ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES, CENTER FOR ENVIRONMENT AND DEVELOPMENT STUDIES

CONSTRAINTS OF COMMUNITY MANAGED RURAL WATER SUPPLY SYSTEMS: THE CASE OF WALMARA WOREDA, OROMIA REGION

A THESIS SUBMITTED

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ART IN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT

BY

OUMER BELAY MAMO

JUNE 2020

ADDIS ABABA, ETHIOPIA

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DECLARATION

This MA thesis is my original work and has not been presented for MA degree in any other University and that all the sources and materials used for the thesis have been properly acknowledged.

Declared By: **Oumer Belay**

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This is to certify that the above declaration made by the candidate is correct to the best of my knowledge as an advisor.

Advisor: _____ _____

Signature Date

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This is to certify that this MA thesis, entitled "Constraints of community managed rural water supply systems, the case of Walmara Woreda, Oromia Region" is prepared by Oumer Belay Mamo. This thesis is submitted in partial fulfillment of the requirements for the degree of Master of Art in environment and sustainable development, complies with the regulations of Addis Ababa University and meets the accepted standards with respect to originality and quality.

Signed by the examining committee:

Advisor: _____ Signature _____ Date_____

External Examiner: _____ Signature _____ Date_____

Internal Examiner: _____Signature _____ Date _____

Chairman: _____Signature _____Date_____

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Table of Contents

List of Figures and Tables

Figures

Tables

Abbreviation/Acronym

ADF	African Development Fund
ANOVA	Analysis of Variance
CBM	Community Based Management
CBNRM	Community Based Natural Resources Management
CBOs	Community Based Organizations
CBSM	Community Based Scheme Management
CBWSM	Community Based Water Supply Management
CMP	Community Managed Projects
CSA	Central Statistical Agency
DAs	Development Agents
ETB	Ethiopian Birr
FGD	Focus Group Discussion
GTP-2	Growth and Transformation Plan Two
HEWs	Health Extension Workers
HH	House Holds
JMP	Joint Monitoring Programme
KII	Key Informants Interview
MDGs	Millennium Development Goals
MoWIE	Ministry of Water, Irrigation and Electricity
MoWRD	Ministry of Water Resource Development
NGOs	Nongovernmental Organizations
O&M	Operation and Maintenance
OED	Operations Evaluation Department (a department within the World Bank)
OWNP	One WASH National Programme
PRWSPs	Potable Rural Water Supply Projects
RWBs	Regional Water Bureaus
RWSN	Rural Water supply Network
RWSS	Rural Water Supply Systems
RWF	Rural Water Supply Facilities

SDGs	Sustainable Development Goals
UNICEF	United Nations Children's Fund
USAID	United States Assistance for International Development
WASH	Water, Sanitation and Hygiene
WASHCOs	Water, Sanitation and Hygiene Committees
WHO	World Health Organization
WSP	Water and Sanitation Program
WSPs	Water Supply Projects
WSS	Water Supply Systems
WWSD	Water Supply and Sanitation Decade
WSSP	Water Supply and Sanitation Policy

Abstract

Failure to maintain access to clean water is one of the key problems in developing countries, including Ethiopia. Although government and humanitarian organizations have made notable attempts to address the shortage of access to potable water, cooperative efforts are still demanding to improve clean water coverage in rural areas. In connection to above stated problem, this study was conducted to investigate the constraints of community managed rural water supply systems in Walmara woreda of Oromia National Regional State, Ethiopia. Therefore, the objective of the research is to examine and identify the constraining factors of community managed rural water supply systems through determining the roles attributed to communities for the consistent functioning as well as non-functioning of water supply systems in the entire management process.

For this, mixtures of quantitative and qualitative research methods were used. Hence a total of 108 households were randomly selected and interviewed by using a semi structured questionnaire. In addition, qualitative data were collected through focus group discussions and key informants' interview. The primary data were also substantiated by field observation and from review of different secondary data sources. The data analysis was carried out using a descriptive statistical analysis based on frequencies and percentages and inferential statistical analysis using Pearson's Chi-Square test and ANOVA (Analysis of variance).

The survey result revealed that a combination of technical, institutional, social, environmental, and financial factors are the major elements which need to be considered to ensure sustainability and functionality of community managed rural water supply systems. The study recommends that the major factors influencing functionality of rural water supply systems includes but not limited to, availability of enough water from the water supply systems, availability of spare parts and proper community-based management. These elements should be considered in the events of water supply systems development from planning to post implementation stages. Hence, to enhance access to potable water supply in rural areas it is important to ensure functionality of existing water supply systems than focusing on construction of new schemes alone.

1. INTRODUCTION

1.1 Background of the study

Access to clean water is a worldwide priority, and indeed an integral part of basic human rights (WHO-UNICEF, 2010). Besides, also important pillars of human development and poverty alleviation and a vital component of primary health care. The provision of adequate and clean water supply therefore represents an effective health intervention which reduces by an average of 65% the mortality caused by diarrheal disease and by 26% the associated morbidity. On the contrary, insufficient, and unclean water results not only in more disease and death, but also in higher health costs, lower efficiency, lower enrolment in schools and, of course, the most obvious denial of people's rights to live with dignity.

