for overall management of water supply schemes at community level

Water supply schemes: refers to safe water points from where beneficiaries of given communities collect water.

List of Acronyms

AAU	Addis Ababa University
ADB	African Development Bank
BGRS	Benshangul Gumuz Regional State
BOFED	Bureau of Finance and Economic Development
BOWMERD	Bureau of Water Mines and Energy Resource Development
CEPAR	Canada Physician Aid for Relief
CSA	Central Statistical Agency
E.C	Ethiopian Calendar
EPY	Ethiopian Physical Year
EWRMP	Ethiopian Water Resource Management Policy
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussion
Gotts	Villages in the Sample Kebeles
HDW	Hand Dug Well
HHs	Households Survey
HPs	Handpumps
IRC	International Rescue Committee
Kebele	Lowest Level of Government Administration Structure
KII	Key Informant Interview
M.a.s.l	Meter above Sea Level
MDG	Millennium Development Goal
MDSW	Machine Drilled Shallow Well
MoWR	Ministry of Water Resources
NE	North East
NGO	Non Governmental Organization
NO	Number
O&M	Operation and Maintenance
PO	Personal Observation
RWSS	Rural Water Supply Schemes
RIPPLE	Research Inspire Policy and Practical Learning in Ethiopia

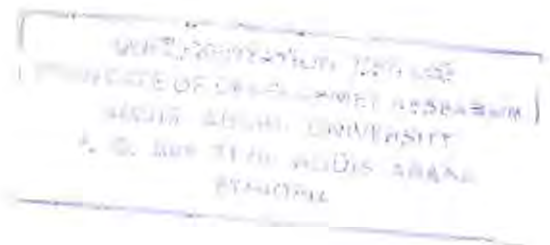
SW	Shallow Well
SNNP	South Nations and Nationality People
SPSS	Statistical Package for Social Science
TVET	Technical and Vocational Educational Training
USAID	United State Aid International Development
UN	United Nations
UNICEF:	United Nations Children's Fund
VLOM:	Village Level Operation and Maintenance
WATSANCOs	Water Supply Sanitation Committee
WASH	Water Supply, Sanitation and Hygiene
WB	World Bank
WCs	Water Committee
WHO:	World Health Organization
WSHPS	Water Supply Handpump Schemes
WWD	Woreda Water Desk

ABSTRACT

Safe, adequate and consistence water supply is the basic needs, and essential for the socioeconomic development of a given society. However, majority of the people in the Woreda rural settings still didn't access potable, sufficient and sustainable water supply. The major causes are poor performance of developed water supply schemes and limitation in the development of new and appropriate water supply schemes. Objectives of this study is to assess the relative performance of rural water supply schemes by assessing the main factors related to community, financial, technical, institutional and environmental in the water supply systems and comparing the main factors and indicators of the performance of rural water supply handpump scheme. A three-stage procedure with both probability and non-probability sampling techniques was used to identify sampled water supply schemes and household respondents in Debatie Woreda. Six water points and 96 HHs were selected purposively and randomly respectively. Cross-sectional design with descriptive analysis was applied using different data collection methods in March 2010. Data were collected through household survey, 6-focus group discussion, key informant interview and personal observation. Both quantitative and qualitative data were collected and used to analyze.

The study found that per capita water consumption in a day on the average is 9.6 liters less than 20 liters (minimum standard set by WHO) of potable water. Poor community participation in the stage of planning, low level of women participation, weak performance of water committee and weak sense of ownership from the community. Inadequate financial contribution for O&M, poor baseline survey for scheme type selection, unavailability of spare parts, poor construction quality, lack of trained technician and weak institutional support are the main factors for the poor performance of water supply handpump schemes. The major water supply schemes used by the community are HDW&MDSW fitted with handpumps. It was observed that 50% of HDW & 66% of MDSW had failed and the functional schemes are providing with interruption. HDW failed due to depth, water quality and users operation and management problems while the failure of SW was mainly due to pump failure and difficulty to operate and manage at community level. The study revealed that HDW are easy to maintain and use, low cost, more participatory and only possible in soft ground formation but poor water quality, inadequacy and seasonality of water supply while MDSW provide the service adequately & quality water supply but difficult to operate and maintain at community level.

The study recommend that the involvement of the community in all level of water supply development and management, adequate external support for O&M, putting in place trained technician, available spare parts, conduct baseline study to select appropriate water supply schemes and construct properly the schemes. Develop MDSW at populated villages, in all ground formation provided that trained technician and spare part availability are ensured and develop HDW-at small villages with soft ground formation and excavate/drill properly at depth to avoid seasonal fluctuation of water from the wells to ensure the better performance of water supply handpump schemes in the rural settings of Debatie Woreda.



CHAPTER ONE

1. INTRODUCTION

1.1 Background

Water is one of the most vital resources without which life could be difficult and critical factor for sustainable livelihood. Households need water for domestic use (for drinking, cooking, washing, cleaning, etc) and for productive use. Access to adequate, clean and safe water greatly contributes to improve health and productivity (Desalegn, 1999).

Maguvu and Mutengu (2008) emphasized that communities and individuals can be deprived of comfort, shelter or food for a period, but they cannot be deprived of water and survive for more than a few weeks. Water supply to any community is, therefore, crucial. It is the determining factor in dictating the healthy condition of any community. The sustainable performance of community-managed rural water supply schemes is a key factor in meeting the Millennium Development Goals (MDGs), in terms of ensuring environmental sustainability, improving health and eradicating extreme poverty for the overwhelming rural majority living in the developing world.

In the majority of cases, it is rural poor communities that are socially and economically affected by water inadequacy and subsequent poverty. The quality of potable water and the threat of waterborne diseases, such as cholera and typhoid, are critical public health issues in many developing countries (ADB, 2002). Moreover, worldwide, poor sanitation practices and a lack of safe and clean water for drinking, cooking and washing are responsible for over 12 million deaths each year (USAID, 1990). For instance, about 2.3 billion people across the world, most of them in developing countries, suffer from disease linked to water unavailability, inadequacy or contamination (POPLINE, 2000; UN, 1997).

Although these problems are diverse and complex, it can not be denied that one of the most important factors behind them is the poor performance and non functionality of community-managed rural water supply schemes. Governments, nongovernmental organizations (NGOs) and donor agencies are striving to scale up water supply and sanitation coverage in developing countries

at the same time as the non functionality rate of those water supply schemes installed is increasing. It is an alarming fact that, in most developing countries, an estimated 30% to 60% of existing rural water supply schemes are inoperative at any given time (Brikké and Bredero, 2003), with serious impacts on the health and welfare of the people. There are social or community, technical, financial, institutional and environmental issues to address.

It has been estimated that 33% of rural water supply schemes in Ethiopia are non-functional at any time, owing to lack of funds for O&M, inadequate community mobilization and commitment and a lack of spare parts (MoWR, 2007).

Technology related strategy for implementation, Universal Access Plan advocate the use of Village Level Operation and Maintenance of handpumps those could be operated and maintained by local technicians and community in rural areas (MoWR, 2006:7). Unless, performance/sustainability level of different rural water supply schemes is improved, the Millennium Development Goal and Universal Access Plan target will difficult to achieved in real term.

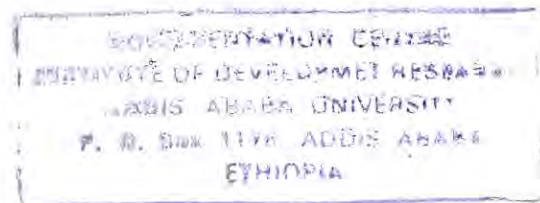
1.2 Statement of the Problem

In Debatie Woreda the handpump schemes are developed in most of the rural settings with the domination of Hand Dug Well (73-HDWs and 9-MDSWs) by Woreda water Desk, regional water bureau and NGOs like CEPAR, UNICEF, Tadisofund, Wesmico and Godana to provide safe and potable water supply to the rural areas of the Woreda. But many of the schemes constructed by the water implementing agencies are not functioning and poorly performing for they are designed. And schemes performance and non-functionality rate vary between scheme types in different villages of the kebeles in the Woreda.

According to the researcher's experience of the study area, performance of schemes related problems of rural water supply system involve a number of factors. 38 (46%) of water supply schemes are not functioning that resulted from different factors and differ from hand dug well to machine drill shallow wells. The problem of rural water supply service is not only due to non functionality of handpump but also there are problems of service reliability i.e. (interruption of service) at the community level in different rural areas of Debatie Woreda. This research focus on the performance of rural water supply schemes fitted with handpumps; mainly because of these schemes is the most common type of water supply schemes in Debatie rural settings.

In short, there were reasons that initiated the researcher in choosing the problem for investigation. At the first place having worked in the rural water supply site selection and supervision of shallow well construction, the researcher observed that many schemes constructed by Woreda, regional bureau and NGOs are not functioning and some are functioning with interruption; secondly the same intervention are going on irrespective of questioning which one of schemes types are appropriate in term of performance. This is to guide future interventions and minimize wastage of resources in the area of interest; and lastly when water supply schemes or facilities are non functional there are a lot of people having access to water supply service reduced. On top of these different researches report and studies don't address the relative performance of different water supply schemes fitted with handpumps. Furthermore, there exists no systematic and adequate study that has been done in the Woreda previously on assessed and established the degree of performance of the rural water supply schemes fitted with handpumps.

Therefore, this study aims to assess the relative performance of the rural water supply schemes fitted with handpumps considering those factors affecting performance of schemes in the context of Debatie Woreda rural setting.



1.3 Objectives and Research Questions

General Objective

The over all objective of this study was to assess the relative performance of rural water supply schemes and underlying factors in Debatie Woreda.

Specific Objectives

The study would have the following objectives:

- To assess the existing status of different rural water supply schemes in the study area.
- To identify factors affecting the performance of rural water supply schemes fitted with handpumps.
- To compare the performance between handpump schemes in the context of the study area to guide future intervention.

Research Questions

This study answers to the following major questions:

- How is the performance status of the existing rural water supply schemes fitted with handpumps in Debatie Woreda?
- What are the main factors affecting the performance of rural water supply schemes?
- Which of rural water supply handpump scheme is suitable and relatively performing better in the study area?
- How does the performance of the two types of schemes compared?

1.4 Significance of the Study

This study assesses and identifies important information concerning performance of different rural water supply schemes in Debatie Woreda and input to any concerning bodies like NGOs in the area of study to intervene and take effective measure to sustain the performance of rural water supply schemes in general and in the study area in particular. It contributes knowledge to the community about the performance of schemes.

The finding of the study provides inputs on the performance to policy makers in the context of rural water supply development and management. It also provides genius inputs to the regional and Woreda water supply sector and regional government to consider or take into account the results of the study for the future water projects implementation in Debatie Woreda rural settings.

The results of the study also serve as baseline information for those who are interested in conducting in-depth research on the performance of rural water supply schemes in the study area.

1.5 Scope and Limitation of the Study

This research focused on the performance of rural water supply schemes fitted with handpumps; mainly because of these schemes is the most common type of water supply schemes in Debatie Woreda rural settings.

This study didn't go into the details of the interrelated factors rather it is restricted on the main factor affecting performance of rural water supply schemes fitted with handpumps and based on the factors and indicators to assess the relative performance of schemes in the study area.

There was absence of well documentation and adequate data like yield of water from the scheme during construction and wells completion reports that describe the capacity of scheme construction in the Woreda and regional level and luck of transport to assess some remote sites of Debatie rural *kebeles*.

The findings of this research are the reflection of the study area but not for others; however it reflects problems with similar characteristics in other areas or *Woreda*.

1.6 Organization of the Study

The study is divided into five chapters. Chapter one is introduction contains backgrounds, statement of the problem, objectives, research questions, significance of study, scope, limitation and organization of the study. Chapter two provides review of related literature. Chapter three contains research methodology applied to conduct the research. Research findings are presented and discussed in chapter four and the fifth chapter deals with conclusion and recommendation.

CHAPTER TWO

2. LITERATURE REVIEW

This section provide theoretical and empirical evidences which help to give the summery of relevant literature on the problem under investigation; these are an overview of the common rural water supply schemes, factors affecting the performance of rural water supply schemes, review of related works, Performance indicators and sustainability aspects, water supply and schemes functionality status in Ethiopia, Water Supply and Sanitation Policy in Ethiopia and conceptual framework.

2.1 An Overview of Common Rural Water Supply Schemes

There are different rural water supply schemes that provide water for rural communities from surface and groundwater sources. These are shallow machine drill tube well fitted with handpumps; hand dug wells fitted with handpumps and unprotected traditional dug manholes are from groundwater and gravity springs, Pond sand filter and Rainwater collection: Rooftop catchments with tank from surface water sources. Of these water supply facilities, hand dug wells and machine drill shallow wells fitted with handpumps are the most dominant in most of rural area and these are discussed as follow:

Hand-dug wells generally have a large diameter and are constructed using simple tools, such as pickaxes and shovels. Their depth ranges from 5 to 20 m. They can be lined with concrete cast on site, precast concrete rings, rock, or concrete blocks. They serve about 200 people. Boreholes are machine-drilled wells. Machine-drilled wells are typically 100-200 mm in diameter and are sunk using relatively sophisticated equipment powered by diesel or electric motors. Machine drilling shallow well is suitable for depths of up to 60m, but the depth depends on the power of the rig and the geological conditions. The number of people that can be served by a drilled well depends on the capacity of the handpump, but it is typically about 300.

In most cases HDWs don't penetrate aquifer strata and dry in dry season and relatively susceptible to contamination. Hand dug wells are not suited to hard ground formations and

take time to dig and line. Construction of hand dug wells can be dangerous due to collapsing soils, falling of objects and suffocation from exhaust fumes from dewatering pumps. The HDWs well may be susceptible to yield fluctuations and possible surface contamination. Machine drilling well can get water from a deeper level than dug wells. HDWs can often supply drinking water at a very low cost, but because of impurities from the surface easily reach shallow sources, a greater risk of contamination occurs for these wells when they are compared to deeper wells (François B. and Maarten B., 2003).

Handpumps have been given a high profile to provide potable water to the world's rural population by leading players in development like the World Bank, UNCEF and other international NGOs. Since the water decade of 1980s thousands of different types of rural water supplies fitted with handpumps were installed in the developing countries as part of the United Nations led-drive to provide safe drinking water. This type of schemes were vigorously promoted as being the best option by which communities could enjoy a safe and reliable water supply assuming handpump are low cost, affordable easy to maintain an appropriate technology, readily available, easy to install, users friendly and efficient. Further more, the advent of the village level operated and maintained (VLOM) and pump in the late 1970s to early 1980s did not much to further the handpump option particularly in Africa with the Afradive leading the way toward the goal of affordable village based maintenance to ensure sustainability (Wood, 1994:132).

How ever, according to Harvey and read (2004a) despite to the popularity of handpumps, evidences suggest that it has failed to deliver satisfactory level of water to the community in sustainable basis.

In 1994 it was estimated that about 40 to 50 percent of handpumps in Sub-Saharan Africa were not working. According to rural water supply schemes (2004b) there are approximately 250,000 handpumps in Africa, more than half of which are not operational. This is backed up by data from Uganda and South Africa which indicate similar operational failures rates.

Further more, according to Reynolds (1992:2) most of handpumps have hard life that many are in continuous use throughout the day hours as long as they can survive such treatment.

They are exposed to the elements, may be subjected to different human scratching of the handlings repeatedly due to unawareness of the consequences of the result on the schemes.

In the regard, to Wood (1994:33) VLOM handpumps were developed and installed in rural areas because it was assumed that users themselves would be able to maintain them, in many case of Africa and other developing countries this has not been proved empirical due to a number of technical, social, financial, institutional and environmental factors.

2.1.1. Evaluation of Choice of HDW and Machine Drill SW

The success of a hand dug well implementation lies on factors such as the surface and subsurface geology, topography as well as position in relation to geo hydrological features like valley, swamp, and syncline but also to the digging standard applied by the implementer. How ever, the boreholes are drilled mainly to reach deeper aquifers than the hand dug wells. Thus the reached aquifers are most of time less vulnerable to seasonal water fluctuation. Due to its low storage capacity, borehole key parameter is the recharge while for a hand dug well it is the storage capacity.

The efficiency and effectiveness of hand dug wells are mainly questioned due to most of them are subjected to seasonal fluctuation in the dry seasons of the year. In term of quality and quantity, the borehole is suitable due to its less vulnerability regarding surface water but also generally not subjected to seasonal water level fluctuation as may be the case of the hand dug wells.

Based on the geology, the evaluation should be coupled to the advantages/disadvantages are below to make suitable choice for sustainability.

Hand dug well have advantageous in that it is easy to maintain by the communities; low cost maintenance, and big storage capacity; In case of broken pump, possibility to draw water with bucket and rope using the manhole and disadvantageous in that, it is Relatively shallow (12-15m) thereby prone to bacteriological contamination; tap water from uppermost formation thereby subjected to the effect falling water table in dry season; Can only be constructed efficiently on soft formation.

Machine drill shallow wells have advantageous in that it is tap water from deep aquifer; not subject to the effect of falling water table in dry season; not subjected to bacteriological contamination; Can be constructed on any type of ground formation and high yield and with disadvantageous in that it is Maintenance is costs and requires means not existing at community level (such as compressor for flushing or redevelopment), In case of pump breakdown no way to draw water, required high skilled staff for implementation (ECHO, 2006:26).

2.2. Factors affecting the performance of Rural Water Supply Schemes

According to Brikke & Bredero (2003:4) and Smet & Van Wijk, (2002:30-31), performance of water supply schemes relies mainly on five interrelated factors: community, technical, financial, institutional and environmental. These factors are broad and contain different sub factors or elements in relation to rural water supply schemes fitted with handpumps and are discussed as follow.

2.2.1 Community Factors

The community factors are likely affect performance of rural water supply schemes in general and schemes fitted with handpumps in particular are the availability of demand for an improved service, community participation in all phases of projects (planning, design, construction and managing the services), operation and maintenance and management through local organization and recognized group.

A. Community Participation

In order to increase the chances of the water supply system to meet the needs of the users, community participation should begin as early as possible in the project development. In fact the community participation should begin as soon as the community requested the water supply facility. Therefore, community member should be directly involved in all phases of water supply scheme development (Brikke 1993 as cited in Mosunda, 2004).

According to Harvey and read (2006:3), community participation involves “mobilizing” a community to become involved in planning and implementing a water supply project. This may take considerable time and should not be rushed. Some communities may become actively involved in the water supply activity at different time. Community participation from the early water supply project enhancement to the future sense of ownership but on going motivation is required for continuing participation. Community participation is the prerequisite for the sustainability of water supply schemes.

However, the conventional form of community participation in Ethiopia especially, during rural water supply handpump scheme development is restricted to: access road preparation, provision of local materials (stone and sand in most cases) and fencing around water supply schemes by the time of scheme development. Most of the time after a year it is impossible to see even the fence around the scheme because of lack of continual community participation in the management phase.

Brikke (200:6), argue that with the community participation, much more is likely implementation to be accomplished and services provided cheaply. As the result large number of community will be supplied in the sustainable way.

B. Women Participation

Community participation should also be looked at from the gender perspective, because women have the responsibility of fetching water and yet they are usually not involved in the decision making processes. According, women have been consistently excluded from any dialogue about the priority of improved water supply, which has contributed to the failure of developed schemes. It should be borne in mind that women are the prime collators of water and are also the primary beneficiaries of any improvement and should therefore be involved in any attempt to improve their water supply facilities (Churchil 1987, as cited in Mosonda, 2004:45).

C. Community Management/ Organization

Community participation could only be sustained when there is a system for organizing the community. Community organization, therefore, entails that a community has the institutional capacity to manage the development and operation of water supply schemes, if it is to be sustainable (McCommon et al., 1990:10). Hence, responsibility to manage water supply system should not be transferred onto the community structure that does not have the capacity to operate and maintain it (Musonda, 2004:45).

Because of aforementioned reason, community management of water supply system usually relies on the formation of water committee which is responsible for all management issues related to water supply in the community (Harvey & read, 2006:4). Water committee is responsible for all activities (managerial, operational, technical and financial) of the particular scheme, which cover a large area than a neighborhood and possibly the whole community.

Typical tasks of a water committee include: represents the community in contacts with support agencies; coordinate with other community institutions and decision-making bodies; ensure equity, organize contributions, organize effective O&M; ensures accurate financial management; promote hygienic or effective use of the facilities; holds regular committee meetings; ensures good communication of all levels; provide and collects information and feed back (Brikkee, 2000:171).