Access to a potable water supply is among the key components for fostering development, and a significant contributor to poverty reduction around the world. As per WHO and UNICEF (2015) joint monitoring program (JMP) report it was found that 663 million people worldwide do not have access to potable water supplies. Such individuals are mainly from sub-Saharan Africa and Asian countries. In addition, the World Health Organization and United Nations Children's Fund (WHO/UNICEF,2017) Joint Monitoring Program for Water Supply, Sanitation and Hygiene (JMP) report presented an updated national, regional, and global estimate for WASH in households. As per the report, the proportion of estimated population using improved water supplies in rural setting of Ethiopia is 62% (23% piped and 39% non-piped water supply systems) and only 5% of the water supply systems are safely managed.

Nevertheless, an important limitation in water supply systems is the failure for uninterrupted functionality of water supply systems. For example, in 2010 the rural water supply network (RWSN) estimated that in developing countries only two out of three water supply systems fitted with hand pumps works at any given moment (RWSN, 2010). Consistency in rural water supply schemes has been well studied, but the issue does not seem to be solved easily. In the 1980s, it was widely recognized among sector

professionals that many of the rural water supply programs in the Global South performed poorly, regardless of the type of technology used.

Communities lacked the sense of ownership in their water supply programs and were not happy with the water supply implementations of donors / humanitarian organizations and public programs. As a result, water supply facilities were not always repaired and maintained, and consumer tariff revenues were often insufficient to pay even for service and maintenance (ADF,2005).

From the first international drinking water supply and sanitation Decade of the 1980s, the idea of community-managed water supplies grew. Water points were built over the decades, but governments lacked the ability to handle and retain human and economic resources The Mal del Plata Conference of 1977 was the summit which declared the period 1980-1990 as the Water Supply and Sanitation Decade (WSSD)

The alternative is to encourage community ownership, including on long-term maintenance of water points. The application and general management of rural water points has traditionally been carried out through assistance from the technical knowledge of the government, low involvement, and possession of the target community in rural areas of Ethiopia. Such methods, however, have failed to acknowledge local resources that could better track rural water supply systems implementation (MoWIE,2016).

Ethiopia included a community-managed strategy in its domestic water implementation strategy in line with the worldwide trend of community-managed water supply system approach. This community-managed project strategy (CMP) utilizes a participatory community mobilization approach in which the community contributes labor, money, and local materials in-kind during the execution process, especially during the construction stage. The approach has been under implementation by the support from UNICEF in five regions of Ethiopia (MoWIE,2016).

Shifting obligations to communities has consequences for the supply chains needed for the original implementation's material and economic flows, as well as for long-term water supply systems maintenance. First, it is essential to combine material and economic flows with the required training operations, as community-managed water systems involve

certain abilities that can only be achieved. Capacity development is described here as the process through which individuals, organizations, and society systematically stimulate and develop their capacity over time to attain social and economic objectives, including by improving understanding, abilities, systems, and institutions. In the CMP approach, government staffs must assume the position of facilitator rather than technical implementer (MoWIE,2016).

In addition to the CMP strategy, the Ministry of Water, Irrigation, and Electricity (MoWIE) created a framework entitled "National Rural Water Supply Operation and Maintenance Management Strategic Framework for Ethiopia" in 2016 with technical and economic assistance from Development Partners. This strategic framework is intended to help the Woredas identify the country's most suitable assistance and tracking systems. This is achieved to guarantee that rural water supply systems are well-operated and maintained by the communities, as well as institutions to guarantee the long-term sustainability of current water supply schemes ((MoWIE,2016).

In view of the aforementioned problems, the primary objective of this study is to investigate and examine the limitations associated to community-managed rural water supply systems. Therefore, with this knowledge, the study endeavored in investigating the effectiveness of community-managed rural water supply systems. Thus, the study assessed the various factors and reached at results which will contribute to science and development, taking Walmara woreda of Oromia region as a case.

1.2 Statement of the problem

One of the main issues in developing counties, including Ethiopia, is lack of securing access to clean water. Although government and humanitarian organizations have made notable attempts to address the shortage of access to drinking water, cooperative efforts are still demanding to elevate water coverage in rural areas. The focus of this research is to investigate water supply associated complications and devise mechanisms to the problems of community managed rural water supply systems in the study area.

The African Development Fund (ADF, 2005) study indicates that about 33% of rural water supply schemes and projects in Ethiopia are non-functional owing to shortage of

finance for operational and maintenance, insufficient community mobilization and ownership of installed water systems. The other factor contributing to the intermittent functioning of water supply infrastructures is the low level of community involvement in decision-making at the beginning and after construction of the water supply systems that in turn negatively impact ownership as well as unavailability of spare parts in closer proximity to user groups.

In the rural setting of Walmara woreda, attempts have been made towards increasing water coverage by construction of new water supply systems through regional development framework and the one WASH national program. Water coverages did not increase as planned due to nonfunctionally rate of the constructed water supply systems are growing closer to proportionality of the new constructions. According to Walmara woreda water office, the rural water supply coverage in the woreda has reached 68.7% in 2018. Preliminary data from the woreda showed that among the water supply systems constructed in the woreda, significant numbers of the water supply systems are either nonfunctional or abandoned due to management associated problems and depletion of ground water table, respectively.

Different research has evaluated and re-evaluated various elements of rural water supply systems like: factors affecting sustainability of water supply systems, evaluation of rural water supply systems service provisions, determinants for functionality rate of water supply systems and performance. Most of such research utilized qualitative research methods for performing the research. As opposed to the other research done so far, this study used a mixture of quantitative and qualitative research methods for assessing and investigating the root causes of the constraints.

Therefore, knowledge of the factors, which influence community managed rural water supply systems can create a positive impact and contribute to sustainability of community managed rural water supply systems. Out of this, the study will establish the factors, which influence community-based management of rural water supply systems in Walmara woreda, of Oromia region.

1.3 Significance of the study

This research will contribute and lead to the better understanding on the constraints of community managed rural water supply systems and to problems and factors attributed to sustainable management of rural water supply systems.

Water supply system functions that encourage consistent functioning but need improvement include, better planning and follow-up, better operation and maintenance, community involvement and management, In addition, it is essential to examine problems that undermine the long-term functionality of rural water systems during planning, design, construction and beyond, (Lockwood *et al*., 2004). To explore the root causes of the water supply service and management associated complications, it is very essential to evaluate the factors influencing the functionality of rural water supply systems use starting from the planning phase to post-construction stages. This assists the nation and the specific Walmara woreda study region as well.

Access to potable water is among the main problems in the globe as a whole and the conditions are far worse in developing counties (WHO-UNICEF, 2010). Hence, the study aimed to assess the prevailing community managed water supply systems constraints by investigating the tangible scenarios of water supply systems management in the study area. The result of the research will provide concrete understanding to line government departments at all levels, NGOs, community-based organizations (CBOs) and other parties working in the rural water supply service provision execution task.

The research will also avail the desired information to government about rural water supply systems community management constraints and propose possible mechanisms on how to improve the community-based management of water supply systems and ensure sustainability of the systems accordingly.

Consequently, the results which are found in this research may be resembling and require applying under minor adjustments as per the context to all other woredas across the country. It complements the overall management elements of rural water supply systems and the results of the research and its suggestions will serve as a reference for policy

makers and humanitarian organizations operating in water supply system services provision to rural Ethiopia in general and Walmara woreda in specific.

1.4 Objectives of the study

1.4.1 General Objective

The general objective of this research is to examine and identify the constraining factors of community managed rural water supply systems in the study area.

1.4.2 Specific Objectives

The specific objectives which are derived from the general objective for accomplishing this research are as exhibited below:

- To assess factors contributing to non-functionality and functionality of rural water supply systems in the study area
- To identify the roles of communities in the development and entire management of the water supply systems
- To investigate the current status and past performance of community managed rural water supply systems

1.5 Research questions

The under listed research questions will be employed in the whole process of the research study for examining and investigating the critical complications in relation to the management of rural water supply systems in the particular study area.

- What are the contributing factors for functioning as well as nonfunctioning of rural water supply systems?
- What are the roles and responsibilities of the community in the development and management of the rural water supply systems?
- Which types of water supply sources are easily available in the area and which type of sources and technologies are preferred by the rural communities?
- Are water supply system spare parts available within closer proximity and affordable to the rural communities?
- What sort of external supports are available for communities to manage rural water supply systems?

1.6 Scope of the study

The principal aim of this study is on investigating the constraints of community managed rural water supply systems constructed in the rural areas of Walmara woreda. It has a primary focus on community managed rural water supply systems facilities and sustainability attributed problems, where the beneficiaries themselves are taking collective responsibility for managing, operating, and maintaining the water supply systems.

Majority of the community managed rural water supply systems are water supply systems from water sources like protected springs, hand dug wells fitted with hand pumps and shallow wells fitted with hand pumps. In most cases, water supply systems from deep boreholes/wells sources are managed by water boards and town municipalities. Hence, this study targeted on investigating constraints of community managed rural water supply systems managed by the effort of the rural community. This comprises protected spring sources, hand dug wells fitted with hand pumps and shallow wells fitted with hand pumps water supply systems, which are both functional and nonfunctional.

The water, sanitation, and hygiene committees (WASHCOs) established for this purpose, when the water systems were constructed and handed over to the community, were deeply studied. In addition, the user community and other stakeholders participated in the planning, construction, management, operation, and maintenance activities were made to be the other domains of the study.