The composition of a water committee varies according to its management and operational mandate. Generally water committee is composed of a chairperson, secretary, treasurer and representative of the users, with the balance between men and women. in the case of the community directly responsible to technical O&M of the system, the committee also includes the operator and/or care taker and the water committee do not have legal status and difficult to make them accountable for the financial aspects (Brikkee, 2000:173).

2.2.2 Technical Factors

According to Brikke (2000:45), the technical factors which influence the performance of rural water supply schemes fitted with hand pumps are technological selection; technical skills needed to operate and maintain systems; availability, accessibility and cost of spare parts; construction quality of the schemes and baseline study for suitable scheme type selection technique.

A. Technological Selection

According to Musonda (2004:45), technological selection is critical to the performance of rural water supply schemes because the type of technology chosen affects O&M. If a community is to manage a water supply system, the technology used needs to be the type of the community care takers maintain with little outside assistance. Also, the technology must suit the existing locality available skills that can be acquired by the community members. The technology is considered to be suitable if it is socially acceptable, economically viable, technically effective and environmentally sound. Communities should have a say in the technology option. The technology options should not be too technical and beyond the comprehension of community members.

In this regard, according to Geleta et al (2002:20), socio-economic viability, social acceptability and appropriateness of technology influence the ability and willingness to manage the improved water supply systems. The use of appropriate technologies, which are low, cost, easy to maintain, simple to use, and readily available are responses to challenge of poor performance and unsustainability of water supply schemes. Appropriate technologies are integral to the concept of village operation and maintenance which emerged in the water decade (Hayson, 2006:8).

B. Baseline Survey for Suitable Scheme Selection

From the External Support Agency, what could be taken as one having paramount importance is conducting water resource and base line survey.

Inputs of experienced expertise of hydrogeology, geophysics, engineering, development planning and sociology are vital in the course of water resource potential assessment, well site selection, and depth to ground water and to choose the right hand pump option. If assessments such as, ground water resource and depth to ground water is not well identified, the result mostly would be low yield/dry wells and thereby poor performing or unsustainable schemes (Sebsibe Alemneh, 2002:18).

C. Availability, Accessibility and Costs of Spare parts

Handpump installation is the most widespread solution for supplying water millions of people in Africa's rural areas. However, at any given moment, average 30 percent of all potentially functional handpumps in Africa are not working. In some cases, 50 percent or more are non functional, partly due to difficulties in obtaining spare parts (WSP, 2006:2).

The problem of spare parts for rural water supply handpumps primarily attributed to lack of formal supply chain mechanism. Hence, Lack of spare parts has been a major constraint in performance of water supplies and has been a recurring problem. In some cases, it has led to the complete abandonment of the water supply system (Brikke et. al., 1995:30). To achieve the sustainable performance of scheme, it should be ensured that after appropriate technology selection, spare parts for that type of the scheme are made readily available (Musonda, 2004:51).

2.2.3 Financial/Economic Factors

The financial factors that affect performance of rural water supply schemes fitted with handpumps are financial ability to meet the cost of maintenance i.e. presence of tariff structure covering O&M and replacement cost; willingness and ability to pay and financial management system (Smet & Van Wijk, 2002).

A. Financial Ability to Meet the Costs of O & M

Failures to adequately cover costs of improved water supply services in developing countries has been identified as major constraints to achieving the goal of safe water supply for all on the continuous basis. In recent years, increased community financing through user payment

for service has been strongly promoted as a solution (Evans, 1992:1). In this regard, according to Getachew (2002:77), even small water supply systems require investment, operation and maintenance. These are often costly and though to be beyond the financial capacity of community, however, experiences shows that communities are willing to shoulder portion of the investment costs and to pay for full O & M provided that they are in need of the service and appropriate community promotion exercise is being carried out. Although there are undoubtedly some areas in some countries where poverty is extreme, the review of global situation reveals that most rural communities can afford to pay for improved water supply services provided that appropriate technology is used. The reason for this argument is that peoples in the rural area are already spending large amount of time and energy in water collection (Musonda, 2004:47).

As far as payment for water supply services are concerned, Ethiopian water resource management policy (1999:23) promotes that for rural water supply scheme partial cost recovery principle to be applied i.e. user communities should cover O & M costs. Such kind of payment is proposed to be effected through different tariff structures. The tariff structure that is adopted for rural water supply schemes that provide communal services like handpumps and public stands posts in flat rate tariff, in which all beneficiaries are expected to contribute equal amount either in cash or in kind in fixed time interval (for instance, on monthly basis).

B. Willingness and Ability to Pay for the Services

Providing services which people can afford is a pre-condition for cost recovery (partial cost-recovery in rural water supply case in Ethiopia). Being able to pay for something and being willing to do so, however, do not always go hand in hand. From an economist's point of view demand is only real (or "effective") when it is accompanied by willingness to pay, in cash or kind for goods or services offered. From this point of view, "willingness to pay" and "demand" essentially mean the same thing (Evans, 1992:20).

In order to the communities meet cost of O & M, community members must be willing to pay for the service. However, not every community member is willing to pay for the service

willingness to pay for the service is influenced by number of factors. For example the community with the river near by is prepared to pay much less for the handpump than a community with similar income who has to walk kilometers to fetch water. This is why a survey should be before the project is started to determine willingness to pay (Roark 1993; Briscoe & de Ferranti 1998, as cited in Musonda, 2004:48).

C. Financial Management System

In order to cover O & M costs and other important replacement costs, the collected money from users' community should be managed properly and used for the intended purpose. Necessary training should be given for water committee for prudent financial management. Or else, there should exist transparent working and accountability mechanism in order to avoid miss utilization and embezzlement of collected money (Davis and Brikke, 1995:66).

2.2.4 Institutional and Legal Factors

According to Brikke & Bredero (2003:4) and Smet & Van Wijk (2002:30-31), institutional and legal factors that affect performance of RWSS fitted with handpumps are policy and legislation, institutional capacity, availability of technical assistance to the community (from governmental and NGOs), involvement of formal and informal private sectors and capacity of technical staffs to deal with community development and knowledge of participatory approaches. On the other hand, the lack in the part of the government to setup an enabling environment for the development of a system and management of drinking water supply service through effective community participation is seen to as the reason for the failure as far as the performance of the scheme are concerned (Bhanderi et al., cited in Bezabih, 2008:21). Besides, there is a great need to provide technical and managerial support by government or donor agencies to the community so as to ensure continued use of the benefits of developed water supply project or program (Devis et al., 1993).

On the other hand, institutional weakness is singled out as a reason for difficulties in providing the necessary service for communities in rural water supply system (Roark et al. in Musonda, 2004:40). Therefore, institutions are required to make radical reform if they are to meet challenges facing the rural water supply sector and if they are to provide effective

service. Organizational framework and quality of the staff also influence institutional effectiveness. Coordinating mechanisms are also essential, especially when several government agencies are involved in the addition to NGOs Donor agencies (Ibid).

2.2.5 Environmental Factors

According to Brikke & Bredero (2003:4) and Smet & Van Wijk (202:30-31), the most important environmental factors that affect the performance of RWSS fitted with handpumps are the quality of water source, the quantity of water source and continuity of water supply.

A. The Quality of Water Source

The quality of water source determines whether the water needs to be treated or not. It also influences the technology choice. Thus, domestic water should be available in acceptable quality to satisfy minimum requirements for drinking, cooking and food preparation as a priority in addition to water for washing clothes and utensils, bathing and personal hygiene and for watering small plots and/or small number of livestock or poultry. Therefore, water source to be developed should full fill a minimum set of quality standards (Dereje, 2007:23).

Furthermore, water quality problem can be easily understood and mitigated by routine testing and understanding the nature of the geology and ground water resources (Foster et al., 2003, as cited in Dereje, 2007:24). Otherwise, if minimum quality standard of drinking water is not fulfilled, performance and sustainability of water supply scheme would be questioned.

B. The Quantity of Water and Continuity of Supply

In selecting site and appropriate method of developing and providing water for domestic uses, attention should be given to potential future demands on the system. The system should be designed with a view of possible future expansion in population or other condition on requires it. In addition to this, knowing and calculating the differences uses of water is important. Single use/user approach is neither efficient nor sustainable. And ultimately it may generate wastage and conflict between uses & users.

Therefore, understanding the hydrology is the key in the process of identifying how the water sites will behave under stress and also the long-term performance and sustainability of water sources under the impact of drought and climate change. Well planned community water supplies, which take into account the nature of water resources, will be more sustainable. It is vital that for the sound development of water resources, the integrated strategies should be adopted (Foster et al., 2000, as cited in Dereje, 2007:25).

2.3. Review of Related Works

Many literatures have shown that there are problems on the performance of rural water supply schemes. For instance, the study conducted by Aklilu (2009), in Bessolinben Woreda of Amhara region on factors affecting performance/sustainability of rural water supply schemes revealed that there are community, financial, technological, institutional support and environmental aspects that affect schemes sustainability. According to Mekonon (2009), study on assessment of problems to the sustainability of rural water supply handpumps in Aleta Wondo Woreda of SNNP region address and analysis problems of sustainability of rural water supply schemes. Getachew (2005), in his study on the determinants of rural water supply schemes in east Shewa Oromia region: compare within the same types of two rural town water supply scheme and used the application of project rules related to demand responsiveness, the intra household characteristic features of community members, and factors related to the comparative advantages of village Socio-economic and geographic conditions and the study indicates that there exists a difference at the stage of project initiation, the volume of households' water consumption, the relative distance of the villages from the major towns, and that of road accessibility. Kebede Woldeie Libasie (2003), on his study on assessment of sustainability of rural water supply schemes in Meskanena Mareko Woreda; assessed the institutional, community and local organization toward schemes sustainability. According to Habtamu Abebe and Israel Deneke (2008), study of the Sustainability of Water Supply Schemes in Alaba Special Woreda; they come with the combination of factors that causes the problem. However, poor management throughout the service delivery chain is a very important element in poor sustainability and service delivery.

The study in Nigeria was carried-out to investigate the state of water supply facilities in 43 communities of Ibeju-Lekki and Eti-Osa Local Government Areas of Lagos State. The survey was helpful in identifying the most appropriate water supply facilities that is economically sustainable to the communities. The major water supply facilities used by the communities were mostly hand dug wells and boreholes which in most cases are fitted with either electrical or hand pumps. Borehole failure was mostly due to people's ignorance, non-availability of spare parts, constant water failure, poor maintenance skill, and attitudes of the communities. The failure of the hand dug wells was mainly due to saltwater intrusion. From the survey assessment, sustainable water supply to the community could be enhanced through the use of hand-pump fitted boreholes. The study recommends the involvement of the community participation in the overall management of the water facilities in order to enhance sustainability (E.O. Longe et al., 2009).

An evaluation in riverine costal area of Bangladesh on Safe Water Technology shows that the more established water supply options considered are rainwater harvesting and the deep boreholes emerge as superior to the hand dug well and the pond sand filter. The chief difference between these two options is essentially scale of application the deep boreholes is optimally suitable for small to medium-sized communities, and is most cost-effective when large numbers of users are served, whereas rainwater harvesting is presently best suited to the individual household (Richard J et al., 2001).

In much of the literature, study on the performance/sustainability of rural water supply assessed the problems that hinder the performance of the schemes. To get the real and better picture of the situation; assessing the relative performance of different rural water supply schemes and the underlying factor is very important. Therefore, this study will design to fill this gap of the performance of rural water supply handpump schemes.

2.4. Performance Indicators and sustainability Aspects for Water Supply

Schemes

Performance indicators can be defined as variables whose purpose is to measure the change in a process or function. These most important indicators water supply schemes are Day-to-day continuity of water supply/service delivery; Adequacy of water (the amount of water produced by the borehole, relative to some minimum allowable level) and quality of water (looks good, taste, smell and is it disinfected) of normal water supply.

For example, the operating pressure in a pipeline and the informal water costs are both quantitative indicators. In contrast, a community member's perception of his/her satisfaction with the existing water supply or sanitation is essentially qualitative. Some of the important performance indicators which can be applied to the O&M of water supply are: water coverage, water production, water consumption, unaccounted water, pipe breaks, unit operation cost, continuity of service, complaints about W&S service and average tariff.

In the case of water supply schemes, if the water supply continues to be available for the period for which it was designed in the same quantity and at the same quality as it was designed, the scheme is said to be sustainable and all of the many elements which are required for sustainability must have been in place (Batzaya T et.al., 2005).

2.5. Conceptual Frameworks

As it can be seen from literature, performance problem of rural water supply handpump schemes involves a number of factors that are internal and external to the community and depend on community, technical, financial, institutional and environment factors and comprise sub factors that have considered to ensure better performance of rural water supply schemes fitted with handpumps.

As far as community factors are concerned literature showed that there should be a demand from the community for improved water supply schemes fitted with handpump before development of the scheme. Community participation should ensure in all phases of water supply scheme development and management. Locally recognized and organized gender

sensitive water committee under take the responsibility of management of rural water supply schemes fitted with handpumps.

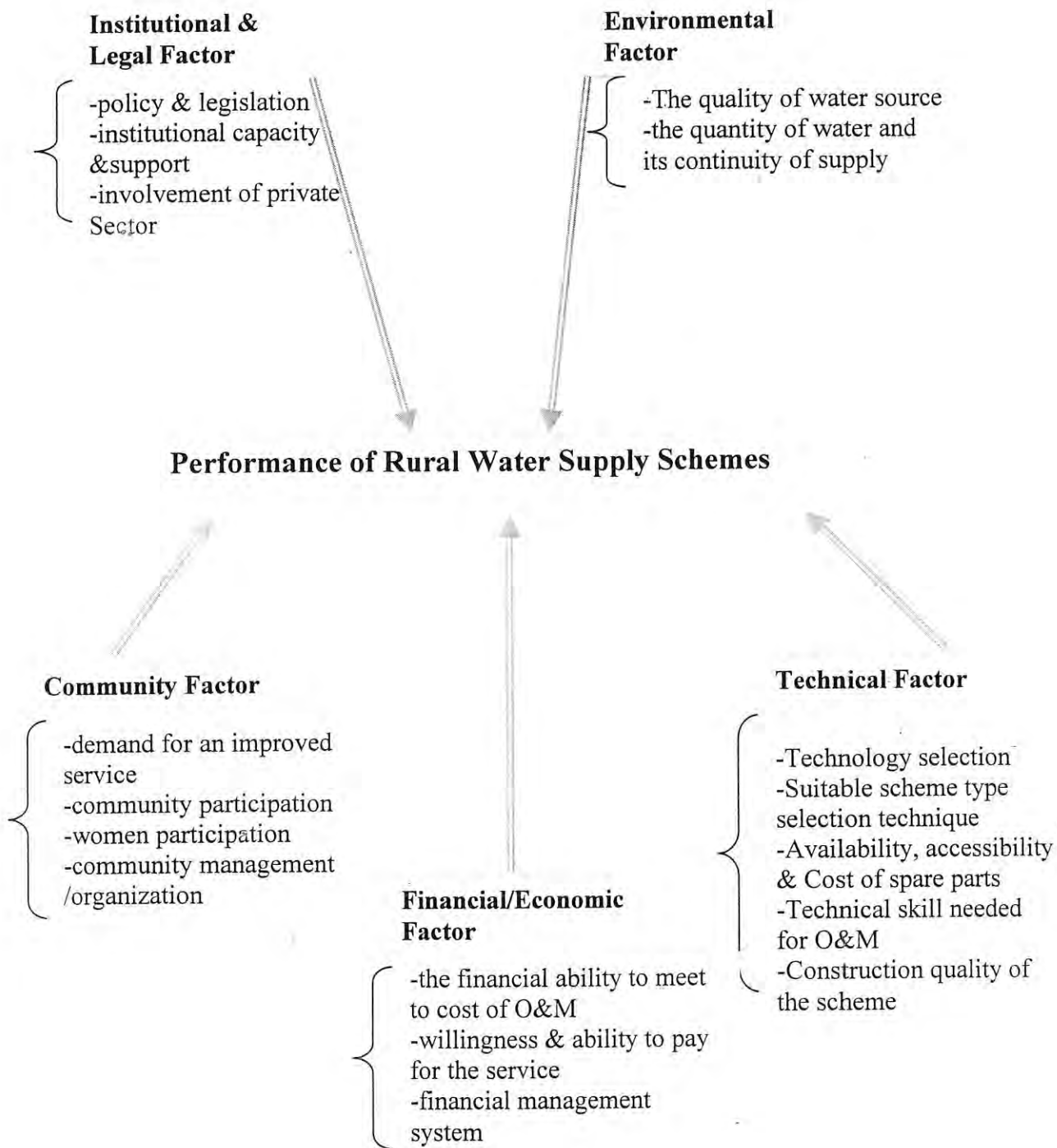
Regarding technical factors, water supply projects should consider village level operated and maintained (VLOM) handpumps for ease of community management, adequately trained and skilled technician under take minor maintenance of handpumps should be created within the user committee, spare parts supply system should be established in the way the community can access and afford them when ever maintenance needed, construction quality of handpumps during water well drilling or excavation and head work construction should be supervised by relevant professional to avoid the problem. Appropriate schemes type selection and choice in the study area should be well assessed and decided to develop suitable water supply scheme to rural settings.

Concerning financial factors, user committee should make regular contribution for O & M of handpumps fitted rural water supply schemes. However, in order to sustain and maintain the existence of regular contribution for O & M the amount of contribution should be based on user ability and willingness to pay, taking into account the minimum requirement over all O and M cost of the scheme and practice of saving the money in local finance institutions.

With regards to environmental factors, in order to avoid the scheme service unreliability due to water quality and inadequacy of yield problem Integrated feasibility study on scheme type selection to the study environment to be sustainability. There before, commencement of drilling for rural water supply schemes fitted with handpumps to avoid the water source inadequacy and to ensure the continuity of water supply.

Regarding institutional and legal factors there should exist polices and legal framework under which water supply schemes are developed and managed and there should exist a room for private sector and capacitated local public institution responsive for monitoring and management.

Figure 1: Conceptual Framework of the Performance of Rural Water Supply Schemes



Source: adopted and modified from Brikke and Bredero 2003, MoWR 2003 and Musonda 2004

2.6. Water supply and schemes functionality status in Ethiopia

Ethiopia is one of sub-Saharan countries with low water supply coverage. According to MoWR Annual report (2008:8), water supply coverage of country is 46.39% for rural population and 82.02% in urban area and overall water supply coverage of the country is 52.46% in 2006/2007(1999EFY). According to the same source, service coverage is given by 5% from previous budget year. As can be seen from this nearly half of population has no access to safe water. Furthermore, there exists considerable disparity among regions have extremely low access to safe water as compared to other regional state.

Water supply scheme status is one of important indicator of water supply scheme performance. However, considerable numbers of developed water supply schemes are non functional in the country because of multifaceted factor. The scheme non functionality is contributing for already existing low water supply coverage. According to MoWR Annual (2007:30), number of non functional schemes in the country is 25% in average. However, the rate varies from 23%-Amhara, 25%-Oromo, 20%-Tigray, 17%-SNNPR, 30% in Benishangul Gumuz and other regions.

To improve the existing status of water supply in Ethiopia, the government has planned and implementing different programs like PASDEP and UAP are the most important ones to mention. PASDEP is a plan for accelerated and sustained development to end poverty for a period of (1998 to 2002). The target of the plan was to raise water supply coverage from 34.5% to 77.5% in the rural areas, from 42.2 to 84.5% in urban areas and to reduce malfunctioning water schemes from 25% to 5% but not the case. Universal access plan (UAP) is also plan to improve WASH status of country.

According to MoWR (2006:6), UAP is a 7 year plan (2006 to 2012) which has been prepared to meaning fully change the low level of water and sanitation coverage and thereby fully benefit parts of the society who had no access to the service before. The target of UAP is to raise water supply coverage 98% in the end of program for rural population within 1.5km radius and 15litre/person/day and 100% for urban population within 0.5km radius and 20litre/person/day.

2.7. Water Supply and Sanitation Policy in Ethiopia

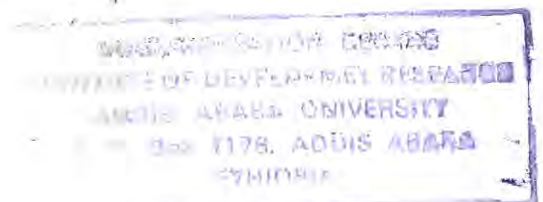
Before 1999, provision of potable water supply and sanitation facilities has been made without any policy framework. However, based on the FDRE constitution Ministry of water resources development has formulated water resource management policy(1999) in which policy on water and sanitation has been given due emphasis. Besides, water sector strategy (2002) and water sector development program (WASDP) (2002-2016) have been endorsed to set the basis for sustainable development and management of the country water resource.

The overall objective of water supply and sanitation policy is to enhance the well-being and productivity of the Ethiopian people through provision of adequate, reliable and clean water supply and sanitation services and to foster its tangible contribution to the economy by providing water supply services that meet the livestock, industry and other water users' demands (MoWR, 1999:21).

Some of the detail Objectives of Water Supply and Sanitation Policy includes:

- Provision of, as much as conditions permit, sustainable and sufficient water supply services to all the peoples of Ethiopia.
- Carry out operation and maintenance of all water supply and sanitation services in a sustainable and efficient manner.
- Promoting sustainable conservation and utilization of the water resources through protection of water sources, efficiency in the use of water as well as control of wastage and pollution.
- Creating sustainable capacity building in terms of the enabling environment, including institutions, human resources development, legislation and regulatory framework for water supply and sanitation.
- Creating conducive environment for the promotion of appropriate sanitation services.
- Develop the appropriate water supply planning parameters, design criteria and standards along with acceptable, desirable and permissible ranges and limits.

With regard to the financial, the policy detail stipulate to promote self financing of the program and projects at local level, provide subsidies to communities who can not afford to pay for basic service, on the capital costs only, enhance self financed and total recovery in urban water supply.



CHAPTER THREE

3. RESEARCH METHODOLOGY

3.1. Description of the Study Area

Debatie Woreda is one of the Woreda in the Benishangul Gumuz regional state. It is located in the south east of Metekele Zone within 10 06' 35"-10 54' 29"N and 35 58' 56"-36 26' 05"E. It has about 2400 km² area and a population of 54,180 (2007 census). Debate Woreda is entirely within the Abay River basin bounded by the Abay River in south and southeast and Dura River in the east, Mandura and Bullen woredas to the north and west respectively. The administrative center of the Woreda is Debatie town located some 50 km southeast of Gilgel Beles along the new road under construction connecting Debatie with the zonal capital. Debate town is accessible by all weather gravel road. The town gets electric power from Hydropower for 24 hours a day and water supply from groundwater with public water point. There are government institutions and services such as elementary schools (Grade 1-8), one high schools (Grade 9-10), and preparatory school (11-12), cable telephone services, postal services, health station, mosques and churches. Weekly market place exists at the center of the town.

According to the information obtained from the Woreda agriculture and rural development office (2010) the average temperature of the Woreda reaches 28 0C and receives annual rainfall from April to the end of September which covers almost 95% of annual crop production. Generally, the climate of the area is characterized as moist Kola. The land use patterns of the Woreda mainly include cropped land, savanna, shrubs, bushes, woodlands and grasslands.

Like other parts of the rural Ethiopia majority of the population of Debatie Woreda earn their livelihood from agriculture. The major agriculture type is production of crops followed by livestock keeping.

The sampled kebeles Berber, Modermo/Legbuna and Zighi are relatively populated and accessible kebeles and about 32, 18 and 20kms far from the Woreda town. There are

elementary schools in all of the three kebeles and health post at Berber and zighi kebeles centers.

As per the information obtained from the Woreda Water Resources Development Desk, the water coverage in the Woreda is not well known. However, rural water point inventory conducted in the Woreda recorded 9 shallow wells, 33 springs and 73 dug well in 14 kebeles of the Woreda. Most of the people live in the highlands and on the transitional sloppy areas bordering the chain of the mountain trending NE to SW. The great majority of the people in the Woreda live in such kebeles as Galessa, Chanco, Berber, Jane, Leg Buna, Zegeh, Bechati, Gipo, and Debate. In the eastern and southern lowlands of the Woreda the population density is very low. Generally the low population density in the lowlands is attributed to scarcity of water sources and malaria problem.

A. Water Point Observation

All of the water points in the sample kebeles were observed in the study Woreda. These are, dug wells, shallow wells (boreholes with a depth of less than 50m). These water points are being used for community water supply. In places surface waters such as unprotected springs, rivers, streams and ponds are also used for domestic consumption by the communities of few kebeles. During field survey about 21 water points of dug wells and shallow wells fitted with hand pumps, with a depth of less than 50m were observed.

B. Physiographic Conditions

Debate Woreda is characterized by highly undulating landscape with chain of mountain crossings the Woreda from north-east to south-west end. The pick of mountain has an average ground elevation of 1800m.as.l where as, the low lands drops up to 750m.a.s.l.

The different rock sequences are eroded by flowing rivers and floods and thick sediments deposit in the surrounding lowlands. The effect of the physiographic setup on groundwater potential and flow can be related to the following points; topographic variation, slope, geological formation and stream entrenchment.

Thus, surface and groundwater potential is dependent the above and many other factors. These factors include climate, geology, vegetation, topography, elevation, and others. Among the above listed factors, climate plays a great role in influencing rainfall, temperature, relative humidity, evapotranspiration and wind speed, which are very important parameters for water resources evaluation.

In the mountainous and undulating areas, there are many rivers, with gentle valleys. The slopes of these valleys increase close to the Abay River. The main rivers form parallel and sub parallel drainage.

C. Geology and Hydro geology of the Study Area

General descriptions of the geological and hydro geological features of the major rocks of the area are: Precambrian rocks are: Schists: - Amphibolite, quartzofeldspathic, graphitic, biotite and chloride type; Marble: - Dolomite and calcite marble out cropping in the western boarder of the Woreda along the road to Bullen; Marble quarry is most common in the Woreda in the area close to the border with Bullen Woreda; Intrusive Rocks: - Meta-granodiorite, meta-granite and granite intrusions are with high resistance to erosion remain outstanding and develop dissected and rolling topography and these are hard ground formation .

Tertiary volcanic rocks like; alkaline basalts: The major outcrops in the Woreda are Mekonen basalts in Berber and Galessa kebele. It is much localized with highly weathered and fragmented outcrop covered with red clay soil in places. Hand dug wells are common in front of houses. This is probably because of the presence of fractured basalts (BoWMD, 2009).

3.2. Research Design

The research design used in this study was cross-sectional study, whereby different data were collected at a time. In order to obtain the required information those are relevant to meet the objective of the study. Both qualitative and quantitative data collection instruments were employed. Probability and non probability sampling techniques were employed to select sample hand pumps, household survey respondents, participants of FGD and key informants.

3.3. Sampling Techniques and Procedure

The study were employed both probability and non probability sampling technique to select sample kebeles, water supply schemes (villages) and households. In the fourteen kebeles in the Woreda; there are about 73-HDWs and 9-MDSWs schemes developed in different villages of the *kebeles*.

A. Selection of Sample Kebeles

Debatie Woreda has 14 Kebeles. According to WWRDD Annual report (2009), there has been water supply and sanitation intervention in all of the kebeles and 9 of them have both handpump schemes were developed in different villages. Hence, taking 9 rural kebeles as sampling frame. Out of nine kebeles which have both schemes types, three representative kebeles having the two types of water supply schemes (hand dug well and Machine drill shallow well) in different *Gotts (villages)* that are very close each other in the same kebele, were selected purposively for the sake of manageability due to time and cost and also consider accessibility of the site.

B. Selection of Water Supply Schemes

According to Debatie Woreda WRDD, the total number of rural water supply schemes at the end of 2001E.C in the Woreda were 115. Out of the total projects 33 were springs not well protected due to in appropriate site selection and not considered as scheme standard as a result they are excluded from the study, 73-HDWs and 9-MDSWs are developed in different villages of the rural settings.

Accordingly, a totals of 6(30%) of the sample kebeles water supply schemes in six villages were selected in the three kebeles that represent the rural water supply schemes in the study area. First, schemes in the sample kebeles were stratified into one functional and the other non functional, both

functional and non functional and then select the sample schemes purposively i.e. one hand dug well and one machine drill shallow well. This was to look at the differences in the performance of each schemes and problems that result one scheme functional and the other non functional in the study Woreda.

C. Selection of Sample Households

Households or beneficiaries were selected by using simple random sampling to give equal chance to all residence or beneficiaries to become a sampling unit and representative sample size of households from the users of water supply schemes; this is due to the similarity of socio-economic conditions of the area.

According to the data collected through the household survey, the total numbers of household beneficiaries of the sample water supply facilities were found to be 481. Then, as can be seen from the table below, from each village by systematic random sampling 12 to 20 (20%) households were selected. Hence, the study took a total of 96 households as sample for data collection.

Table 1 Sample Size of Households by Kebeles, Gotes and Scheme Type

S.No	Kebele	Gott/Site name	Well type	Status of scheme	Sample size determination	
					No. of HH Beneficiaries	20% of HHs
1	Zigi/Girzi	Zigi 01	MDSW	Functional	100	20
2	>>	Chidem	HDW	Functional	76	15
3	Berber	Kebelesuk	MDSW	Non functional	90	18
4	>>	Dugumsefer	HDW	Nonfunctional	60	12
5	Modermo	Moderm 01	MDSW	Nonfunctional	75	15
6	>>	Moderm 02	HDW	Functional	80	16
Total					481	96

Source: WWD & Water committee from respective community, 2010

3.4. Data Sources and Type

The study was used quantitative complemented by qualitative approach. Thus, both quantitative and qualitative data were collected to counter balance the limitation of the one by the other. The quantitative data mainly was obtained from household survey. Qualitative data was generated

through focus group discussion, key informant interview and personal observation to supplement, complement, validate and triangulate data obtained from households.

Source of primary data were from beneficiaries or households, local elders, local chairpersons, water expert, heads at Woreda and regional level and other project implementing agencies. Official statistics and reports available in the project implementing agencies', internet sources, official reports in Woreda office, bureau of water resource and finance and economics were the major sources of secondary data in this study.

On the other hand, the data input for this study was both primary and secondary sources. The major sources of secondary data were from governmental and non governmental publications, annual and inventory reports, pervious studies, internet sources and books.

The primary data was collected from sample households, participants of Focus group Discussion and Key informant interviews that had been made with water supply beneficiaries and governmental and non governmental water supply agencies. In addition personal observation was another source of primary data.

3.5. Methods of Data collection

Data on the performance of different rural water supply schemes and underlying factors were gathered through different data collection methods Thus, Households Survey, Focus Group Discussion, Key Informant Interview and Personal Observation were employed to collect primary data.

A. Household Survey

Primary data on all relevant variables such as problems related to the performance of rural water supply facilities, community participation, and role of water committee, technical, financial and institutional issues were collected through structural questionnaires.

Since most of the sample population in the study area are illiterate, structured interview were found to be the most appropriate to obtained the required data. It also provides the opportunity to

investigate new things and reduces the probability of non response, although the method demands time. Thus, closed and open ended questionnaires were prepared in English and translated into Amharic and Shinashigna to collect the data from the households. Before the actual data collection, the structured questionnaires were tested in all sample villages with two interviewees. Then certain modification was made on the data collection format.

The HH survey was conducted by 3 recruited and trained enumerators, who are fluent in local language (Shinashegn) and Amharic with close supervision of the researcher. With regard to their educational status, two of the enumerators are Diploma holders from TVET in water supply and sanitation and electromechanical and one is grade 12 complete. (See Annex-1 interview schedule used).

B. Focus Group Discussion/FGD/

The primary data collected from sample households were enriched by additional information obtained through focus group discussion. During data collection two FGDs in each water points were conducted with water committee and selected women groups to generate the required information. On the average 5-7 people have been participated in the focus group discussions conducted in each village. First, discussions were made with the women group alone who were expected to have better knowledge and concern about the problem related to performance of rural water supply schemes. Next, Discussion were held with 3-water committee member, 1-local elder and one local chairperson groups were made on the different issues related to the performance of the rural water supply schemes with the help of checklist (refer annex-2) by the principal researcher.

C. Key Informant Interview/KII/

A key informant interview is particularly important in generating information related to institutional, technological and on the problems and success in different water supply scheme intervention made so far on the performance rural water supply facilities. Hence, the views of water supply agencies (experts and heads) were important as they have better knowledge of the cases in

point. An interview guide was prepared and information gathered through unstructured interview (refer annex-3).

D. Personal Observation/PO/

The researcher observed 21 developed water supply schemes (3-SWs and 18 HDWs) located in the sample *kebeles* using observation checklist (refer annex-4). This help to find out the actual status of the performance, functionality, operation and maintenance and the scheme type of water supply facilities. The primary data collected through direct observation of schemes complimented to the information obtained through other primary sources of data.

3.6. Data Analysis and Presentation

Both quantitative and qualitative methods of data analysis were used. The primary data collected from household survey through structured questionnaires were first checked for accuracy and data entries coded. Then, data were entered, edited and analyzed using statistical package for social science (SPSS) version16.0 software. Descriptive statistics such as percentage, frequency, mean, standard division, chi-square and cross tabulation were used to analyze the data quantitatively.

On the other hand, data gathered through key informant interview, focus group discussion and personal observation were organized according to themes and analyzed qualitatively to strengthen data obtained from household survey. On top of these, methods of triangulation were used to analyze data collected from different sources and data were presented using tables and figures.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

4.1. Demographic and Socio-Economic Characteristics of the Sample

Respondents

Knowing socioeconomic profile of the respondents is important to understand their characteristics and roles in socioeconomic development. Accordingly, in this study total of 96-HHs are surveyed in three *Kebeles* those use water from 6-purposively selected community managed schemes fitted with handpumps. Based on the result of survey, demographic and socioeconomic backgrounds are discussed in this section.

4.1.1 Demographic Characteristics of the Respondents

4.1.1.1 Sex Composition and Age Structure of Respondents

The following table-2 shows that the profile of respondents sex and age structure. Accordingly, 76(79.2%) of the respondent, out of 96HHs interviewed are male while 20(20.8%) are female. This study showed more male than female because the beneficiaries of each handpump schemes are listed by the head of HHs. In the study area numbers of families headed by males exceed that of female headed.

With regard to age structure, out of the total HHs respondents, 90(93.8%) were found economically active (20-50) age groups. The average age of the respondents was 35 years with St. Deviation 13.82. These groups of people are expected to participate actively in the process of rural water supply development and management and any other development activities.

Table 2: Percentage Distribution of Respondents by Sex composition and age Structure

Issues	Category	Frequency	%
Sex	Male	76	79.2
	Female	20	20.8
	Total	96	100.0
Age structure	Less than 20	1	1.0
	20-30	30	31.2
	30-40	41	42.7
	40-50	19	19.8
	Greater than 50	5	5.2
	Total	96	100.0

Source: Household survey, 2010

4.1.1.2 Marital Status and Family Size of Respondents

As can be seen from table (3) out of 96 surveyed respondents 4(4.2%) are single, 72(75%) married, 15(15.6%) divorced and 5(5.2%) are Widowed. This indicates that great majority of the respondents are married. The researcher learnt that male headed households were married but female headed households were divorced or widowed in the study area.

With regard to family size of the respondents, from the total respondents, 25(26%) have family size of below 4, 41(42.7%) are with family size of 5 to 6, 22(22.9%) with family size of 7 to 9 while the remaining 8(8.3%) are with family size above 9 number within a single household. The average family size was 5.1 with standard deviation of 2.49.

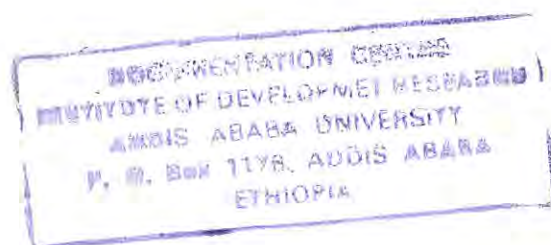


Table 3: Percentage Distribution of respondents' by marital status and family size

Issues	Category	Frequency	%
Marital status	Single	4	4.2
	Married	72	75.0
	Divorced	15	15.6
	Widowed	5	5.2
	Total	96	100.0
Family size (in person)	Below 4	25	26.0
	4-6	41	42.7
	7-9	22	22.9
	Above 9	8	8.3
	Total	96	100.0

Source: Household survey, 2010

4.1.1.3 Ethnicity and Religion of Respondents

As table (4) shows, majority of the respondents belong to Shinasha ethnic groups. Out of the total respondents, 70(72.9%) constitute Shinasha, 20(20.8%) are Amhara, 5 (5.2%) are Oromo and the remaining 1(1%) of the respondents belongs to other ethnic groups as far as ethnicity is concerned.

With regard to religion of the respondents, out of all respondents 83(86.5%) are Orthodox, 9(9.4%) are Muslim and the remaining 4(4.2%) respondents belongs to protestant.

Table 4: Percentage Distribution of Respondents by ethnicity and religion

Issues	Category	Frequency	%
Ethnicity	Shinasha	70	72.9
	Amhara	20	20.8
	Oromo	5	5.2
	Others	1	1.0
	Total	96	100.0
Religion	Orthodox	83	86.5 ^{2*}
	Muslim	9	9.4
	Protestant	4	4.2
	Total	96	100.0

Source: Household survey, 2010

4.1. 2. Socio-Economic Characteristics of the Respondents

4.1.2.1. Educational Level and Income Source of Respondents

Education is an instrument for the socio- economic development of a nation. This is because, literate citizen can better participate in an effort that is aimed at progress and makes better use of the benefit of growth. Accordingly, a study on problems related to the performance of rural water supply need to look into the educational status of the target community.

As shown in table (5), from the total of the household respondents, 55(57.3%) are illiterate, 16(16.7%) are able to read and write, 6(6.2%) first cycle complete, 12(12.5%) are second cycle complete, 3(3.1%) are high school complete and 4(4.2%) are above high school. This indicate that majority of the respondents are Illiterate or able to read and write.

On the basis of this finding, we can conclude that literacy level in the rural areas of Debatie Woreda is very low. This is in tern could be one of the reason for the problems for the poor performance of rural water supply schemes. This is also indicated by FGD participants that the low level of awareness of the community is the factor for weak community usage and ownership to the handpump schemes.

With regard to income source of the respondents, out of the surveyed household respondents, 80(83.3%) respondents income source is agriculture. The rest 5(5.2%), 5(5.2%) and another 6(6.2%) respondents replied that their major income source is Government employee, daily labor and peaty trade/business respectively.

This finding shows that the dominant income source of the family in the study area is agriculture. The researcher also observed that Debatie Woreda is suitable for agricultural activities and the farmers enjoying good yearly crop harvest during the survey.

Table 5: Educational levels and major income source of respondents

Issues	Category	Frequency	%
Educational level	Illiterate	55	57.3
	Able to read and write	16	16.7
	First cycle(i-4)	6	6.2
	Second cycle(5-8)	12	12.5
	High school(9-12)	3	3.1
	Above 12	4	4.2
	Total	96	100.0
Major income source	Farming/agriculture	80	83.3
	Government employee	5	5.2
	Daily labor	5	5.2
	Peaty trade/business	6	6.2
	Total	96	100.0

Source: Household survey, 2010

4.2. Existing Water Supply Handpump Schemes Situation in the Study Area

4.2.1. Overview of Common Rural Water Supply HP Schemes

According to the inventory result of water supply schemes by Woreda water desk, there exist 82 different types of rural water supply handpump schemes in the Woreda. The handpump schemes are found in most of rural kebeles of the Woreda. The wells in which handpump fitted are either hand dug well (HDWs) or Machine drilled shallow wells (MDSWs). The HDWs are manually drilled wells, with average depth 11.5m while MDSWs are machine

drilled wells with the average depth 28m below the surface in the study area. As far as distribution of wells concerned 73 (89%) are HDWs and 9(11%) are machine drilled shallow wells.

With regard to the number of beneficiaries of the wells concerned, about 15,132 (27%) people get water supply services from the developed schemes fitted with handpumps in the study area but currently many of the population are not getting water from the water points because considerable number of the handpump schemes became nonfunctional and functional schemes provide the service with interruption at time of the survey due to different factors, those to be discussed under a section factors affecting the performance of the water supply schemes fitted with handpumps in the study area. Needless to say, users whose scheme failed to give water service shift to secondary sources, such as distant water sources in some community, traditional dug well, unprotected springs and rivers.

As stated earlier, there are generally a total number of 6 water supply facilities in the 6 sampled villages, with a total population of 2,405. This indicates that if all the facilities were to function properly, 300 people for MDSWs and 200 peoples for HDWs would depend on only one water supply facility. This is, however, not the case as more than 440 and 360 people depended on just one facility for MDSW and HDW respectively.

As far as the handpump schemes implementers are concerned, there are about five different government and non governmental organizations involved in the development of rural water supply handpump schemes since late 1980s of E.C. Out of the total handpump schemes developed in the Woreda 29 handpump schemes were developed by CEPAR international NGO, 14 schemes were developed by Godana local NGO, 24 water points were developed by regional government by the assistance of UNICEF and budget of the regional and Woreda, 9 schemes by Tadiso fund and 6 water points by Wesmico local NGO. But during the time of survey the only active NGO is the new one i.e. Finn BG-WASH /Finland government started a year ago and the project focused on the development of hand dug wells due to low cost and more community participatory but this is excluded in the study.