The magnitude of timeframe considered for this study purpose was water supply systems constructed and which have been providing service for the community for ten years durations. A purposive weight is provided in including rural water supply systems constructed within nearly the last ten years (2008-2017). This is mainly because of investigating water supply systems which provided service for relatively longer durations, for which the imperative study information could be easily obtained. Water supply sources constructed in 2018 were not considered as it would be too early for this kind of water supply systems to assess its constraints.

1.7 Limitations of the study

This research and the researcher provided emphasis on the constraints of community managed rural water supply systems. Apart from the others, the popular constraints of water supply systems are associated directly and indirectly to sustainability complications of service provisions. In this regard, the study focused on assessing constraints of water supply systems managed by the effort of the community like protected springs, hand dug wells and shallow wells, which are the prime improved water supply sources in rural context and settings of Ethiopia, including Walmara woreda.

The concentration on protected spring, hand dug well, and shallow well typology of water supply sources and water supply technologies only, could be considered as drawback of this study. Because constraints of community managed water supply systems which contribute to sustainability complications go beyond such water supply technologies as well. Nonetheless, the other type of water supply source typologies and water technologies were not available in the study woreda and the other deep borehole water supply sources were few and not being managed by the community.

Apart from the limitations associated to the community managed water supply sources typologies and technologies, there were also limitations in relation to finance, time and logistical facilities to reach farther kebeles while performing the data collection process for this research. Moreover, the study focused on constraints related to community managed rural water supply systems, other constraints of water supply systems managed like by water boards and town municipalities were not investigated in this study. This is mainly because such inclusions absolutely demand huge investment, time and other resources to accomplish the task. Hence, these necessities were limitations of the study scope again.

1.8 Arrangement of the study paper

This research paper is divided into five chapters, for the sake of simplicity. The first chapter starts with introduction; the paper's introduction section outlines the summary of the work as a whole. In this section, the context of the study, description of the problem, general and specific objectives, research study questions, study significance, scope and limitations of the paper's analysis and organization of the paper are specifically defined.

The second chapter focuses primarily on analyzing relevant literatures and on the conceptual context. Chapter three deals with methods and materials used for the purpose which includes, description of the study area, research methods, research design and sampling procedure, sampling frame and procedures, sample size determination for household survey, data collection methods and tools, method of data analysis. The fourth chapter focused on results and discussions and the final chapter is elaborating about the conclusions and recommendations.

2. LITERATURE REVIEW

Water access is a prerequisite for health and livelihood, that is why the MDG goal for sustainable access to affordable drinking water supply is formulated. Improved and quality water supply and sanitation infrastructure are commonly acknowledged as a key element of human rights, core contributing pillars for social and economic growth (ADF, 2005).

Research have shown that rural water supplies in sub-Saharan Africa, especially hand pumps, often show low sustainability rates. Key causes for this include inadequate policy or legislation; inadequate institutional support; shortage of funding mechanisms; unsuccessful management structures; absence of technical backstops and ground water table variability due to climate change. These problems will be solved only by adopting a holistic planning and execution strategy instead of concentrating on a unilateral issue alone (Niyi, 2007).

2.1 Global status of community managed water supply systems

The standard for per capita water demand is defined by WHO guideline as 20 liters per person per day (Admassu *et al*., 2002). When springs are used for multiple purposes such as domestic use, livestock watering, irrigation and supply through storage, care should be taken to prevent contamination of water used for human consumption (Muthusi, 2007). As compared to hand dug wells, natural or developed springs are easily contaminated by different contaminant agents. This comparison generalization does not seem realistic, if spring sources are protected appropriately, they are less prone to contamination and whereas hand dug wells are more susceptible to contamination because of their shallow depths.

Effective rural water supply systems operation and maintenance (O&M) is critical to the consistent operation of rural water supply systems. Community management of rural water supply systems is ineffective for operation and maintenance (O&M) unless there are enough available financial resources and assistance is provided for maintenance on a regular basis (Binder, 2008).

Binder (2008) says that ' increasing the distribution of the finance for rural water supply schemes operation and maintenance is very indispensable, nonetheless that is not the only way to fulfill the difficulties of attaining the Millennium Development Goals (MDGs). Improving operators' ability and suitable institutional management is also compulsory to achieve the MDGs'.

The consistent functionality of water supplies is fundamentally related to the water source that they use, (Harvey and Reed, 2004). A water supply will only be sustained if the withdrawal rate does not exceed the replacement rate of the resource over the lifetime of the system. Comparably, (Lockwood *et al*., 2004) stated that worsening of source water quantity will be of major concern in areas of low rainfall, or poor groundwater re-charge, where there is greater thought to over-extraction. Whereas, even in relatively water plentiful regions of the world, the source can fail to satisfy demand, either due to population expansion or abuse of the supply for non-domestic uses. An assessment of borehole water source reliability by (Harvey and Reed, 2004) demonstrated the importance of the following, drilling wells at specific times of the year; well depth in relation to dynamic water level; and pump positions below the dynamic water level when installing reliable borehole. Climate change also affects the availability of water, especially in areas with dry climate conditions. Climate change impacts due to dry events such as El Nino which leads to shortage of water resources in some rural areas usually located in semi-arid and arid regions (Vammen, 2012). Water quality may also suffer from contamination from agricultural by-products or chemical fertilizers. In either case, care must be taken in the design of water supply projects to determine the sustainability of the water source over a long period of time, (Lockwood *et al*., 2004).