Generally, among total water supply handpump schemes 24 (30%) are developed by the government and the remaining 58 (70%) are developed by NGOs. This figures shows that majority share of the handpumps were developed by NGOs.

4.2.1.1. Water Supply HP Schemes and their Functionality Status in the Woreda

As can be seen from the table (7) the dominant rural water supply scheme type in the study Woreda is hand dug well and it accounts about 89% of handpump schemes in the Woreda and the remaining 11% is Machine drilled shallow wells fitted with handpump with almost all Afradive pump installed except one HDW installed with Indian mark II.

With regard to the handpump performance for village level operation and maintenance (VLOM) are considered, both of the scheme types are considered as village level operation and maintenance schemes (Arlosoroff et. al, 1987:87).

Based on the field observation made by the researcher during the time of the survey 3-MDSWs and 18-HDWs are physically observed and found that 12 were non functional and 9-were functional by the time of survey from these 2-MDSWs & 10-HDWs were non functional and 1-MDSW & 8-HDWs were functional. On the basis of the data collected from the WWRDO out of 82 handpump schemes 38 (31-HDWs and 7-MDSWs) of them are non-functional and 44 schemes are functional by the time survey. As it was discussed in the next section, even majority of functional handpumps were providing service with problems i.e. with low yield and frequent interruptions as learned from beneficiaries. As a result considerable numbers of beneficiaries of the hand pump schemes run out of potable water supply sources, shift to secondary sources or to other villages that are relatively far from their home.

4.2.2. Current Water Supply Situation of Respondents

All respondents households are users of handpump scheme developed within their community at least by the time of they were functional and new. During the time of survey, out of the total 96HHs, those are using from their handpumps were, 49(51.1%). The remaining

47(49.9%) were not getting the water supply service from the original handpump schemes because of pump failure and depth problem that lead the scheme non functional.

In response to the question provided to the respondent to know from where they are getting the water for drinking after the main source or the handpumps are nonfunctional, the following result were obtained as from the table (4.5) shows, 16 (34.1%) are using from developed water sources (i.e. HDW & MDSW fitted with handpump) in the other community. The rest 31(65.9%) the respondents are using from undeveloped water source (rivers, traditional dug wells and unprotected springs).

Table 6: Current sources of drinking water supply for respondents, those their HP non functional

Water sources	Frequency	%
River	15	31.9
Traditional dug well	11	23.4
HDW fitted with HP	13	27.7
Unprotected spring	5	10.6
MDSW fitted with HP	3	6.4
Total	47	100.0

Source: Household survey, 2010

This finding shows that 16 (34.1%) of the respondents aware of the benefit of using safe water from developed sources but majority, 31(65.9%) of the respondents still going to unsafe water sources such as rivers, traditional dug wells and unprotected springs for more reason of pump failure and insufficiency of water of schemes in near by community. The health implication of unsafe water source is also considerable.

The researcher also observed that many inhabitants of Berber kebele (Dugmsfer Gotes) were using water from unprotected private traditional dug well which is common and available in front of most of houses used as the main sources of water for domestic propose during the time of study. The reason was that the water from improved scheme especially HDW were not sufficient to cover our domestic consumption, dry of the well during 'Bega' season and poor management of the water committee in the of handpump schemes in the kebele.

The problem on service delivery is not only restricted to the beneficiaries for those their water supply handpump schemes become non functional also for those their water supply handpump are function by the time of survey. The problems are interruption of the service delivery, because of pump failure, insufficiency of water in the well and delay of the pump with out getting maintenance once it became nonfunctional.

As shown in the table (7), the largest percentage of the respondents 49 (51.0%) confirmed that female were responsible for water collection in the family. In the contrast, 34 (35.4%) respondent reported that water collection was mainly the duty of women and children/girls, 8(8.2%) put children as the main water collector in the home, 3 are male and 2 are both male and female. This finding is more or less similar with many studies conducted in rural water supply schemes. It also supports the assessment result of WHO that indicated, children and women, who are the common water attendants; spent much time on water collection in the rural areas of Ethiopia (WHO, 1995:7).

Based on the finding it is safe to say that water collection is mainly the responsibility of women and children in the rural settings of Debatie Woreda.

Table 7 Percentage distribution of Water collection task in the Family

Issue	Category	Frequency	%
Water collection task in the Family	Male	3	3.1
	Female	49	51.0
	Children	8	8.3
	Female and Children	34	35.4
	Male and female	2	2.1
	Total	96	100.0

Source: Household survey, 2010

Household respondents are also asked to know the functionality situation of the handpump schemes since the time of construction, as it can be shown in the table (9), out of the total household respondents 80(83.3%) have experienced non functionality problem of their hand pumps after construction. Only 16(16.7%) of the respondents did not faced the service

discontinuity. This finding clearly shows that the poor performance of water supply schemes and water service interruption are prominent phenomena in the study area. The major reason according to beneficiaries and Woreda water desk experts for the water supply handpump malfunctioning are pump failure (spare parts such as rods, joints and seals) and seasonality or depth problem of most HDWs.

In order to enhance service reliability, timely maintenance of the non functioning water supply schemes is important. In this regard, the response to the question asked to know how fast the maintenance of the handpumps were under taken in the study area once the scheme non functional, have given the following responses. As it can be shown from the table (8), all the respondents said that their handpump were in state of disrepair once non functional from a month to more than a year. And from the respondent majority 55 (57.3%) said that the schemes were in the state of disrepair due to seasonality of HDW schemes (depth problem) but others are due to pump failure.

The above finding clearly shows that the practice of fast maintenance when handpump schemes became nonfunctional looks slow in the study area. The reason behind this practice is not straight for ward. It has got social, technical, institutional, financial and environmental dimension these were discussed in the next section.

Table 8: Percentage Distribution on Functionality situations of water supply HP schemes

Issues	Responses	Frequency	%
Non functionality problem since construction	Faced	80	83.3
	Not faced	16	16.7
	Total	96	100.0
The time HP in the state of disrepair once fail	A month	11	11.5
	1-6 month	17	17.7
	6 month-1 year	55	57.3
	More than a year	13	13.4
	Total	96	100.0

Source: Household survey, 2010

With regard to the main problems to the non functionality of water supply handpumps schemes, the following result were obtained from the surveyed households, among the sample respondents 33(34.4%) were indicated pump failure 15(15.6%) replied that the depth problem/seasonality, 6(6.2%) reported as water quality problem and 41(42.7%) of the respondents reported that problem of how to operate and manage are problem to the poor performance/non-functionality water supply handpump schemes.

From the above finding we can concluded that the main problems for the non functionality and poor performance of water supply handpump schemes are inability to operate and manage the scheme properly, well depth and water quality problems.

Table 9: Frequency distribution of the main problem for the non functionality of the HP schemes

Issues	Responses	Frequency	%
Main problem for the non functionality of the HP	Pump failure	33	34.4
	Depth problem/Seasonality	15	15.6
	Water quality problem	6	6.2
	Problems of how to operate and manage the scheme	41	42.7
	No problem	1	1.0
	Total	96	100.0

Source: Household survey, 2010

In table below (10), it is depicted that 55(57.3%) of the respondents have been collecting water two times, 28(29.2%) three times, 8(8.5%) more than three times and 5(5.2%) one times. The average amount of water collected in single tripe was 20-liters (a Jeri can).

As it can also be indicated from the table below, 77 (80.3%) of households were utilizing less than or equal to 41-50 liters per day, the daily consumption water of 19 (19.8%) respondents was found to be more than 51 liters per day per households. The study also reveled that the mean household water consumption and the amount of water per capita were 44.65 and 9.6 liters respectively. The finding of the study is similar to the research conducted by Mengesha

(2002:47) in North Gonder were the amount of water per capita consumption was found to be 8 liters.

In contrast, the amount of water per capita consumption in the sample *kebeles*, about 9.6 liters was significantly different from WHO guide line and MoWR universal access program target values set at least 20 and 15 liters per capita per day (Webster J, et al., 1999:416; MoWR, 2008:2).

Based on the above finding it can be concluded that peoples in the rural areas of Debatie Woreda do not get sufficient water for their healthy life.

Table 9: Amount of water consumption and number of water collected per day

Issues	Category	Frequency	%
Daily HH water consumption per liter	20-40	4	4.2
	41-50	73	76.1
	51-75	17	17.7
	More than 75	2	2.1
	Total	96	100.0
Water collected frequency per day	Once	5	5.2
	Two times	55	57.3
	Three times	28	29.2
	More than three times	8	8.3
	Total	96	100.0

Source: Household survey, 2010

4.3. Factors Affecting the Performance of Rural Water Supply Schemes

4.3.1. Community Factor

A. Community Participation

In many countries one of the major causes for the failure of the rural water supply schemes in general and handpump schemes in particular has been the lack of community participation (WB, 2002:101). In the other words users or beneficiaries involvement in all phases of the

local water supply development and contribution to the system development has paramount importance to better perform the water supply facilities. Accordingly, Desalegn (1999:40) strongly argue that, unless user community are involved from the beginning and are conscious of a need for safe water supply there is a danger on the facilities if it will not be used and maintained properly.

The conventional way of community participation in the rural water supply project is by provision of labor and locally available construction materials such as stone, sand and wood. But in some cases every input of the projects comes from implementing agency and end users contribution and inputs are neglected. Having this in mind sample households were asked whether they participated in the development of the water supply hand pump schemes or not.

With regard to the community participation in development of the different type water supply handpump scheme, the following result was obtained from the surveyed households, as it can be indicated in the table below (11) 35(81.4%) and 29 (54.7%) respondents were participated for HDW and MDSW development respectively and 8(18.6%) and 24(45.3%) respondents were not participated in HDW & MDSW development of water supply scheme respectively. The non participants were also asked the reason that they were not involving, accordingly, they reported the following, implementing agencies done every thing, we were not there at that time, we were not asked and others. Majority of MDSW scheme development non participants reported that we were not asked and the implementing regional water resource bureau done every thing using machine drilling and other head work too but the case of HDW scheme majority of them were not there at the time of the scheme development. Similarly, participants of FGD and KII confirmed the same reason as households said. Besides, the statistical chi-square test shows, there is association and differences between scheme type and community participation at the time of scheme development with probability level $P < 0.05$.

From this finding it can be concluded that the community participation for MDSW development was found to be less than HDW development and this may be one cause for the failure of the performance of the shallow well schemes.

Table 11: Differences in Community participation in HP schemes development

Issue	Type of HP scheme	response	Frequency	%
Community participation in the development of water supply handpump	HDW	Yes	35	81.4
		No	8	18.6
		Total	43	100.0
	SW	Yes	29	54.7
		No	24	45.3
		Total	53	100.0

Chi square= 4.058*, Significant at $P < 0.05$ (cross tabulation)

Source: Household survey, 2010

As far as the level of community participation in the rural water supply development project phases are concerned, the following result have been obtained, as the table (12) shows, among the total respondents who had participated in different phases of water supply developments, majority 41(64.1%) said they had participated during construction of the scheme, 16(25%) of the respondents said after construction, 6(9.3%) said they had participated at least in the two phases and in all development phases and the rest 1(1.6%) respondents said they had participated in the planning phase only. This implies that majority 61(95.3%) household respondents didn't participated satisfactorily during the planning stage, which is the most important phases that give the opportunity for the community to make informed decision for the water supply scheme to be develop (like site selection, type of water supply scheme and technology, their role and responsibility in contribution and follow up). Similarity participants of FGD and KII also confirmed that users or beneficiaries were not fully participated during the planning stage. This has seen as the failure for the performance of water supply schemes.

Regarding to the type of contribution made by the respondents, the survey result revealed that among participated households 45(70.3%) respondents contributed local material (like stone, sand and wood), 9(14.1%) contributed labor, 2(3.1%) money, 6(9.4%) contributed by idea and coordination and the rest 2(3.1%) of the respondents contributed both labor and local material.

In assessing who was/ were participated in the family during the water supply handpump schemes development. 40(62.5%) households reported males, 2(3.1%) were female and 12(18.8%) indicated the participation of both male and female. This shows that involvement of females or women in the rural water supply development was very limited in the study area and this may cause for poor performance of handpump schemes developed for the community for the case that women are the prime beneficiaries and collector of water from the water points.

Table 12: Levels of community participation in the HP development

Issues	Category	Frequency	%
Phases of community participation of water supply development projects	Planning	1	1.6
	During construction	41	64.1
	Post construction	16	25
	Planning & during construction	2	3.1
	During & post construction	2	3.1
	All	2	3.1
	Total	64	100.0
Contribution of community in the development of the water supply scheme	Labor	9	14.1
	Money	2	3.1
	Local material (stone,sand,wood)	45	70.3
	Labor and local material	2	3.1
	Others(like, coordination)	6	9.4
	Total	64	100.0
Who have participated in the development of the water supply scheme in your family?	Male	40	62.5
	Female	2	3.1
	Male & female	12	18.8
	Total	64	100.0

Source: Household survey, 2010

B. Community Management

Community managing rural water supply handpump schemes successfully means operating and maintaining a system on a day to day basis so that it continues to provide the service for its designed period as planned. There fore, water supply handpumps schemes will be better perform if they are managed by users themselves and water supply agencies need to strengthen the capacities and willingness of the community to take the responsibility to manage their water supply systems. Further more without proper community organization structure, effective community participation has difficult to continue the better performance of the handpump scheme. The communities exercise the management of rural water supply scheme is through establishment of water committee.

In line with this, the study has investigated the community management system in the study area. As a result it was observed that except one of the sampled water point five of sampled water supply handpump schemes have got established water committee. The numbers of members of water committee were five for HDW and seven for MDSW handpump schemes with gender composition of two women and three men for HDW and two women and five men for MDSW during establishment of the committee by the community and implementing agency. But some members of water committee in three sampled MDSW water points were not found at the time of survey due to different reasons like death and migration from their residence place.

However, in the response to the question forwarded to know whether the management body performs adequately its duties and responsibilities the following result was obtained. Out of surveyed household the majority 70(72.9%) of the respondents said that the management body are not capable and adequately discharging its duties and responsibility and they are not pleased with the performance of the water committee and 26 (27.1%) of respondents reported that the water committee are capable of managing water supply handpump schemes.

As far as the problems of the water committees are concerned, respondents were asked and they reported that they lack interest and commitment as there is no incentive for their work;

they transfer their duty to others like guards, some of them don't have adequate knowledge, lack of accountability and transparency problem and they discriminate among users.

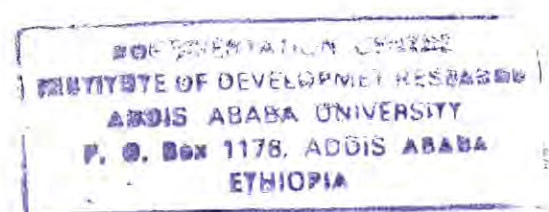
The data collected from FGD held at Kebelesuk, Chidem and Zigeh01 *Gotes* confirmed that they did not as harder as management of rural water supply demands because of lack of additional training and follow up from the implementing agencies, lack of power to enforce rules, the committee had no real legality to act within the community and lack of sense of ownership.

The respondent also recommend for the improvement of the performance of water committee as follows; water committee should be strengthen through training, non performing should be replaced by concerned individuals, the water implementing agencies should follow up and assist water committee performance and incentive and accountability mechanism should be established.

According to the information collected from head of Woreda water desk and participates of FGD water committees of water points on the responsibility and linkage between them to manage the water supply hand pumps it was found poor due to insufficiency of skilled human resource and lack of spare parts to carry out operation and maintenance at Woreda level and lack of tool kits for minor maintenance, lack of legal status and commitments from member of committees.

Furthermore, as it was observed during field survey; it was learned that water committees of the four water point were found to be as nominal rather than responsible body for the schemes and also observed that the water supply handpump schemes left with out fence and protection but the case of Modermo 02 Gote HDW which was functional the water committee are well performing their duty and the scheme were performing relatively better than MDSW scheme developed the near by Gote surveyed.

This finding supports the study result of Davis et al. (1993:148), who reported that water committee for most of water supply projects in the developing countries did not function intended for various reasons.



C. Communities Sense of Ownership

The water supply handpump schemes probably be poorly managed, misused rarely repaired by the community, if the beneficiaries do not feel sense of ownership. The degree of sense of ownership depends on the level of community participation in the development and management process.

In assessing sense of ownership of the community to the developed schemes, 38(39.6%) of respondents reported that they feel sense of ownership while 58(60.4%) of them did not. The data also collected from KII indicated that one of the problems for the poor performance of water supply handpump schemes is the absence of sense of ownership by the beneficiaries who didn't handle/used properly and not to contribute the cost cover finance for operation and maintenance. Similarly majority of the FGD participants confirmed that the absence of sense of possession due to low level of awareness, failure of scheme to satisfy the demand of the beneficiaries and existence of alternative water sources and lack of full participation in all stage of development.

The data collected during direct observation also shows that 20 of the handpump schemes have weak or no fences. Only 3 of the total observed handpump schemes have guard. The researcher has also observed that majority of the visited handpump schemes were mostly pumped by users and mostly by children at any time through out the day and even there were improper operation of the scheme by some adults. These are indicator of weak or absence of ownership to the developed handpump scheme. The finding of the study similar to the study results of Aklilu (2009:76) who was reported that there was weak sense of ownership of beneficiaries for the improved water supply in Besslon Woreda of Amhara region.

Therefore, from the above findings it can be concluded that rural communities in the study area have weak sense of possession for the developed water supply facilities that could be one of the factor affect the performance of the rural water supply schemes.

4.3.2 Financial Related to Factors

Water supply scheme for its establishment, operation, maintenance and management costs money. Accordingly existence of users' contribution and its adequacy, ability and willingness to pay and proper management and utilization of the collected fee is important factor for the better performance of water points.

A. Existence of User Payments and its Adequacy for O & M

From the review of related literature part, the existence of user payments and its adequate for O & M is important to ensure better performance of rural water supply handpump schemes. In addition, EWRMP promotes that all water supply undertakings to adequately address costs associated with O & M and based on 'cost recovery' principles. And also the policy clearly states that rural water supply tariff settings should be based on objectives of recovering O & M costs. This is to ensure the better performance of water supply handpump schemes.

Accordingly, sample households were asked to tell their position towards the existence of users' payment and its adequacy for O & M of their schemes. As the following table shows, Out of the total household surveyed 83(86.5%) replied that they pay for developed water supply service while 13(13.5%) respondents didn't pay for the water supply service at the time water supply schemes are functional but at the time of survey; for the non functional the beneficiaries didn't pay fee. The data collected from FGD participants also confirmed that as it was establishment, majority of beneficiaries pay the water service fee at the time the scheme functional except beneficiaries of Zigih01 SW that almost half of them didn't pay for the service. The form of payment is in cash (1-birr) in most of the water point developed in the sample *kebeles*. There is no significant difference users' contribution for the water supply service between the handpump schemes.

This result supports the research finding of Haysom (2006:22), which indicated water supply fee contribution is weak in the majority of the rural villages of Tanzania which primarily correlated to performance and functionality status of the scheme.

As far as user's payment of the hand pump scheme type concerned, respondents also asked to know whether the payment they made fair or not. As the result 39(40.6%) and 30(31.3%) households reported that it is fair for HDW & MDSW respectively and 4(4.2%) & 23(24%) of the respondents reported not fair HDW & MDSW respectively; from this it is indicated that Chi square=28.488, $P < 0.05$ test shows significance difference between the two schemes. Hence, considerable number of respondents of MDSW scheme beneficiaries reported that the payment they made were not fair than HDW beneficiaries due to inadequacy of the payment they made for operation and maintenance as the result of the schemes experience pump failure.

Furthermore, sample households were asked that whether they pay regularly or not, as it is indicated in the table below, 56(58.3%) respondents pay regularly while 40(41.7%) respondents didn't pay regularly for the water service. Similarly as learned from KII and FGD participants there are some beneficiaries didn't pay for water supply service regularly in all water points. In addition, it was indicated that 84(87.5%) respondents support the idea of water tariff for water supply schemes for their better performance.

Table 13: Situations of user contribution for operation and maintenance of HP schemes

Issues	Responses	HP scheme type				Total	
		HDW		MDSW			
		Frequency	%	Frequency	%	Frequency	%
Do you pay service fee?	Yes	33	34.4	50	52.1	83	86.5
	No	10	10.4	3	3.1	13	13.5
	Total	43	44.8	53	55.2	96	100
Do you think the payment you making fair?	Yes	39	40.6	30	31.3	69	71.9
	No	4	4.2	23	24.0	27	28.2
	Total	43	44.8	53	55.3	96	100

Chi square=28.488*, Significant at $P < 0.05$, for payment making fair (cross tabulation)

Source: Household survey, 2010

As far as adequacy of payment of users' fee was concerned, the user community should contribute the money needed for operation and maintenance. The study indicated that majority

91(94.5%) household respondents reported that the service fee rate set by the community through water committee. In other words involvement of water supply agencies during service fee rate setting decision was limited to facilitation. Therefore, the amount of fee and mode of payment were not standardized and it was done depend on the capacity and interest of each community.

Regarding to the amount of users payment majority 73(76%) of sample households made payment 0.5 and 1-ETB. The study found that the amount of payment was not adequate for operation and maintenance costs.

Furthermore, majority 63(57.3%) and considerable number 28(32.3%) of the respondents reported that service fee collected were used for salary of guard and minor repair respectively.

From the above finding it can be concluded that even though there were existence of users' fee contribution, it was inadequate to cover the operation and maintenance costs and one of financial factor for the poor performance of water supply handpump schemes.

Table 14: Frequency distribution of service fee money from users meant for

Type of HP scheme	Purpose of fee	Responses	
		Frequency	%
HDW	Minor repair	17	39.5
	Salary of guard	25	58.1
	Cost of technician	1	2.3
	Total	43	100.0
MDSW	Minor repair	11	20.4
	Salary of guard	38	70.4
	Cost of technician	1	1.9
	Major repair	4	7.4
	Total	54	100.0

Source: Household survey, 2010

B. Ability and Willingness to Pay

In order for the communities to meet the costs of operation and maintenance; beneficiaries must be willing and able to pay for the service. This is why the survey is recommended before the project started to determine the community capacity and willingness to pay.

As the result table (15) shows, 42(43.75%) of the respondents indicated that they are willing to pay 1-ETB per month per household, 31(32.3%) households respondents reported 2-ETB and 11(11.5%) are willing to pay 3-ETB per month per household. Thus, the surveyed households are able and willing to pay more than what they are paying now if the service is continuous and performing better. Similarly the data collected from FGD confirmed that majority of users water supply handpump schemes are capable and willing of paying for the service.

From the above finding, it can be concluded that the majority have the capacity to pay for the service. Therefore, it is not the main problem for the poor performance handpump schemes in the study area. This results support the finding of the study done in Malawi where the communities were willing to make significant payment for the water service. And Bernberger (2000:118) indicated that willingness to pay a better quality and reliability water supply.

Table 15: Amount users' willingness and ability to pay for the water supply service

(Per HH/month)

Issues	Amount in birr	Frequency	%
Users willingness and ability to pay for water supply service	0.5-birr	7	7.3
	1-birr	42	43.75
	1.5-birr	4	4.2
	2-birr	31	32.3
	3-birr	11	11.5
	Greater than 3-birr	1	1.0
	Total	96	100.0

Source: Household survey, 2010

C. Financial Management System

From the review of related literature, financial management deficiency is one of the obstacles for the smooth functioning of water points. It is needless to say that the money collected should be managed properly and utilized for the purpose it was collected for. In view of the above financial management body and capacity in the study area were assessed and the results are presented as follow.

As table (16) shows, out of all respondents 79(82.3%) said that water committee manages the water fee collected from users. The same response has been obtained from community KII and FGD with water committees.

Furthermore, financial management requires honesty and capacity to properly manage the users' money collected. Sample households were asked the capacity of financial management. As a result indicated from the same table among 96 respondents 52(54.4%) reported that the scheme managers has capacity to manage the money collected from the users and considerable number 44(45.8%) of respondents indicated that the scheme managers do not have capacity to manage the money collected from users.

The data collected from community FGD participants' confirmed that water committees of water points at Moderno (HDW & MDSW) and Chidem (HDW) beneficiaries show confidence on the competence of the committee, who were able to manage properly. But committees of other water points are not competence to manage the schemes.

On the basis of these findings it can be concluded that financial management capacity by community is major treat for better performance of rural water supply in the rural areas of Debatie Woreda.

Table 16: Percentage distribution of financial management situation of handpumps

Issues	Responses	Frequency	%
The capacity of water committee to manage the finance	Capable	52	54.2
	Not capable	44	45.8
	Total	96	100.0
Collected fee management responsibility	Community	79	82.3
	Others/guard	17	17.7
	Total	96	100.0

Source: Household survey, 2010

4.3.3 Technical Related Factors

As indicated in the literature review, technical related to the performance of rural water supply handpump schemes are technology/type of scheme choice, availability of spare parts, operation and maintenance skill, and design and construction quality are the most important factors affect the performance of the handpump schemes.

A. Technology/Scheme Type Selection

Use of appropriate technologies means low cost, easy to maintain, simple to use and readily available is one of the factor affect the performance of water supply schemes. Appropriate technology is an integral to the concept of VL0M. The community should also play in selection of the technology/scheme type to fit the context.

A technology is considered suitable if it is socially acceptable, economically affordable and environmentally sound. Thus, user communities should have a say in technology choice and technology choice should be simple at community level.

Accordingly, the nature of water supply technology choice and who selected the existing schemes were assessed and the result are presented as follow, As can be seen from the figure below (3), Almost all respondents of household survey indicated the community members didn't have say in the scheme type selection they are using. Similarly, Majorities 90(93.75%)

household respondents reported that the existing water supply scheme type or technologies were selected by implementing agencies (Government and NGOs).

B. Baseline Survey for Suitable Scheme Selection

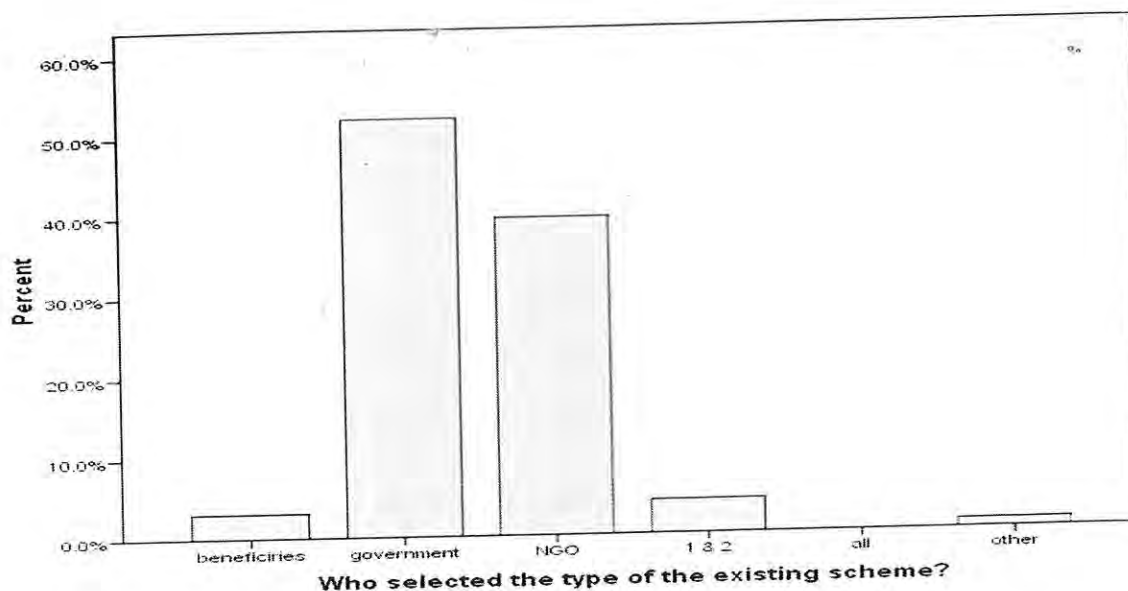
As far as baseline survey for suitable scheme type selection are concerned, inputs of experienced expertise of hydrogeology, geophysics, hydraulic engineering, development planning and sociology are vital in the course of water resource potential assessment, well site selection, and depth to ground water and to choose the right hand pump option. If assessments such as, ground water resource and depth to ground water is not well identified, the result mostly would be dry wells and thereby poor performing or unsustainable schemes (Sebsibe Alemneh 2002,18).

As a result large percentages 66(68.8%) of the respondents said that the preliminary base line studies were not conducted to develop the existing water supply handpump schemes. The result supports the study of many literatures that indicate communities were not consulted in the choice of technology and base line study to choice appropriate scheme type to be developed and installed for its suitability to use at their village. Similarly, KII participants at Woreda water desk indicated that there is no preliminary baseline study at hand that shows possible water points suitable to each village to intervene appropriate schemes and there was no trend of preliminary water point location in the Woreda that lead the poor performance of developed handpump scheme.

Besides, At the time of survey, selection of scheme type based on the suitability of Handpump scheme for all villages of the Woreda were also asked the KII at zonal and regional levels, they were reported that MDSW scheme is suitable for all formation with more for those villages geological formation difficult to dig the rock/soil formation by human and for those villages have large number of population but required more instructional structure and supports for the maintenance and rehabilitation while HDW are suitable for villages with soft ground formations and shallow ground water depth due to cost, more participatory and simplicity of the schemes to use at community level.

Based on the above finding it can be concluded that community involvement in the water supply scheme type selection were weak and there was no water points baseline study master plan for each villages in the Woreda. These are main factors affect the performance of water supply schemes.

Figure 3: Nature of stockholder involvement in technology/type of scheme selection



Source: Household survey, 2010

C. Operation and Maintenance Problems

Better performance of rural water supply handpump schemes cannot be fully realized if communities are not able to operate and maintain their own water supply facilities. This is because operating and maintaining water supply schemes in day to day basis ensures the continuous work of the scheme for its design period. Hence, effective operation and maintenance of handpump water supply schemes by the community is important to the better performance of schemes and as the result the community utilized continuously the benefit of rural water supply schemes.

The researcher observed that during field survey, the non functionality of the SW schemes were pump failure due to lack of trained technician equipped with proper toolkits and spare parts to carry out the maintenance and poor head work construction in Kebelsuk and Modermo01 Gotes (see figure 4 below).

Figure 4: Lack of technician & spare parts to carry out maintenance and poor head work construction problem, Kebelsuk Gote, Berber kebele (MDSW)



Source: Field observation, 2010

With the above in mind, the existence of local technician to operate and maintain their water supply schemes were assessed. As table 17 shows the large percentage (60.4%) of the respondents reported that there are no local technician that maintain and repair when schemes get failed to provide the service while (39.6%) of the respondents replied the existence local technician for operation and maintenance of water supply facilities. The study also further looked at whether local technician have been actually maintaining the technical failures of the schemes or not the household served indicated, all respondents reported that local technician did not repair and maintain any failure of the water supply schemes.

Further more, the capacity of the community to operate and maintain the water supply handpump schemes were assessed As a result, 54(56.2%) of the respondents replied the handpump schemes developed are simple to operate and maintain while considerable number 42(43.8%) of respondents said they do not have the ability to handle and maintain water supply schemes due to absence of well trained technicians at community level.

Similarly, KII respondents from the water supply implementing agencies indicated that two technicians were trained from each community but their support and achievement are not

encouraging as trained technician as a result the community seeking external support even for minor technical failures. This is because, as the information collected from FGD participants reported that the training given to local technician didn't adequately prepared and enabled them to carry out effective operation and maintenance and the technicians did not aware the users to operate properly the water supply scheme.

From the above finding, it can be concluded that majority of the communities in Debatie *Woreda* do not have awareness and ability to operate and maintain water supply schemes properly due to lack of trained local technical and follow up from the external bodies which is factor for poor performance of majority of handpump schemes in the Debatie *Woreda* rural areas.

Table 17: Situation of community involvement in O & M

Issues	Responses	Frequency	%
Existence local technician for O & M work	Exist	38	39.6
	Not exist	58	60.4
	Total	96	100.0
Simplicity of HP scheme to operate and suitable to use	Simple	54	56.2
	Not simple	42	43.8
	Total	96	100.0
Is the training on water supply scheme O & M given to the committee?	Yes	71	74.0
	No	25	26.0
	Total	96	100.0

Source: Household survey, 2010

D. Availability of Tools and Spare Parts

Handpumps are mechanical pumps needed to move in order to give water and they are subjected to breakdown. Specially, parts such as seals and rods are frequently broken. Therefore, availability of tools and spare parts is very important to ensure better performance of rural water supply schemes.

In assessing whether the local technician equipped with toolkits or not, all respondents of households who were reported the existence of technician in their village, said the technician did not equip with the tool kits. Similarly KII from WWD office and FGD participant from the community indicated that lack of toolkit at community level contributed for difficulty to community to repair water supply handpumps.

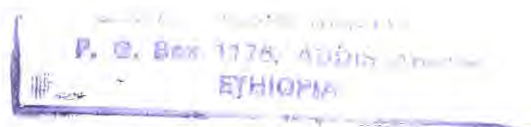
With regard to the availability, accessibility and affordability of spare parts by community were assessed, As can be seen from table (18), majority 81(84.4%) and 88(91.7%) household respondents reported that spare parts are not available and affordable at community level when needed respectively, while remaining 15(15.6%) and 8(8.3%) respondents replied that existence of access of spare parts and get from the government water sector.

Based on these findings it can be concluded that, unavailability of spare parts at community level is major problem and threat for the performance of rural water supply handpump schemes. This finding contradicts with the study result of Musonda (2004:127) found that availability of spare parts is not a major problem for the performance of rural water supply schemes in Zambia.

Table 18: Percentage distribution of Community access to spare parts

Issues	Response	Frequency	%
Affordability of spare parts at Community level when needed	Affordable	15	15.6
	Not affordable	81	84.4
	Total	96	100.0
Available & accessible of spare parts at community level	Available	8	8.3
	Not available	88	91.7
	Total	96	100.0

Source: Household survey, 2010



E. Construction Quality of Handpump Schemes

As indicated in the review of the related literature, quality of construction is one of the technical elements which affect the performance of rural water supply handpump schemes. This element comprises proper sitting of wells, proper well drilling and completion and proper construction of head/top part of the pump. Even though, the issue is too technical and beyond the capacity of community to assess the complete construction quality; where as households were asked on the over all construction quality of water supply schemes. In addition well completion reports are needed to evaluate the work done by contractor or implementing agencies, unfortunately there is no documented report that shows the construction history of wells, as a result, in this study, the surveyed households asked how they evaluate the construction quality of handpump schemes.

As can be seen from the table below, 40 (41.7%) and 31(32.3%) of the respondents evaluated the construction quality as not good and good respectively, while 25(26%) respondents evaluated their water supply facilities construction as very good. FGD participants from Mdermo-02(MDSW), Dugumsefer (HDW) non functional schemes and Chidem (HDW) semi-functional schemes *Gotes* also reported that they were not happy with the work done and construction quality of their water supply was poor. Similarly KII respondents indicated that they were not satisfied with the depth excavated; it was very shallow and hence adequate ground water was not tapped for HDW schemes construction by the local artisan/contractor and the poor head work which get leaked and contaminated the water in the well. In addition, SW scheme constructed at Modermo 02 *Got*, the community were not happy with the construction made after the well drilled and completed by drilling machine. At the time the well were developed sufficient water were pumped out, at that time we were happy, but the construction made during pump installation and head work were not good and when the contractor handover it to us there were difficulty / problem to pump up the water and they told us it will easier after you pump it for two or three days. But this is not the case after we pump it for two years with this difficulty installed pedestal pump fall down and now non functional.

Further more, the data collected through field observation by the researcher showed that the construction quality of majority of the HDW handpump schemes visited were poor. The

observed construction problems are depth problem, developed very close to rivers/stream/contamination, leaking of slab of the flat head and improper manhole construction for HDWs and pump handling short and not suitable to pump or poor head work design and construction for MDSWs. Besides, the chi-square test shows there is significant difference between handpump schemes and the construction quality at $P < 0.01$.

Hence, from the above finding it can be concluded that poor construction is one of the main problem for poor performance of rural water supply handpump schemes and MDSWs scheme construction is relatively better than HDWs in the rural areas of Debatie *Woreda*.

Table 19: Households Evaluation of WSSs construction qualities

Issues	Responses	Type of HP scheme			
		HDW		MDSW	
		Frequency	%	Frequency	%
Evaluation of the construction Quality of the water supply scheme	Excellent	0	0	3	5.7
	Very good	4	9.3	18	34.0
	Good	12	27.9	19	35.8
	Not good	27	62.8	13	24.5
	Total	43	100.0	53	100.0

Chi-square test= 17.538*, Significant at $P < 0.01$

Source: Household survey, 2010

Figure 5: Non-functional scheme, Problem of depth and with out fence for HDW, Dugmasefer *Gote*, Berber *kebele*



Source: Field observation, 2010

4.2.4 Institutional Related Problems

There is a great need to provide technical and managerial support by water implementing agencies to the rural communities specially, from the Woreda and regional water sector to ensure the better performance and continued the use of water supply scheme developed. For this reason the institutional set up and organizational arrangements are central issues for the performance of water supply facilities (Davis et al., 1993).

In order to provide proper and timely support to rural communities, it is important to build adequate capacity at all level with special emphasis at the local government level.

In the view of the above, WWD capacity and nature of institutional arrangement and support provided to the community in the study area were assessed and the results are presented below.

A. Institutional Capacity of Woreda Water Desk

As discussed in the literature review, the institutional capacity is a critical factor in the rural water supply sector and influenced particularly by the organizational framework and the quality of staff in human resource, office structure and adequate budgets to carry out its mandates.

In relation to this, the study has investigated the organizational capacity of Woreda water desk, which is responsible for water supply facility development and management in the *Woreda*.

As of decentralization in the water sector are concerned, power and responsibility to develop and manage the water points have been given to the Woreda. The water sector in the Woreda level is Desk which is under Agriculture and rural development office and it has no power to share and utilized the resources with full capacity and to address the institutional objectives. This is important factor that affect the local institutional capacity to support fully the rural community water supply scheme performance problems in *Debatie Woreda*.

i. The WWD Human Resources

Man power is the most important resources that coordinate all other resources towards the achievement of organization objectives. Accordingly, water supply projects continuous utilization of the benefit by the community comes as a result peoples of required number, qualification and experiences at different level particularly at local Woreda water desk level. The information collected from KII the head of Woreda water desk indicated that the existing organization structure is not good to accommodate all the required human resources so that it is difficult to achieve the objectives.

As a result the study found that at WWD there are one desk head, 3- technical school 10+3 in water supply and sanitation and 1-certificate in electromechanical. This shows that the human resource at Woreda level is not efficient to achieve the objectives of the water sector. Similarly, Woreda water desk head replied that one of the major problems in the water desk was lack of required personnel due to budget constraints and desk set up.

From this findings it can be concluded that weak desk level structure and budget constraint are causes for weak human resources capacity of the Woreda water desk to provide support to community in management of water supply schemes.

ii. Material and Financial Resource Capacity

In addition to human resources, material and financial resources are also critically important to discharges their responsibility for the WWD properly.

As far as material resources of the Woreda water desk are concerned, the desk has got only one Motor cycle as transportation facility that is used by share with other desk including Agricultural and rural development head to under take the activities of every section and the water desk equipped with chairs, one computer, copy machine provided a year ago by Finn-WASH BG program which is the only active NGO in the Woreda. Besides, toolkits required to carry out O & M were not available in sufficient quantity in the *Woreda*.

With regard to the financial resources, the trend of budget allocation in the Woreda was investigated for the last three years. Almost large amount of money is allocated for salary, which indicated that, no differences in the challenges of the sector.

Capital budget was not allocated for the most of the years and the recurrent budget were almost similar for the last three years some of the reasons are, Water desk is under Agricultural development office so that lack attention to allocate proper finance, It was also assumed that NGOs like CEPAR before two years ago and Finn WASH-BG program started one years ago were expected to look into the problem of water supply schemes. Similarly the KII and FGD participants of Woreda water desk members argue that even though the government gives attention to universal access of water supply, no enough power and resource is given to the lower levels.

Based on the above, the research found that Debatie Woreda water resource development desk has limited institutional capacity to undertake all its activities to achieve the objectives of the rural water sectors. Hence, the Desk was unable to provide the necessary supports to

the community in the operation and maintenance of water supply handpump schemes which are experiencing poor performance and non functionality in the rural areas of the *Woreda*.

Table 20: Allocated budget to the WWD, 2000-2002

Year (E.C)	Allocated budget in ETB			
	Total budget	Capital	Recurrent	
			Salary	Running
2000	52,113.36	Not allocated	37,113.36(71.2%)	15,000(28.8%)
2001	63,427.12	Not allocated	47,075.12(74.2%)	16,352(25.8%)
2002	166,833.87	86,350.00(51.8%)	63,249.87(37.9%)	17,234(10.3%)

Source: Debatie Woreda WRD, 2010

B. Institutional Support for Community Management

It has been realized that although community can take the significant share of responsibility, external support services are still required. Therefore, one way of enhancing the performance of rural water supply schemes is the provision of institutional support to community management bodies by government staffs or NGOs and also problems that are beyond community level need to be addressed by supporting agencies.