Other critical variables for the consistent functioning of rural water systems are continuous and long-term support for rural communities. This is increasingly identified as a key factor for sustainable management, evidenced for its imperativeness as provided in many of the World Bank's recent project suggestions and in several recent newspapers (Lockwood, 2002) and (Schouten and Moriarty, 2003). It is stated that it is not anticipated that most rural communities will manage on their own way indefinitely.

Support and guidance must be given to tackle a range of issues in order to guarantee the sustainability of RWSS projects and associated benefits. As Lockwood pointed out, there are four main characteristics provided by such aid mechanisms, in addition to technical support for physical infrastructure O&M., such aid mechanisms provide four main characteristics. These are technical support, coordination, and facilitation, monitoring and information collection and preparation. The issues discussed so far by different literatures are realistic and will contribute not only to the sustainability of rural water supply systems but also key approaches to address the constraints that community managed rural water supply systems encounter in developing countries including Ethiopia.

2.2 Water Supply frameworks, policies, and strategies of Ethiopia

The Ethiopian National Strategic Framework for Rural Water Supply Operation and Maintenance Management established in 2016, focusing on the need for Rural Water Supply Facilities (RWSF) O&M to be mainly based on the Community-based Scheme Management (CBSM) strategy to enable continuous service delivery. This emphasizes community responsibility and authority over their water supply facilities ' development, operation and maintenance. The CBSM is a lately established Water, Irrigation and Electricity Ministry framework, the core of the structure is community-based management of water supply systems. Nonetheless, the extent, importance, effect, and contribution to impact rural water supply system management requires further investigation.

According to this document, the average national non-functionality of the rural water supply schemes, according to the National Water Supply Sanitation and Hygiene (WASH) Inventory (2011) was 25.5%. It varied between 20% and 35% region to region. The reasons for non-functionality are numerous and have a lot to do with insufficient attention to software issues and short project delivery timeframes which do not allow time for training and follow up post implementation. By July 2015, the GTP 2 baseline for national non-functionality was 15.5%. A lack of effective spare parts supply chain in the country limits the government authorities and community structures to maintain schemes. Not only is this constraint a technical problem, but it also leads to the issue of maintenance funding as the spare parts cost becomes high when bought from

distant vendors. There are many root causes of non-functionality learned during the evaluation. To mention a few of them are issue of research and design, season of digging a well, bad quality of construction and workmanship, quality of installed systems, effects of climate change such as drought and flooding, unavailability and costly spare components owing to the lack of adequate spare part supply chain and lack of institutional assistance (MoWIE,2016).

The objective, outcome and outputs of the rural water supply operation and maintenance management based on the Ethiopian Growth and Transformation Plan 2 (GTP-2) outcome is shown in figure below.

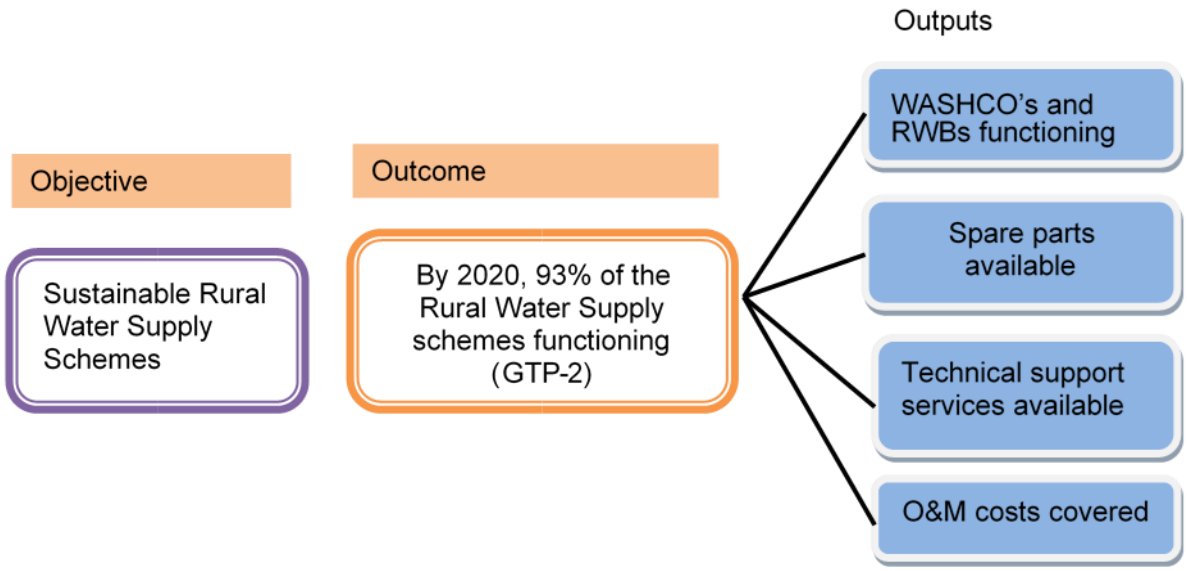

Figure 1: Rural Water Supply Operation and Maintenance Management Objective, Outcome and Outputs based on GTP-2