For the community to manage effectively and ensure the performance of the system the problem that hinder need to be identified in ordered to promote sense of ownership and responsibility by the community to minimize dependence on external support. Those supports may include providing adequate training on the system over all administration, financial management, operational and maintenance technique and procedures and carry out those it, ensuring availability of spare parts and equipped with toolkits.

As the result the study showed, majority 91(94.8%) respondents of the household survey reported that the external support service given to the community from both government and NGOs to the effective manage their water systems were inadequate.

Participants of FGD who represented water committee at Modermo 02, Kebelesuk and Dugumasefer *Gotes* (non-functional water supply schemes) explained emotionally that frequently they request for support of scheme maintenance which is beyond their technical and financial capacity were not react timely on part of the Woreda water desk as a result their facilities were not providing the service for extended long time. Besides, participants of FGD were also complaining on the implementing agencies for their absence in ensuring availability of spare parts and their close follow up and monitoring situation of the schemes.

Key informants from the governmental officials also argue that support to rural communities in managing water supply schemes but there are resource limitations and NGOs didn't refresh water committees and they are absent once they handed over to the communities.

The data collected through personal observation also evidenced the weak and inadequate support given from external agencies. For example, non-functional MDSWs at Modermo 02 and Kebelesuk *Gotes* have technical problem which is beyond community capacity.

Based on the above finding it can be concluded that the institutional support service to communities in rural water supply of the Debatie *Woreda* rural setting was inadequate. Which is the major cause that influence the performance of rural water supply handpump schemes

4.2.5 Environmental Related Problems

The yield water supply schemes in the Woreda were low to medium due to the nature of geological formation, less rainfall distribution and hot temperature of the area. But if the water recharge areas are protected and used properly the water resources are enough. The yield of the water supply handpumps has to be proportional to the number of beneficiaries and this is important issue for the performance and service reliability of water supply schemes.

Majority of household respondents reported that Inadequacy of water in the community is the result of seasonal variation, population growth, and the non functionality. Consequently, the pressure on the scheme will be increased and the performance threatened.

Participants of FGD from the water committee and KII from the Woreda indicated that majority of the water supply schemes in the community are inadequate due to increase in the number of beneficiaries, shortage of water during dry season, inadequate depth excavation/drilling and pump failure.

As far as water quality is concerned, water quality is typical environmental factor and indicator of scheme performance. Similarly household respondents indicated that Water quality problem is the result of physical water quality problems like contamination by external leaked organisms, turbidity due over pump and taste of water from the scheme.

Participants of FGD from the water committee and KII from the Woreda indicated that there is problem of bacteria contamination in some of water wells, test and turbidity problems. This is due to leakage through cracks of scheme and over pump of low yield wells.

From the above finding it can be concluded that there were inadequacy of water from the water supply handpump schemes due to population pressure, shortage of water at dry season and inadequate depth excavation and non functionality of the schemes. Besides, there were water quality problem due to contamination by external leaked tiny organisms; turbidity and taste are observed from some of the schemes as water quality problems.

4.4. Comparative Analysis on the Performance of the Handpump Schemes

In this part a comparative analysis of the performance of schemes results are presented and analyzed. The comparative analysis is based on the performance indicators and on finding/established facts presented and analyzed in the previous sections. To this end some of factors affecting the performance of schemes are used for the two types of schemes. Besides, qualitative data collected from the beneficiaries as well as from concerned key informants was employed to substantiate the interpretation of the findings.

Moreover, the relevant secondary data is also used in times needed to facilitate the comparison. In order to look at significant differences and similarly in relation to schemes performance in the study Woreda; data were gathered from HHs, FGDs ,KII and direct observation on factors and indicators of the scheme performance were used to compare and analysis the result of this study.

Factors and indicators to the performance of rural water supply handpump schemes; such as simplicity, functionality, consistency, adequacy, quality, major technical problem and institutional support with respect to handpump scheme type will be analyzed using cross tabulation & chi-square tests and presented as follow.

A. Functionality with Respect to Water Supply HP Schemes

Rural water supply schemes are functional when they provide the service delivery to the beneficiaries but if not, non functional. As far as the type of handpump schemes with respect to scheme functionality concerned, the following result were obtained from the sample schemes household survey.

As one can see from the table (21), out of the 50 respondents reported that their handpump schemes were functional, 32(64.0%) said HDWs and 18(36.0%) replied MDSWs at the time of survey. But the contribution of the functionality within scheme types for overall handpump scheme are 74.4% and 34.0% respectively.

It can be also indicated from the same table that among 46 respondents reported their handpump schemes were non functional, 11(23.9%) reported HDWs and 35(76.1%) said MDSWs at the time of survey. But the contribution of the schemes non-functionality within overall scheme type is 25.6% and 66% respectively. This is due to MDSW schemes are difficult to maintain by the communities, require well skilled technician and institutionalized structure that repair the failure of schemes to provide the service in the study area.

Similarly, FGD and KII participants from the communities and the WWDD also confirmed that HDWs are relatively in the state of functional for long time than MDSWs but most of HDWs dried during dry peak seasons of the year. Besides, MDSWs are better performing at the time of they were functional but when they failed to provide the service due to their difficulty to maintain by beneficiaries contributed to the schemes to stayed for long time in the state of non functional.

Besides, the statistical test (chi-square=15.569*) shows, there is association and dependence between scheme type and functionality with probability level $P < 0.01$.

From the above finding we can concluded that HDW handpump schemes were relatively more functional with low yield than MDSWs in the Debatie *Woreda* rural settings.

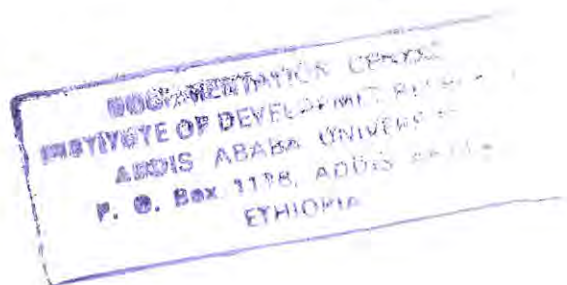


Table 21: Type of handpump scheme with respective scheme functionality Cross tab

Issues	Responses		Type of HP scheme		Total
			HDW	MDSW	
Is the scheme functioning?	Yes	Count	32	18	50
		% within the scheme functioning	64.0%	36.0%	100.0%
		% within Type of HPs	74.4%	34.0%	52.1%
		% of Total	33.3%	18.8%	52.1%
	No	Count	11	35	46
		% within the scheme functioning	23.9%	76.1%	100.0%
		% within Type of HPs	25.6%	66.0%	47.9%
		% of Total	11.5%	36.5%	47.9%
Total	Count	43	53	96	
	% within the scheme functioning	44.8%	55.2%	100.0%	
	% within Type of HPs	100.0%	100.0%	100.0%	
	% of Total	44.8%	55.2%	100.0%	

Chi square= 15.569, Significant at P<0.01(cross tabulation)*

Source: Household survey, 2010

B. Water Supply HP Scheme Simplicity to Operate and Suitability to Use

As it was discussed in the review of related literature, rural water supply handpump schemes were developed and installed in the rural areas because it was assumed that users themselves would be able to operate and maintain them.

With this in mind respondents were asked to know the simplicity of the scheme at village level. As it can be seen from the table (22), the schemes type with respect to simplicity of handpump to operate and simple to use were concerned, out of the total household surveyed 54 respondents reported that 41(75.9%) HDWs and 13(24.1%) MDSWs were simple and suitable to use and operate. While among 42 respondents said 2(4.8%) HDWs and 40(95.2%) MDSWs were not simple to operate and use. Besides, the statistical test shows, there is association and dependence between scheme type and simplicity with probability level $P<0.01$.

FGD participant of water committee and KII at Woreda water desk also confirmed that HDWs are relatively simpler than SWs to operate and use at community level.

On the basis of the above finding we can concluded that hand dug well scheme are relatively simpler to operate and suitable to use at community level in the rural areas of Debatie *Woreda* that lead to the community easily to operate and manage the scheme to ensure the better performance of water supply schemes.

Table 22: Simplicity of handpump scheme to operate and suitable to use

Issues	Type of HP scheme	Responses	Frequency	%
Simplify of HP scheme to operate and suitability to use	HDW	Simple	41	95.3
		Not Simple	2	4.7
		Total	43	100.0
	MDSW	Simple	13	24.5
		Not Simple	40	75.5
		Total	53	100.0

Chi square= 48.383, Significant at P<0.01(cross tabulation)*

Source: Household survey, 2010

C. Problems to Non Functionality of HP Water Supply Schemes

The problems to the non functionality of rural water supply handpumps schemes were discussed in the previous sections. In this section the main problems of the water supply handpump schemes are presented and discussed as follow. As far as the non functionality of the water supply handpump schemes are concerned, respondent households were asked to know which main problems for the non functionality of the two types of schemes experienced.

As the table below shows, out of total HDW beneficiaries 15(34.9%) and 20(46.5%) were reported the problem as depth problem/seasonality and problem of how to operate and manage the scheme respectively and the remaining 7(16.3%) and 1(2.3%) are problem of water quality and pump failure respectively.

With regard to the beneficiaries of MDSW, large percent 32(60.4%) of the respondents reported that the problem for the non functionality of schemes was pump failure specially the inside parts like foot valve and rod joints and 21(39.6%) replied that problem of how to operate and manage the scheme. Similarly FGD participants of water committee and selected women groups reported that the non functionality of handpump schemes were mainly due to depth problem and problem of community to operate and use for HDW and pump failure that is beyond the community level and problem of to operate and manage the schemes for MDSW.

Based on the above finding it can be concluded that main problems for the non functionality of rural water supply handpump schemes were pump failure, depth problem and problems of how to operate and manage the scheme by the community.

Table 23: The main problems for the non functionality of different HP schemes

Type of scheme	Responses/problems	Frequency	%
HDW	Pump failure	1	2.3
	Depth problem/Seasonality	15	34.9
	Water quality problem	7	16.3
	Problems of how to operate and manage the scheme	20	46.5
	Total	43	100.0
MDSW	Pump failure	32	60.4
	Problems of how to operate and manage the scheme	21	39.6
	Total	53	100.0

Source: Household survey, 2010

D: Consistency of Service Delivery of Water Supply HP Schemes

Consistency of service delivery of water supply points is one of the indicators of the performance of water supply schemes. Almost all the water supply handpump schemes found in the Woreda are not deliver the service consistently to the communities as presented below.

As indicated in the table (24) below, 27(62.8%) respondents of HDWs scheme user reported as the service delivery of the scheme are inconsistent while the remaining 16(37.3%) respondent replied as the delivery of scheme is consistence and reliable. But household respondents of MDSWs beneficiaries were also asked on the consistence delivery of the scheme they are using. As the table below showed, 35(66.0%) of the respondents of SWs users indicated service delivery of the water supply schemes are weak while 18(34%) of household surveyed reported that the service delivery was consistence. Besides, chi square tests showed there is no significant association between the handpump schemes and consistency of the service delivery of the scheme. As a result majority 66% of MDSWs and 62.8% of HDWs of respondents reported that schemes consistency in service delivery service is weak; this indicates HDWs are less significantly consistence than MDSWs handpump schemes.

Participants of FGD at community and Woreda levels reported that at the time of functional SWs are more reliable and consistence than HDWs but because of pump failure and weak maintenance MDSWs by the Woreda water desk which is beyond the capacity of the community that results inconsistency of MDSW schemes and seasonality of water supply for HDW schemes due to depth problem to provide service consistently. Besides, KII participants at Woreda water desk and regional water resource bureau reported that the problem inconsistencies of handpump schemes are mainly the technical and environmental related i.e. pump failure which is beyond community that lead the MDSW in the state of non functional is the problem for inconsistency of the scheme while the seasonality (drying at the dry peak seasons of years) of water supply due to depth problem for HDWs.

From the above finding it can be concluded that at the time of survey majority of the schemes are inconsistently providing the service and both of the handpump schemes insignificantly

associated. But at the time of functional, MDSWs are more reliable and consistence than HDWs schemes.

Table 24: The consistency of service delivery with respect to HP water supply schemes

Issue	Type of HP scheme	Responses	Frequency	%
Consistency of service delivery and reliability	HDW	Very good	6	14.0
		Good	10	23.3
		Weak	27	62.8
		Total	43	100.0
	MDSW	Very good	5	9.5
		Good	13	24.5
		Weak	35	66.0
		Total	53	100.0

Chi square test=1.318, Not Significant (cross tabulation)

Source: Household survey, 2010

E. Adequacy of Water Supply Handpump Schemes

Adequacy of water from the scheme is one of the indicator of the performance of water supply schemes and it is measured at the community level by the yield of water supply handpump schemes proportionality or more with the number of beneficiaries.

With this in mind respondents were asked on the adequacy of handpump schemes that they are using. As following table (25) shows, out of the total HDW users 29(67.4%) and 11(25.6%) of the respondents replied that the quantity of water from the HDWs scheme was weak and good respectively. while out of 53 households benefiting MDSWs 42(79.2%) and 5(9.4%) of the respondents reported that the adequacy of water from the scheme were good and weak respectively. FGD and KII participants also support this idea that MDSW handpump schemes adequacy is better than HDW schemes due to its deeper ground water sources. Besides, the statistical chi-square test shows, there is association and differences between scheme type and adequacy with probability level $P < 0.05$.

Based on the above finding it can be concluded that of MDSW handpump scheme is relatively more adequate in the amount of water supply than HDW schemes.

Table 25: Adequacy of water with respect to the type of HP scheme

Issue	Type of HP scheme	Responses	Frequency	%
Adequacy of water from the scheme	HDW	Very good	3	7.0
		Good	11	25.6
		Weak	29	67.4
		Total	43	100.0
	MDSW	Very good	6	11.3
		Good	42	79.2
		Weak	5	9.4
		Total	53	100.0

Chi square=30.660, Significant at P<0.01(cross tabulation)*

Source: Household survey, 2010

F. Water Quality with Respect to Water Supply HP Scheme Type

Water quality of the scheme is one of the indicators of the performance of water supply handpump schemes. Water quality problems may be the result of water-rock and soil interaction in the given geological formation and physical water quality by human and animal causes.

Water quality problem experienced by the water supply schemes are bacteria contamination, taste and turbidity of water from the source was observed mainly by HDW scheme beneficiaries.

With regard to water quality problem households were asked whether their water supply has got water quality problem or not. As a result 30(69.8%) of HDWs user respondents reported that there were water quality problem from their water supply scheme like bacterial contamination, bad taste and turbidity while 13(30.2%) of respondents replied no water quality problem in their water supply

But majority 48(90.5%) of MDSW beneficiary household respondents replied that there is no water quality problem in their water supply schemes while the remaining 5(9.5%) of respondents reported that there was water quality problem in their water supply schemes like turbidity at the time of over pump. Besides, the statistical chi square test shows, there was association and differences between scheme type and water quality with probability level $P < 0.01$.

Similarly, FGD participants of water committee and selected women groups reported that water quality problem was mainly observed in HDWs schemes and the committees some times add chlorine to disinfect the problem but it was not enough amounts and not continuously supplied by the Woreda water desk to solve the problem of water quality problems.

Based on the above finding it can be concluded that water quality problem was observed and experienced in HDW schemes than MDSW.

Table 26: Water quality with respect to types of water supply HP scheme

Issue	Type of HP scheme	Responses	Frequency	%
Water quality of the scheme	HDW	Very good	2	4.7
		Good	11	25.6
		Weak	30	69.8
		Total	43	100.0
	MDSW	Very good	5	9.4
		Good	43	81.1
		Weak	5	9.4
		Total	53	100.0

Chi square=37.471, Significant at $P < 0.05$ (cross tabulation)*

Source: Household survey, 2010

G. Main Technical Problems with Respect to HP Schemes

The technical problem that handpump schemes encountered in the study area are lack of spare parts, inappropriate scheme type selection, inappropriate design/poor construction quality and Lack of the technical to carry O & M.

With in mind household respondents were asked to know the differences within handpump scheme types and the result presented in the table below (27), 25(55.8%) of HDW and 48(90.6%) of MDSW user respondents were replied that there is lack of spare parts and tools while the remaining 19(44.2%) of HDW and 5(9.4%) of MDSW user reported that it was not the problem of spare parts.

Considerable number 13(30.2%) HDW beneficiaries indicated that inappropriate scheme type selection is a problem for the failure of water supply in the study area while the rest reported as the selected scheme were appropriate. And 23(53.5%) of HDW and 9(17%) of MDSW user respondents replied poor construction quality is the technical problem for the failure of the performance of water supply schemes while 21(46.5%) and 44(83%) respondents indicated that the construction quality were good respectively. And also 13(30.2%) of HDW and 35(66%) of MDSW respondents reported the lack of technical to carry out O & M were the main technical problem experienced while 30(69.8%) and 18(34%) were carry out O & M at their village level respectively.

From the above finding it can be concluded that lack of spare parts and tool and lack of the technician to carry O & M are main technical problem encountered by the MDSW users while HDW beneficiaries experienced in all of the technical problems listed.

Table 27: Differences in technical problems for water supply handpump schemes

Technical problems	Responses	Type of HP scheme			
		HDW		MDSW	
		Frequency	%	Frequency	%
Lack of spare parts and tools	Yes	24	55.8	48	90.6
	No	19	44.2	5	9.4
	Total	43	100.0	53	100.0
Inappropriate scheme type selection	Yes	13	30.2	1	1.9
	No	30	69.8	52	98.1
	Total	43	100.0	53	100.0
Inappropriate design/poor construction quality	Yes	23	53.5	9	17
	No	21	46.5	44	83
	Total	43	100.0	53	100.0
Lack of the technical to carry O & M	Yes	13	30.2	35	66
	No	30	69.8	18	34
	Total	43	100.0	53	100.0

Source: Household survey, 2010

H. External Support Requirement of HP Schemes

The requirement of external support is very essential for the better performance of rural water supply schemes. As the result the requirement of external support for water supply schemes were asked the household respondents. As the table below shows, majority 32(74.4%) of HDW users and 41(77.4%) of MDSW users indicated MDSW require external support than HDW due to difficulty of the schemes to maintain at community level and require trained technician to carry out O & M while the remaining replied HDW schemes.

Similarly, KII respondent from Woreda Water desk said that there was difficulty at community level to maintain MDSWs when they get failed and their spare parts are not available at community level. In addition for rehabilitation it requires developing machinery not available and found at community level which is impossible by human labor.

The data collected from FGD participants at community levels indicated that at the time MDSWs failed to provide the service, communities tried to maintain the failure of scheme but they didn't make it due to difficulty for them.

From the above finding it can be concluded that MDSW handpump schemes required more external support than HDW schemes.

Table 28: Requirement of external support with respect to handpump scheme type

Issue	Users of	Responses	Frequency	%
Type of the HP scheme often requires Support from the external water agencies	HDW	HDW	11	25.6
		MDSW	32	74.4
		Total	43	100.0
	MDSW	HDW	12	22.6
		MDSW	41	77.4
		Total	53	100.0

Source: Household survey, 2010

From the above finding of the comparative performance analysis between HDW and MDSW handpump schemes it can be concluded that HDWs are easy to maintain and operate by the community, only possible in soft ground formation, low cost for development and maintenance but due to shallow depth and poor construction quality they are subjected to contamination and falling of water table in the dry season while MDSWs are tap water from depth as a result not subjected to contamination and falling of water table in the dry season, developed in all ground formation with higher yield but the maintenance of scheme failure is difficult at community level and require external support of trained technician and materials.

4.5 Measures to be taken to Ensure Better Performance of Rural Water Supply Schemes

Respondents of household surveyed, FGD and KII were asked to recommend possible solution to ensure better performance of rural water supply HP schemes in the study area.

The major findings of the study are summarized as follow:

- Ensuring community demand for the improved service.
- Involving user community including women in all phases of water supply development and management
- Building the capacity of water committee and community
- Promote and ensure users contribution of money to share construction and cost of O & M
- Community involvement in selecting the technology to be developed and installed
- Selecting appropriate and suitable handpump scheme type for each village before intervention/master plan shows feasibility study for each village.
- Selecting appropriate design, competent contractor, and professional supervision to ensure construction quality.
- Assigning trained water technicians at kebele level
- Ensuring availability of spare parts at Woreda and community level
- Keeping scheme fence and clean at all time
- Allocating the required budget, transport system to WWD and strengthen WWD to WWDO / build capacity of the WWD
- Providing regular support from implementing agencies to the problem that are beyond the capacity of communities.
- Since there are pressures on the water supply schemes the implementing agencies should develop/improve additional and suitable (majority of the community recommend SWs) scheme type which serves adequately and consistently for the communities in the Woreda.
- Select and develop HDWs at the places easy to dig by hand /soft ground formation drill/excavate with proper depth for small villages and construct properly to ensure the better performance of the scheme while MDSWs at places of all and/or hard ground formations and for relatively more populated villages provided that ensure and assign trained technician and spare parts available.