According to (Harvey and Reed, 2004), there are a broad variety of public policies and strategies, some directly, others indirectly, affecting rural water supplies. Many of these, deliberately or otherwise, have an important effect on the sustainability of water facilities. For Instance, the Ethiopian Water Resource Management Policy for 1998 recognizes that water supply is an essential component of general water resource management and includes water supply planning in the field of extensive water resource management undertakings. It also promotes the development of water supply on participation driven and responsive approaches without compromising social-equity

norms. It also declares the creation and promotion of a sense of ownership consciousness in societies and their obligations for the operation and maintenance of water supply systems and the development of participatory, self-reliance, community involvement and management procedures (MoWR,1998). However, when evaluating sustainability at village level, the problem of the policy setting is not regarded directly relevant (Parry-Jones *et al*., 2001).

The evidences reviewed in the aforementioned literatures in this research which are attributed to, operation and maintenance, community based management, determinants for consistent long term service provision of community managed rural water supply systems, participatory approach, community ownership, pre-implementation and pot implementation variables and institutional support are realistic and reasonable. Whereas the relative contamination of spring sources as compared to hand dug wells is not representative. On the contrary, spring sources have less chance of being contaminated as far as they are properly protected, and hand dug wells are most of the time prone to contamination due to their very shallow depths.

The CBSM is a framework which was established by ministry of Water, Irrigation and Electricity, the core aim of the framework is building a structure of community-based management of water supply systems to ensure long term functionality, by community-based operation and maintenance. It is undeniable fact that, community-based operation and maintenance is modern approach which contributes for long term service provision of rural water supply systems, whereas the framework alone will not guarantee long term service provision. As there were also other resembling approaches like the community managed projects (CMP) approach which did not manage to ensure long term service provision. As a result, the cascading of the framework, existence of perennial water sources, availability of persistent finance, supply chain for spare parts, user fee collections, technical knowledge and capacity of the community and the contribution of the framework to impact the rural water supply system management etc are imperative. Thus, the CBSM and CMP framework's applicability and nexus with multidimensional water supply system management issues requires further investigation at grass root level. The applicability and the associated impact at community level are

crucial for effectiveness and to guarantee long term service provision through community management of the water supply systems.

2.3 Sustainability and management of rural water supply systems

Supplying clean drinking water is an imperative component for eradicating poverty and improving world population public health. As part of the Millennium Development Goal (MDG) 7, one of the goals was to halve the percentage of people who are unable to access adequate clean drinking water, and basic sanitation by 2015 (UN, 2011). Despite the declared fulfillment of the drinking water part of the goal (WHO and UNICEF, 2014), this is not realistic around the globe, as some regions are still far behind in meeting the goal of drinking water supply (WHO and UNICEF, 2015). Apart from the disproportions in water access, it is also worth noting that the declaration of success ignores two key components of water supply, which are the provision of safe water and the guarantee of a sustainable water supply (Alexander *et al*., 2015).

To achieve the Millennium Development Goals portion of drinking water supply, it has been found that development experts in the water sector are more concerned with constructing new water supply networks than with ensuring their continued service delivery (Katz and Sarah, 1997; Montgomery *et al*., 2009). Few investments were made in operation and maintenance (O&M) and upgrades of the existing water supply system infrastructures (Hutton and Bartram, 2008). Only 5-20 percent of the total water supply project costs are expected to be allocated to operation and maintenance (O&M) compared with the proposed 60 percent for sustainable water supply systems (Hutton and Bartram, 2008). Resource shortages for maintenance activities have jeopardized sustainability while denying communities the benefits of better water systems. In September 2015, in its Sustainable Development Goals (SDGs) (United Nations, 2011), the UN General Assembly developed a standalone water goal (number 6), The goal targets on ensuring availability of water and sanitation for all as well as guaranteeing their sustainable management as well. This experience shows that water supply systems continue to be a problem even after the MDGs.

The determinants of sustainability of rural water supply systems are classified into two primary classifications. There are pre- implementation and post-implementation

considerations. Some of the variables for pre-implementation are community engagement, choice of technology, choice of location, sensitivity to demand, construction quality and training of the user community. The post water supply systems implementation considerations embrace technical support from the concerned departments, community satisfaction on the services provided, operational and maintenance (O&M), financial management, community training and sustainability attributed commitments. Requirement for proactive approach is one of the variables for pre-implementation of rural water supply systems. In this perspective, demand is characterized as the quantity and quality of water supplied where community members choose to consume at a given price rate (Gizachew, 2005). In a demand responsive strategy, recipients should feel the need for a secure supply of drinking water to define safe drinking water supply initiatives. As a result, demand for water supply should encourage the management of the water supply system and increase the sustainable cost for the water supply system (Gizachew, 2005).

The vital issue to sustainability is engaging user groups in the effective planning, implementation, service, safety, and maintenance of water supply systems. Community members' contributions may take the form of cash, labor, equipment, services, or involvement in project-related decision-making and meetings (Davis and Liyer, 2002).

Over the past three decades, experience has shown that water and sanitation operations are most efficient and viable if they encompass a participatory strategy that responds to real demand, builds operational and maintenance capacities and cost sharing, involves community members directly in all key decisions, develops a sense of community ownership of the project and makes appropriate use of the project education / training and participatory efforts to change behavioral practices are also important (USAID, 2009).

Long-term service provision of any water program is almost wholly dependent on effective operation and maintenance (O&M), and this part of the water supply system is still a very often mistreated facet (Musonda, 2004). Implementing an effective Operation and Maintenance system depends on related layers of imperative management. The first level is centralized control by an external body of water supply systems; the second layer has zonal / regional responsibilities, and the third tier is local government (Sami &

Murray, 1998). The first two solutions are unsuitable for water supply facilities operated by the community because they are a centralized structure that emphasizes a top-down form of support. Unfortunately, these strategies have struggled to effectively maintain and provide service to rural water supply systems. The third tier will be more successful in ensuring that sustainability is promoted. If the societies fail to run and manage their own water supply networks, sustainability cannot be completely realized. This is mainly because operating and maintaining of the water supply system on the day to day basis ensures that the facilities continue to function for long durations.

2.3.1 Factors contributing for sustainability of community managed rural water supply systems

In this portion of the literature review, the various key factors that influence sustainability of rural water supply systems will be investigated. Based on reviewing different existing literatures, the below factors contributing to sustainability of community managed rural water supply systems were recognized as key for maintaining sustainability by (Harvey and Reed, 2004), which are directly or indirectly related to the constraints of the rural water supply systems management. Some of these key factors which contribute for the sustainability of rural water supply systems encompass: Policy environment; Institutional structures; financial resource; Community and other Social entities; Technology; Support of supply chain; and operation and maintenance (O&M).

Apart from the indicated once, (Lockwood *et al*., 2004) reached at two critical factors which are constraints for community-managed rural water supply systems, these are related to post implementation of water supply projects.

a) Constraints which are internal to the community

The constraints of community managed rural water supply systems which are internal to the community and leading to complications of management are, community dynamics, political or social conflict, lack of cohesion, lack of technical and managerial capacity and lack of financial resources.

b) Those constraints which are external to the community

The constraints which are beyond the domain of the capacity of the community and require external involvement or support for the management of rural water supply systems are, shortage of spare parts availability and supply, lack of supportive policies, conflicts, problems associated to water supply systems extension and upgrading.

The various factors enumerated below are believed for influencing the community-based management of rural water supply systems in most settings. These critical factors discussed below were used for the purpose of this research, as identified by different literatures. The factors are also considered as being prime role players either as constraints or contributors for consistent management of rural water supply systems, in case of exclusions and inclusions, respectively.

2.3.1.1 Technical factors

One of the main factors in deciding a successful management of rural water supply systems is technological factor. In the categorization of technical factors, the issues investigated relate to technology preference and selection, technical capacities for the operation and maintenance of water supply systems, and availability of spare parts on the market and at various support agencies.

Technologies that are favored are low-cost, easy to understand and manage and easy to repair technologies, which likely to be more reliable than those needing experience or equipment (Harvey and Reed, 2004). A study conducted by (Katz and Sara, 1997) found that sustainability was higher in communities where the community is informed about technology choices, the type of technology and the community is made to be convinced of the level of service provision. The study found that quality of water supply systems construction works had a significant influence on sustainability aside from technology as per (Katz and Sara, 1997). The easiness for performing operation and maintenance (O&M), level of acceptability and satisfaction by beneficiaries and cost of the technology type ought to be considered jointly when looking into technology choices, (Harvey and Reed, 2004).

An adequate supply of spare parts and maintenance tools are obvious to be the primary necessity for consistent and long-term functioning of rural water supply systems. Spare part supply chains are now being recognized as one of the key determinants for sustainability. This true when the technology supplied is imported, like hand pumps, solar pumps, submersible pumps, and generator sets. There are very limited sustainable supply chains in Africa, and that many water supply projects continue to replicate in ineffective approaches to supply chain development (Harvey, 2009).