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The assessment of this study was on the relative performance of water supply handpump schemes, focused on the existing water supply situation, the main factors affects the performance of water supply schemes and the comparative analysis of the performance based on the indictors and main factors affecting of the water supply schemes. Based on the findings of the study, it can be concluded as follows.

A. Existing Water Supply Situation

The study found that the amount of water consumption per capita is about 9.6 liters which is less than the standard guide line of WHO and MoWR universal access program target value at least 20 liters and 15 liters per capita per day in that order.

Besides, the finding of the research study revealed that the traditional sources are the main sources of drinking water and developed water supply schemes either are not providing the service at all level or providing service with frequent interruption and low yield which clearly shows that the poor performance and non functionality of water supply schemes are the major problems of the rural settings of Debatie *Woreda*.

B. Factors Affecting of the Performance of Water Supply Schemes

As the community factors are concerned; the community played role in demanding for the improved water supply schemes. But there was lack of community participation during planning stages and less participation during post management, low level of women involvement even though, they are the prime collector of water from the water supply schemes, limited water committee capacity and weak or no sense of ownerships are found to be community factors affecting the performance and functionality of rural water supply handpump schemes in the Debatie *Woreda*.

The water committees are not performing adequately in managing their water supply handpump schemes, they lack interest, commitment, didn't mobilize the community adequately and didn't fence the schemes properly. Further more, study found that water committee didn't capacitated by implementing agencies to discharge their duties and responsibilities properly.

With regard to financial factor the study found that capital costs for rural water supply are fully covered by water implementing agency which is the major constraint in achieving the goals of safe water supply with proper performance for their designed life even though there exists a practice of users contribution for O & M, majority of the beneficiaries didn't pay regularly this implies regular contribution of financing mechanism for O & M are not established yet in the community in the study area.

However, the respondents support existence of regular user's fee mechanism provided that the water supply schemes provide the service properly and the committee manages the scheme properly. Besides, majority of users agreed that the current amount of contribution is not adequate to cover costs of O & M and it is encouraging that the user's ability and willingness to pay was to be greater or equal to 1 birr/HHs/month.

Further more, technical factors contributed for the poor performance of water supply are failures to consult and involve the beneficiaries in the technology and scheme type choice, lack of community skill to operate and maintain the handpump schemes properly due to absence of trained technician, unavailability of tools and spare parts either at Woreda level and poor construction quality are found to be the major problems to the better performance of water supply in the Debatie *Woreda*

With regard to the institutional support related problems, the study found that the limited capacity of the Woreda water desk to provide adequate support to the community in the development and management of the water supply and absence of adequate external support after the construction of the scheme for operation and maintenance are the major threat for the continued functioning of rural water supply in the study *Woreda*.

Based on the environmental related problems the study found that inadequacy of water from the water supply handpump schemes due to population pressure, shortage of water at dry season and inadequate depth excavation and non functionality of the schemes and water quality problem due to contamination by external leaked tiny organisms; turbidity and taste are observed from some of the schemes as water quality problems are major factor for the poor performance of the water supply schemes in the Debatie *Woreda*.

C. Comparative Analysis on the Performance of Water Supply Handpump Schemes

Comparing the two handpump schemes by their functionality, it is found that HDWs handpump schemes were relatively more functional than the MDSWs. Besides, the main problems for the non functionality of rural water supply schemes were pump failure, depth problem and problems of how to operate and manage the scheme that is pump failure and problem of how to operate and manage are for MDSWs while depth problem and problem of how to operate and manage the scheme are for HDWs.

As far as simplicity of the schemes are concerned, it is found that Hand dug well scheme are relatively simpler to operate and suitable to use by the community.

With regard to comparing consistency of service delivery majority of both of the handpump schemes are inconsistent and insignificantly associated to deliver the service consistency. But at the time of functional, MDSWs are more reliable and consistence than HDWs schemes.

Based on the adequacy and water quality of the two handpump scheme types are concerned, MDSW handpump scheme is found to be more adequate in the water supply than HDW schemes. Besides, water quality problem was observed and experienced in HDW schemes than MDSW.

Comparing the two type handpump schemes based on the main technical problems it is found that lack of spare parts, tool and trained technician to carry O & M are main technical problem encountered by the MDSW users while HDW experienced; lack of spare parts, tool and inappropriate design/poor construction quality are the technical problems that hinder the performance of the schemes.

Further more, the requirement of the external support are concerned; MDSW handpump schemes required more external support than HDW schemes.

Comparing the handpump schemes performance, HDWs are found to be simpler to use, operate and maintain by the local community, the approach of their development is more participatory, low cost and require local material to develop, suitable for small villages. But the problems experienced and observed were poor excavation/drilling, seasonality, water quality problem, inadequate water supply and only possibility in soft geological formation. While MDSW handpump schemes deliver adequate and quality water from the depth and not easily contaminated by externals but relatively difficult at community level to operate and maintain, require external support in all phases of its development & management with institutionalized approach, require technology to drill and to rehabilitate and require higher costs.

Therefore, the study found that the performances of majority of handpump schemes developed in the Woreda rural areas are weak.

5.2 Recommendation

Although, a lot of efforts have been made so far towards accessing rural communities with clean and safe drinking water supply, most of the rural populations in the study area are not benefited with potable water from the developed water supply schemes due to system failure to provide service as intended and inadequacy of water supply from most of the schemes. The finding of the study clearly indicated that despite a lot of work has been done, the majority of the water supply handpump schemes are non functional and/or functioning with frequent interruption which indicated the weak performance of the water supply systems in the study area. As a result there are more needs and attention should be given to build these weak performances of the schemes. There is a danger that if these weaknesses are not addressed, what has been done and achieved so far in the rural water supply may be lost.

Hence, in this part the researcher recommend the following points to resolve the problems for the weak performance and to guide future interventions of rural water supply handpump schemes in Debatie *Woreda*.

- The implementing agencies should strengthen the community participation. In other words the users of water supply handpump schemes should be involved and aware of the need for the water supply scheme to be developed from the beginning for the facility to be used and maintained properly.
- In order to improve community participation the implementing agencies should done the following from the beginning. Identify the need of community, assess together with community and take in to account their contribution for operation and maintenance, the implementing agency should ensure the community are clear about their role and responsibility and ensure the community leadership with particular emphasis on women in all stage of water supply handpump schemes.
- Building community capacity to manage the water supply system for rural water supply facilities to be managed properly by the community, legalization the water committee, clearly defining their roles and responsibility and providing them with

adequate and practical training on the technical and financial management of the schemes are critically important for the proper performance of the system. Water implementing agency should develop working manual, incentive for the committee members like refresher training, experience sharing from better performing water supply schemes with in and out of the Woreda and jointly reviewing the performance of the water committee helps to enhance their ongoing capacity, motivation and commitment in achieving the better performance of water supply handpump schemes.

- Most of water supply handpump schemes are VLDM. But due to poor participation during development and difficulty to maintain by the community MDSW handpump schemes relatively are not VLDM like HDW. Therefore, adequate training should be given for the community technicians to undertake minor maintenances. Further more, the necessary toolkits should be provided to community technician to work the maintenance when the problem occurred.
- Handpumps are mechanical devices that their parts are subjected to wear through usage for fast wearing parts such as seal and rods. Therefore the spare parts supply chain should be established and available at community and Woreda level.
- According to EWRMP, O & M costs of rural water supply schemes should be covered by user community as the result users should contribute adequate money regularly in order to cover the cost of O & M in this case tariff level should be revised and the financial management through saving in local financial institution should be improved and strengthen.
- The implementing agencies should conduct the preliminary study and selection appropriate scheme type for villages of the Woreda before their implementations. Based on the study MDSW scheme is suitable for all formation with more for those villages geological formation difficult to dig the rock/soil formation by human and for those villages have large number of population but required more instructional structure and adequate supports from external water sector for the maintenance and rehabilitation while HDW are suitable for villages with soft ground formations and

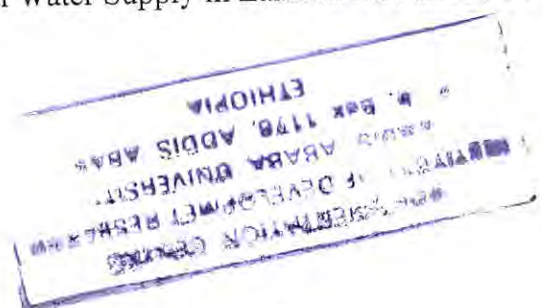
shallow ground water depth. Since, they are low cost, more community participatory during the development and simpler to operate and use by the community.

- Low yield, water quality problem and seasonality of water supply problem has contributed for the poor performance and the non functionality of handpump schemes in the study area occurred due to inadequate excavation/drilling and inappropriate site selection for HDWs handpump schemes while difficulty to maintain for the pump failures and lack of external support has contributed for the non functionality and poor performance of SW. Therefore, the necessary feasibility study should be conducted by the relevant professional with the community participation before the commencement of well excavation and drillings. And also during excavation supervision should be made by the community and appropriate professionals in order to avoid yield deficiency of the well and partial penetration of the ground water aquifer/water bearing zone of HDWs and Spare parts and trained technician should be available to minimize pump failure and external support for MDSWs.
- Institutional capacity of the WWD in term of structure, human power, materials and financial resources should be strengthen through adequate budget allocation for recurrent and capital, purchase logistics and materials and employ experienced and relevant experts to achieve the better performance of the water supply in the rural areas.
- Therefore, due to the insufficiency of water, water quality and depth problem, the implementing agencies should consider during the development of HDWs drilling/excavations done up to the penetration of aquifer, construct the inside of well and head work of scheme properly, select and develop in soft ground formation, protect the surrounding from contaminants and degradation of the recharge area While MDSWs are adequate and good quality of water supply should be developed at places like populated rural areas, in all ground formation and particularly for those formations difficult to drill by human and involve the community in all stages of scheme development; provided that there are institutional supports and trained technician to carry out the O & M when pump failures occurred.

REFERENCES

- Alemu Azmeraw, 2006. An assessment of Community Management of Rural Water Supply Schemes: the case of eight peasant associations in North Gonder Zone, MA thesis CDS, AAU.
- Aklilu Getnet, 2009. Factors Affecting Sustainability of Rural Water Supply Schemes: Bassoliben Woreda Amhara region. MA thesis CDS, AAU.
- Arlosoroft et al., 1987. Handpump Schemes are Considered as Village Level Operation and Maintenance, Handpump Technology Choice, UK.
- Batzaya T, 2005. SWOT Analysis and Performance/Sustainability Study for a Service Sector, India.
- BGWMEDB, 2007. Benshangul Gumuz Water Mines and Energy Development Bureau Water Schemes Inventory Report, Assosa.
- Finn BG and BWMED, 2009. Hydrogeological and Geophysical Study by BERU consulting in Five Woreda of Metekel Zone, Benshangul Gumuz Regional State, Western Ethiopia.
- Brikké, F. and M. Bredero, 2003. Linking Technology Choice with Operation and Maintenance in the Context of Community Water Supply and Sanitation. Reference Document for Planners and Project Staff. Geneva: WHO and IRC.
- CSA, 2007. Summary and Statistical Report of the Population and Housing Census Results of Ethiopia.
- Davis j and Brikke F, 1995. Making your Water Supply work; Operation and Maintenance of Small Water Supply schemes, IRC, The Hague, The Netherlands.
- Derje, 2007. Sustainability Problems of Rural Water Supply Schemes, Bambasi Woreda, Benishangul Gumuz.
- DCSC, 2009. Customer Service Standard for Water Supply and Sewerage Services, India
- Desalegn Ramato, 1999. Water Resource Development in Ethiopia: Issues of sustainability and Participation, Forum for Social Science studies (FSS) Addis Ababa, Ethiopia.
- ECHO, 2006. Evaluation of the Choice of Schemes Case Study of Nimba County Action Contre la Faim, Liberia.
- E. o. Longe, O.B. Omotoso and G.A. Sodamade, 2009. Appraisal of Sustainability of Water Supply Facilities in rural riverinecostal areas of legos state Department of Civil and Environmental Engineering, University of Lagos, Nigeria.

- Habtam A. and Israel D, 2008. The Sustainability of Water Supply Schemes a Case Study in Alaba Special Woreda, Hawassa, Ethiopia.
- Harvey, P., Reed, R. A, 2004. Rural Water Supply in Africa: Building Blocks for Handpump Sustainability. Water, Engineering and Development Centre, Loughborough University Press, UK.
- Hayson, 2006. A Study on Factors Influencing the Performance of Rural Water Supply in Tanzania. Available from <http://WWW.Wateraid.org>.(accessed on 3rd December, 2009).
- Hofkes EH, 1983. Handpump Maintenance: Guidelines for Organizing Handpump Maintenance Systems. The Hague, IRC International Water and Sanitation Centre.
- Kebede Woldeie Libasie, 2003. Assessment of Sustainability of Rural Water Supply Schemes in Meskanana Mareko Woreda.
- Lockwood, H., 2004. Scaling-up Community Management of Rural Water Supply. Delft: IRC.
- Maguvu, Edmore S.; Mutengu, Sherman, 2008. An Investigation into the Factors Limiting Effective Water Supply in Rural Areas of Zimbabwe: A case study of Zhomba in Gokwe North District, Journal of Sustainable Development in Africa, Vol.10, No.1, 120 – 138.
- Mc common c, Warner D, and Yohalem D., 1990. Community Management of Rural Water Supply and Sanitation Service, UNDP-WB Water and Sanitation Program, Washington. DC, USA.
- Mekonen, 2009. An assessment of Problems to Sustainability of Rural Water Supply Schemes Particular attention to Handpumps the case of Aleta Wondo Woreda Sidama zone, SNNP. MA Thesis, CDS, AAU.
- Mengesha Admasu. Aberakumie and Misganaw Fantahun, 2003. Sustainability of Drinking Water Supply Project in Rural of Gonder Ethiopia. Journal of health development;(3):221-229 available on website <http://WWW.cih.uib/journal/EJHD/ejhdv17-n03/92mengesha>.
- MoWR, 1999. Ministry of water resource development, Water supply and sanitation policy, Ethiopia.
- _____,1999. Ministry of Water Resource Development and Management Policy, Ethiopia.
- WASDP, 2002. Water Supply and Development Program for Sustainable Development and Management, Ethiopia.
- Musonda, 2004. Issue Regarding Sustainability of Rural Water Supply in Zambia. MA thesis, CSS, South Africa.



- POPLINE, 2000. Population and the Environment: The Global Challenge – Population Reports. Series M, No. 15. Population Information Program, Center for Communication. Baltimore: The Johns Hopkins University School of Public Health.
- Reynolds J., 1992. Handpumps: toward a Sustainable Technology. Research and Development Drinking the Water Supply Decades, UNDP-WB water and sanitation program, Washington, DC, USA.
- Richard Johnston, et al., 2001. Safe Water Technology in Rural Rivrinecostal areas of Bangladesh.
- Sebsibe Alemneh, 2002. Guidelines on Sustainable Community Management and Financing of Rural Water Supply and Sanitation, COWDO, Addis Ababa.
- Smet Jo; Van Wijk, Chrstine, 2002. Small Community Water Supplies; Technology people and partnership, IRC, Delft. The Netherlands.
- USAID, 1990. Strategies for Linking Water and Sanitation Programs to Child Survival. Washington, DC: USAID.
- WHO/UNICEF, 2000. Global Water Supply and Sanitation Assessment Report, Geneva / New York.
- Wood, 1994. Challenges of Hand pump Technology Choice in the Developing Countries, Africa.
- WWD, 2009. Debatie Woreda Desk of Water Resources Development 2001 E.C. Water point Inventory Report, Debatie.
- Zelalem Getachew, 2005. Determinants to the Performance of Rural Water Supply Schemes in Ethiopia. A case of Two Rural Water Supply System, Amuye Serra and Habru Seffu Schemes, MA. Thesis, AAU.

Annexes

A. Questionnaire for Household Survey

General Objectives and Confidentiality

The purpose of the study is to generate relevant information on **the relative performance of rural water supply schemes fitted with handpumps in Debatie Woreda**. The research is conducted for MA Degree in environment, water and development at college of Development studies of Addis Ababa University. It is expected that policy makers and other responsible bodies will make the finding of this study as background information to improve the conditions of the rural community with regard to safe, suitable and sustainable rural water supply schemes fitted with hand pumps. The study is conducted only for academic purpose and be sure that the information you provide will only be used for this research. Your full support and willingness to respond to questions is very important for the success of the study. Therefore you are kindly requested to answer all questions and give reliable and complete information on the issues.

Direction for Interviewer:

1. Introduce yourself.
2. Inform the respondents clearly about the purpose of the questionnaire and win their consent and use pen.
3. Circle choices for questions with alternatives and describe and write the answers of respondents for questionnaire that require explanation in the space provided.

Identifications:

1. Name of interviewer _____
2. Date of interview _____
3. Name of kebele and Village/Got _____
4. Questionnaire identification number _____

Part 1: Background information

1. Sex? 1. Male 2. Female
2. Age (in years)? 1. Less than 20 2. 20-30 3. 30-40 4. 40-50 5. Greater than 50
3. What is your current marital status? 1. Single 2. Married 3. Divorced 4. Widowed
5. Separated
4. Household (family) size? 1. Below 4 2. 4-6 3. 7-9 4. Above 9
5. Ethnic group 1. Shinasha 2. Amhara 3. Oromo 4. If other, specify _____
6. Religion 1. Orthodox Christian 2. Muslim 3. Protestant 4. If other, specify _____
7. Educational level
 1. Unable to read and write (illiterate) 2. Able to read and write
 3. First cycle (1-4 Grades) 4. Second cycle (5-8 Grades)
 5. High school (9-12) completes 6. Above 12
8. What is your major occupation?
 1. Farming 2. Government employee 3. Daily labor
 4. Peaty Trade 5. Others, specify _____
9. Average monthly income of the family (in birr)? _____

Part 2: Current Water Supply Situation

10. Which one is your main source of water supply for drinking?
 1. River 2. Traditional Hand Dug Well 3. Hand dug well fitted with handpump
 4. Machine drilled Shallow well fitted with handpump 5. Unprotected spring 6. If others, specify _____
11. How far is the water source from the house? (_____ in kms or ms)
12. For what purpose do you use the water from the main sources in addition to drinking?

13. If the water from the main source does not cover the entire household utility, which one is your other source of water for drinking?
 1. Traditional dug well 2. Protected dug well 3. Unprotected spring
 4. River 5. If other, specify _____
14. Does the water supply scheme service has unintended/ as planned? _____
15. Who collects water in your home mostly?
 1. Male 2. Girls 3. Women 4. Boys 5. Both women and girls
 6. Both the women and males 7. If others, specify _____
16. How many times a day is water collected? 1. Once 2. Two times 3. Three times
4. More than three times

29.1 If your response to Q 29 is "No" why do you think the reason for not participating?

1. Not asked 2. Every thing is done by implementing agency
3. Lack of awareness 4. Used to live elsewhere 5. If others, specify _____

29.2 If your response to Q 29 is "yes", at which stage/s of the development/ construction

Process you have participated

1. Inception 2. Planning 3. During Construction
4. Post- construction 5. 1 and 2 6. 2 and 3 7. In all phase

30. What was your contribution in the provision of the water supply schemes?

1. Labor 2. Money 3. Local material/stone, sand, wood/
4. Labor and local material 5. If any other, specify _____

31. Who have participated in the development of water supply scheme in your family?

1. Adult males 2. Adult females
3. Adult male and females 4. Children 5. I don't know

32. Is there management system put in place for the developed water supply scheme? 1. Yes 2. No

32.1 If your response to Q 32 is "yes", who manages the scheme?

1. Community/ water committee alone 2. Government alone
3. NGO 4. Both 1 and 2 5. If others, specify _____

33. Do you think the management body adequately performed its duties and responsibilities?

1. Yes 2. No

33.1 If your response to Q 33 is "No", what do you think the reason? _____

34. Do you take the water supply scheme as your own property? 1. Yes 2. No

35. What is your overall satisfaction (sufficiency, yield and reliability of well water) with the service?

1. Very Good 2. Good 3. Fair 4. Poor/Bad

36. How do you evaluate the service provision and functionality of the improved handpump scheme you are using? 1. Good 2. Fair 3. Poor 4. If other, specify _____

37. What type of the scheme do you prefer to be developed? 1. Hand dug well fitted with handpump

2. Machine drilled Shallow well fitted with handpump 3. If other specify _____

38. How do you evaluate the over all community participation before and after scheme development?

1. Well participated 2. Poorly participated 3. Not participated

39. What do you think should be done by the community to improve the problems related with continued and sustainable use of the water supply schemes? _____

Part. 4: Issues Related to Financial Factors

40. Did you contribute money for capital assets during the construction of the scheme? 1. Yes 2. No

40.1 If your response to Q 40 is 'No', who financed the developed water supply scheme?

1. Community 2. Government 3. NGO 4. 1 and 2
 5. All in collaboration 6. If others, specify _____
41. Do you pay for the service you get from developed water supply scheme? 1. Yes 2. No
 41.1 If your response to Q 41 is "yes" how much money do you pay per month on average or per Container you use to fetch water? _____
42. Do you think the payment you are making is fair? 1. Yes 2. No
43. How much money is your ability to pay for the service per month or per container? _____
44. Do you pay for the water supply service regularly? 1. Yes 2. No
 45.1 If your response to Q 44 is "No", why don't you pay regularly?
 1. I can't afford 2. No one is responsible for collection 3. Abuse of corruption
 4. The service is not continuous 5. If other, specify _____
45. Who set the price of the water fees?
 1. Community 2. Government 3. NGO
 4. 1 and 2 5. All in collaboration 6. If other, specify _____
46. What is your perception on tariff level? 1. Expensive 2. Fair 3. Inexpensive
47. Does the community have financial capacity to sustain the service? 1. Yes 2. No 3. Don't know
48. The collected service fee money from users is meant for?
 1. Minor repair only 2. Major repair only
 3. Spare parts purchase only 4. Salary of guard only 5. All cost of the scheme
 6. Cost of technician only 7. If other specify _____
49. Who manage the water fees collected from users?
 1. Community 2. Government 3. NGO
 4. 1 and 2 5. All in collaboration 6. If other, specify _____
50. Do you think the scheme managers have the capacity to manage the finance? 1. Yes 2. No
51. How do you evaluate the financial contribution and management in the handpump scheme you are using?
 1. Good 2. Fair 3. Poor 4. If others, specify _____
52. What do you recommend to improve financial related problem to sustain the water supply scheme?

Part.5: Regarding Technical Factors

53. Have you been informed of the advantage, costs and disadvantages of the potential technologies or handpump type to be installed? 1. Yes 2. No
54. Who selected the type of the existing scheme?
 1. Beneficiaries 2. Government 3. NGO
 4. 1 and 2 5. All in collaboration 6. If other, specify _____

55. Did the preliminary /baseline study conducted before scheme selection to develop?

1. Yes 2. No

56. How do you evaluate the construction quality of the water supply scheme?

1. Excellent 2. Very Good 3. Good 4. Not good 5. If other specify _____

57. Is the handpump scheme simple to operate and suitable to the users? 1. Yes 2. No

58. Are/is there local technician /s for operation and maintenance work? 1. Yes 2. No

59. Is the training on the water supply scheme O & M given to the technician or the water committee?

60. Where does the community get the spare parts to carry out operation and maintenance?

1. Purchase on market
2. Given by the government agency (regional/ zonal/Woreda water offices)
3. Donated by NGOs 4. If other, specify _____

61. Accessibility, availability and affordability of spare parts at the community level for O&M.

Variables	1=Yes	2=No
Accessible		
Available		
Affordable		

62. Which major technical problems have you encountered to make the water supply scheme properly function and sustain the service to the community? (Multi response is possible).

1. Lack of adequate spare parts and tools 5. All of the above
2. Inappropriate technology/scheme type selection 6. If other, specify _____
3. Inappropriate design/poor construction quality
4. Lack of the technical skill to carry out O & M

63. How do you evaluate the over all technical aspect of the scheme you use?

1. Excellent 2. Very Good 3. Good 3. Poor

64. What do you recommend to alleviate the problems that the water supply is experiencing and to make the scheme proper functional for long period of time? _____

Part 6: Regarding Institutional Support

65. Does the community receive adequate external support from government to effectively manage water supply handpump scheme? 1. Yes 2. No

66. What supports did the community get from the Government organizations and NGOs in relation to managing the water supply schemes to make properly functional and sustainable? _____

67. Did the Supports given to the community from government and non-governmental organizations in the form of continuity? 1. Yes 2. No

68. Is there any training given to your communities regarding use of clean and potable water? 1. Yes 2. No
69. How do you evaluate the approach of water provider institution during handpump scheme development in your area? 1. Excellent 2. Very good 3. Good 4. Not Good 5. I don't know
70. Which type of the schemes often requires support from the external water agencies?
1. Hand Dug Well 2. Machine drilled Shallow Well 3. If others, specify _____
71. What types of support the community needs to ensure better performance of water supply schemes?
-

Part 7: Regarding Environmental Issues

72. Do you remember in which season the water supply handpump was developed?
1. During dry season ("Bega") 2. During wet season ("Kiremt") 3. If other, specify _____
73. Do you think the existing water supply source is adequate to beneficiaries? 1. Yes 2. No
73.1. If your response to Q 73 is "No" what do you think the reason for in adequacy? And what is your suggestion to tackle the problem? _____
74. Do you think the water supply source now you are using water quality problem? 1. Yes 2. No
74.1. If your response to Q 74 is "yes" what kind of water quality problem you observed?
-
75. How do you evaluate the over all water quantity and quality of the handpump you are using?
1. Excellent 2. Very Good 3. Good 4. Not Good /poor
76. How do you evaluate the over all water quantity and quality between the hand dug and shallow wells handpump schemes in your area and near by village's scheme? _____
77. What do you recommend to alleviate the problems of water quality and quantity that the handpump is experiencing to make the scheme sustainable and properly functional? _____
78. Information on the performance indicators of water supply handpump scheme (Answer, 1=excellent, 2= very good, 3= good and 4= weak). Indicate **circle** on the scheme type that the household is using.

<i>Performance indicators</i>	<i>HDW</i>	<i>MDSW</i>
Consistency of service delivery/ day to day service provision		
Functionality of the scheme for the designed period		
Adequacy of water from the scheme		
Water quality of the scheme		
Over all performance of the scheme		

Thank you!!!

B. Checklists for Focus Group Discussion

I. Checklists for Point of Discussion with Water Committee

Date of discussion _____

Kebele _____ *Village* _____

HP-Scheme type & status _____

1. When was the scheme constructed?

2. How is the committee established? Who decided the members of committee?

How many of you are women? Are all members are working now? If not how many are not working and what are their reasons?

3. How many households are benefiting the handpump developed? How many are paying the fees?

4. Does the water committee have formal recognition? (Yes/No) If "No" what do you think the problem manifested on water supply handpump because of lack of legal recognition?

5. To whom the water committee is accountable for? What is your reporting mechanism?

6. Are there activities the committee does regularly? (Yes/No). If "yes" could you mentioned the major once?

7. How does the committee evaluate community participation in general and women's participation in particular at all phases (pre implementation, during implementation and post construction) of the schemes?

8. Did the beneficiaries pay user fees regularly? (Yes/ No) If "No" why do you think the reasons and what measures have been taken to solve the problem?

9. How does the committee manage their financial resource? Do you have bank account and /or financial record?

10. What are the type of expense do you have? Is money collected from use fees covers your expense? (Yes/No) If "No" how do you cover uncover expense?

11. Are there care takers with the necessary tools and skill those can carry out maintenance during handpump breakdown within community or committee? (Yes/No).If your answer is "No" who undertakes the maintenance works?

12. How and from where spare parts are obtained when needed? Which part of the scheme fails most commonly?

13. What support (financial, technical and others) have been given to the community/ committee from the external (government and NGOs) to sustain the water supply service?

14. How does the committee evaluate community participation in general and women's participation in particular at all phases (pre, during and post implementation) of the scheme fitted with handpump? And how were the contribution?

15. Did the scheme management and administration training given to the community by the scheme provider? (Yes/No) If "Yes" when was the training provided? How do you evaluate the issue and content of training?

16. Did the scheme providers adequately prepare the committee to manage and sustain the water supply scheme? (Yes/No) If "No" why do you think the reason?

17. From your experience what major problems are encountered in relation with your water supply handpump and service delivery? (Place in order of their seriousness)

18. How do you evaluate the performance of the handpump scheme in your community?
(Good, Fair, poor) and why?

19. How do you evaluate the approach of different water provider institution pre and during water supply handpump development in your area and the neighboring village?

20. Is there the other type of handpump in the neighboring village? (Yes/No) If "yes" how do you compare the sustainability with the handpump scheme in your area?

21. How do you evaluate the relative performance of schemes between and within hand dug well and shallow well handpumps by their service delivery in your community and the surrounding? Why?

22. What solution do you recommend in order to alleviate the problems and to sustain the functionality of the scheme?

II. Point of Discussion with Selected Women groups

Date of discussion _____

Kebele _____ *village/Got* _____

HP-scheme type and status _____

1. Have you participated or consulted in the water supply project? If yes, what were your contributions, and if not, why women were not participated?
2. Who are responsible to fetch water for domestic purpose mainly?
3. Does the management of the scheme involves women and treats users fairly?
4. How do you evaluate the advantages of having the new scheme verses the traditional source?
5. Have you faced the problem with the water supply scheme non functional? (Yes/No), If 'yes', what do you think are the major reasons and where do you get water at that time?
6. How do you see the performance of the handpump scheme you are using now?
7. How do you evaluate the performance of handpump scheme in your area with the other or the same type of the handpump in the neighboring village?
8. From your experience, what major problems are encountered in relation to water supply handpump scheme to make it properly functional and to sustain the benefits gained from the water supply?
9. What type of handpump scheme do you need to be developed to minimize the burden of work load related to water fetching and to sustain the water supply of the scheme? Why?
- 10 What do you recommend to alleviate the problem of the scheme and make it functional for long time?

III. Point of Discussion with Debatie Woreda Water Desk Members

Date of discussion _____

1. What are the major objectives of your water office/desk in relation with rural water supply in general and schemes fitted with handpump in particular?
2. How do you see the performance of your office in connection to its objectives and implementing its plans?
3. Which rural water supply schemes are common in the Woreda? Why do you think, they are developed more and how do you evaluate the schemes performance between and with handpumps?
4. How many of water supply scheme handpumps are functional and/or non functional in the Woreda?
5. If there are problems, what are the main factors affecting your performance/ implementation? In what way?
 - Human resources?
 - Budget?
 - Integration with relevant stakeholders?
 - Logistics?
6. How do you see the functionality status of schemes fitted with handpumps in your Woreda?
7. Did your office give necessary support for community to manage the handpumps in your Woreda? (Yes/No)
 - 5.1 If your response is “yes” what support do you provide?
 - 5.2 If “No” what are the constraints do you face?
8. Do you participate in feasibility studies (potential assessment, site and technology selection) and implementation phases of scheme development? If ‘yes’ how? If ‘no’ why?
9. Do different water development agencies developed different handpump schemes in your Woreda? Is there functionality and sustainability difference between and within the handpumps developed and those developed by government and other NGOs? (Yes/No) If “yes” what kind of differences are there?
10. What kind of support do the NGOs provide to the community to sustain the handpumps in your Woreda?
11. Is there coordination between your office and NGOs organizations? (Yes/No)
 - If “yes” what are coordination areas?
 - If “No” what are reasons for the lack of coordination?

12. How do explain the hand over of the water supply handpump schemes developed by the organizations?

13. Despite their Village Level of Operation and Maintenance nature of most of the schemes fitted with handpumps, considerable numbers of schemes are not functional/non-sustainable and differ from hand dug to shallow well in the Woreda. What are the main factors do you think are affect hand pump sustainability between and within the schemes?

- Low community participation /women participation
- Projects approach
- Water committee inefficiency
- Spare part: availability, price, chain of supply
- Non-payment of user fees
- Design and construction problem/ Poor construction quality
- Suitable and appropriate scheme selection problem
- Water quality problem
- Poor Woreda water office capacity and support
- Shortage of water in the well
- Lack of monitoring and evaluation of the scheme status
- Others

14. How do you evaluate your institution capacity with rural water supply schemes sustainability problem to sustain the service of different type of handpumps schemes?

15. Do you conduct base line study for each Kebeles in the Woreda, shows the type of scheme that is suitable and appropriate based on their soil/geological condition?

16. What type of the scheme fitted with handpump is relatively perform /functional with adequate water service to the community in the Woreda in general? Why?

17. What do you recommend to sustain the rural water supply handpump schemes in the Woreda? And how do you evaluate the performance between and within hand dug well and shallow well in the Woreda at different rural settings?

C. Checklist for Key informant interviews (KII)

I. Checklist for interviewing key informant from governmental officials (regional and Woreda) water sectors

Date _____

Name of the organization respondent _____

Position of the respondent _____

1. What are the major objectives of the establishment of your organization in relation to rural water supply?
2. Is there regional water resource management policy in general and water supply development and management policy in particular? If “yes” what it say about the issues of rural water supply? If ‘Not’ how do you implement it?
3. Do you prefer handpump technology among others? (Yes/No) If “yes” what is the reason? What type and mark of handpump scheme do you prefer? Why?
4. How do you evaluate the status of the handpump schemes implemented by the office and others in the region/ Woreda now?
5. Did the government institution adequately prepare the baseline study of the Woreda regarding suitable and appropriate water supply scheme type for different rural kebeles? (Yes/No) If “yes” how are they prepared?
6. Did the government institutions adequately prepare the community to manage and sustain their water supply schemes fitted with handpump? (Yes/No) If ‘No’ what are the reasons?
7. What types of institutional support your office is providing to the lower government offices/community in sustaining the functionality of the handpumps? And how frequent are the support?
8. How do you evaluate the different rural water supply schemes with there performance when they are designed to develop by your office and by other water agencies like NGOs?
9. Are spare parts and toolkits ready and available and affordable at regional, Woreda and community level? (Yes/No) If ‘No’, where do you get it?
10. What problems are faced by your organization/ office to make the rural water supply handpump sustainability?
11. How do you see the coordination of your office and with the lower governments and stockholders to support the scheme service?

12. What request of the scheme problems are mainly reported to your office from the community?
13. What are the common rural water supply schemes in the region/Woreda?
14. Which type of rural water supply scheme is dominated in region/Woreda? Why?
15. Which schemes fail more recurrently and why?
16. Which schemes perform for a longer period of time without failure? Why?
17. What are the major problems /causes for rural water supply handpump failure in the region/Woreda?
18. What are the differences in functionality/non functionality between and within rural water supply schemes fitted with hand pumps?
19. What are the major problems associated with the provision and management of rural water supply schemes in general and rural water supply handpumps in particular?
20. What interventions mechanisms/strategy do you recommend to alleviate existing problem in the water supply sector and to enhance better performance of rural water supply schemes in general and handpump in particular?

II. Checklists for interviewing key informant from NGOs working on rural water supply handpumps schemes in the Woreda

Date of interview _____

Name of organization/respondent _____

Position of the respondent _____

1. When did your organization start working in Debatie Woreda? Is the organization currently active in the area? In which kebeles you intervened?
2. What is the role of your organization regarding rural water supply related activities?
3. How many water supply schemes have been implemented by your organization and how many of the people/households are benefited from the service? And how do you evaluate the status the schemes?
4. Which type of schemes do you developed for the rural communities? Why for?
5. How do you relate the type of scheme selection for development and its performance situation in different kebeles of the Woreda according to the existing/geological condition?
6. In what ways the participation of the local communities/women taken into consideration pre, during and post development of the water supply scheme?
 - 6.1 What was the role of communities in the water supply project? (Problem identification, Prioritization, site selection, project design selection, scheme type selection and service Level selection) and how did the hand over of the schemes taken at last?
7. Is the choice of scheme type considers both hand dug and shallow wells fitted with handpumps? (Yes/No) If 'No' what are the reason for? And If 'yes' why you selected it?
8. What are the present water management strategies for handpump scheme you have constructed?
9. How you handle the O&M of the handpump schemes and availability of spare parts?
10. What are the strategies to ensure the long term performance of the handpump scheme?
11. What do you think are the major problem/causes for rural water supply handpumps failure?
12. How do you evaluate the relative performance of different rural water supply schemes in general and handpumps in particular in your intervention?
13. What solution do you recommend to alleviate the problems of the non functionality and unsustainability of the schemes for long period of time?

III. Checklist for interviewing Key informants of Kebele chairpersons/ elders

Date of interview _____

Position of the respondent _____

Name of person _____

1. When was the handpump scheme developed? By whom?
2. What was the drinking water source before the construction of the scheme?
3. How do you compare the situation of drinking water before and after the construction of the handpump? What benefit obtained by using developed handpump?
4. How do you evaluate the community participation before and after implementation of the scheme?
5. Is the handpump scheme functional? (Yes/No), If 'no' what are the major problems for the failure to the service delivery? If 'yes' is the community properly benefited?
6. Who manage the handpump scheme?
7. How do you see the performance of the water committee in scheme management and when and how the water committee established and composite?
8. What will be done when the water committee mismanages the scheme?
9. How do you participate personally in the handpump management?
10. How do you explain the demand for water in relation to its population?
(Pressure on scheme, difficulty in providing quality service)
11. What complain are there on the use of scheme? (Quality, quantity, distance, waiting time, scheme failure, etc)
12. Do you have the two type handpump schemes in different villages of the kebele? (yes/No) If 'yes' How do you evaluate the relative sustainability of the different handpump schemes in the kebele? And which one do you think is suitable and appropriate in your kebele context?
13. How do you recommend the water committee and the government to make water supply handpump to sustain the service?

D. Physical observation checklists

I. Information about Hand dug well / Shallow well schemes fitted with handpump

Name of kebele _____ Name of the Village/Got _____

Date of observation _____ Scheme type _____

1. Date of construction _____
2. How frequent do the breakdown occur _____ on average every (day/month/year)
3. Is the water shortage happen? When?
4. Yield of hand dug well _____ litre/second
5. Location of the HDW/MDSW with reference to (river, village, etc) _____ comfortable/ accessible.
6. HDW/MDSW service to the community, for drinking, for domestic etc _____
7. Any unprotected source near the village that the community using _____
8. Who collect water from water point? _____
9. HDW/MDSW construction component (physical appearance) of the scheme _____
10. Total households using the handpump scheme _____
11. Is the scheme functional at the time of visit? (Yes/No)
12. Reasons for non functionality of the handpump scheme _____
13. The average distance of the handpump scheme from the beneficiaries _____

Specific diagnostic information

1. Is the HDW/MDSW source protected by masonry or concrete wall? (Yes/No)
2. Does the well have an inspection manhole with cover? (Yes/No)
3. Is the masonry or concrete slab faulty or leaking? (Yes/No)
4. Does silt, worm and other discharged with the water? (Yes/ No)
5. Is the well fenced? (Yes/No)
6. Is the well protected from flooding during rainy season? (Yes/No)
7. Are there any latrine uphill of the well? (Yes/No)
8. The over all physical quality of the HDW/MDSW (Good/Poor/Very good)
9. Information on what was planned so far and the current performing status of the schemes

<i>Variables</i>	<i>Planned /at the beginning</i>	<i>Performing /supplying now</i>
Household benefited		
Yield of the scheme		
Designed period to serve		

Table: Status of Water Supply HP Schemes in the Sample Kebeles

<i>Kebele</i>	<i>Village/Gote</i>	<i>Type of HP scheme</i>	<i>Status</i>	<i>Remark</i>
Berber	Kebelsuk	MDSW	NF	Pump failure
	Nechilo	HDW	>>	Poor construction
	Elementary school	>>	F	
	Near Health clinic	>>	NF	Depth problem
	Mitre	>>	F	
	Dugmasufer	>>	NF	Depth problem/seasonal
	Westi	>>	>>	Pump failure and insufficient water
	Near Animal clinic	>>	>>	Poor construction quality
Legebuna/Modrmo	Modermo02	HDW	F	
	Modermo school	>>	NF	Water quality problem
	Semania chisi	>>	F	
	Mereritu	>>	NF	Water shortage
	Modermo01	MDSW	>>	Pump failure and difficulty to operate & maintain
	Donbenmewcha	HDW	>>	Depth problem
Giriz/Zigi	Zigi	MDSW	F	
	Sherewonzi	HDW	NF	Poor construction
	Keyafer01	>>	>>	Water quality problem
	Keyafer02	>>	F	
	Mogar	>>	>>	
	Kuter-1	>>	>>	
	Kuter-2	>>	NF	Depth problem
	Girz mender 4	>>	F	