Long term service provision and functioning of any water supply system depends mostly on effective and perennial operation and maintenance (O&M) functions, however this factor is not regularly considered and performed on the ad hoc bases, (Musonda, 2004). Operation and maintenance system bases and functions on different management levels. These layers include those managed by, central body, the regional responsibilities, and the third one consists of the local community (Sami & Murray, 1998). The first two tires are not suitable for community managed water supply systems as they are centralized system. Sustainability cannot fully be realized if communities are not able to operate and maintain their own water supply systems. Hence, the third level, which the community is managing their water supply systems will be effective as the operation and maintenance will be done by the local community.

On the contrary, Harvey and Reed (2004) argued that despite its rising pervasiveness in recent years, operation and maintenance by the capacity and management of the community exhibited minimal success rate and could not be the preferred approach. Based on the study carried out by (Chaka *et al*., 2011), support and funding for major repairs in Ethiopia are generally sourced from line government water departments. In most cases, water, sanitation, and hygiene committees (WASHCOs) lack funds and the capacity to handle, do not have the necessary O&M skills. These capacity limitations of WASHCOs created capacity dependency of WASHCOs on woreda water office. Therefore, new, and innovative maintenance systems and approaches require further investigation, especially those that encourage indigenous private sector participation (Harvey & Reed, 2004).

2.3.1.2 Institutional support

As per Harvey and Reed (2004), many different institutional factors determine the consistent functioning of rural water supply systems. The institutional support sorts for sustainable management of rural water supply systems are attributed to external assistance provided by different agencies. The available agencies providing supports for rural water supply management include donors, non-governmental organizations, government sectors of different levels and private sectors.

In order to ensure the sustainability of rural water supply systems, it is imperative to provide support and direction that addresses a multidimensional factor. There are four principal roles provided by support mechanisms. These are in addition to the conventional type of technical support provided for the Operation & Maintenance (O&M) of physical infrastructure of water supply systems. These support activities encompass coordination and facilitation, follow up and monitoring, information gathering and training provisions for building capacities.

Studies conducted in Ethiopia on rural water supply sustainability indicate that external support in post construction is very minimal and irregular due to different reasons (Chaka *et al*., 2011). The finding of this study showed that the main concern about support is almost on new construction and on implementation phase, rather than long-term support for building capacities and on preventative maintenance operations for protecting major breakages. On the other hand, involvement of local private sectors for post implementation or post-construction phase support is ignored or done on ad hoc bases.

There are no developed reporting lines and mechanisms for operation and maintenance activities, the reporting systems are not working, sometimes minor breakages are reported to zonal and regional departments. There are shortages of available supply chains and linkages with private sector and spare part market is weak. Spare parts distribution is problematic with very weak private sector supply chains.

2.3.1.3 Factors attributed to management and community involvement

The World Health Organization (WHO, 1996) described community management as; “The means that the beneficiaries of water supply systems have responsibility, authority

and control over the development and management of their water supply services". As per the above definition, community ownership and management however does not mean that community will not get support from different external sources. Nonetheless, the community ought to own the water supply system, make the right and timely decisions on when to look for external support, exercises, manages and control over access to the system.

Community based management (CBM) approach in water supplies is fundamentally concerned about the involvement of the beneficiary communities in the management of installed water supply facilities. The CBM is an approach that has been in place and use since long years, as early as 1980s. The CBM was in use long even before the birth of Community Based Natural Resources Management (CBNRM) approach. The Community Based Natural Resources Management approach may be said to be a widening of the CBM, as the previous not only looks at water resources but also other types of natural resources as well, e.g. forests, range lands, water resources, fish resources, wildlife etc. The aim of both CBM and CBNRM approaches are to provide an emphasis to consumer demand for services, build community capacity to manage resources and facilities, and consider long term institutional arrangements for technical assistance to communities.

The community-based management model is the most widely implemented approach to managing rural water supply systems in Africa (Harvey and Reed, 2004). Nonetheless, as identified by (Carter, 2009), communities lack motivation to manage water supply systems effectively, particularly this is true in the rural contexts of Africa. As a result, in many communities managed rural water supply systems, communities are known to experience exclusion from involving themselves in the management of the water supply systems even before major breakdowns encounter. In such instances, the management as well as operation and maintenance issues of the water supply systems are addressed by a support from an external management and rehabilitation programme (Shaw, 2012).

Given the broader utilization of the community-based management approach in various developing countries for managing water supplies, yet the community-based approach to rural water supply systems have their own limitations. Research carried out so far

indicated that community ownership and management approach will raise the level of possession and contribute for the responsibleness in the management. However, in concrete terms just because a certain community possess a water supply system this does not necessarily imply that the community will attain sense of responsibleness for the management, similarly ownership will not ensure the willingness to manage and pay for other operation and maintenance requirements of the water supply systems (Harvey and Reed, 2004).

According to the study conducted by (Whittington *et al*., (2008), there is a claim that community management has contributed to bringing numerous advantages and benefits to the good performance of water supply management. The community-based management approach has assisted in significant changes in management and efficiency as indicated by recent studies. For the reasons of success and failure ascribed to community-based water supply management, a tremendous effort has been made to establish better understanding. Some of these factors are supply chains, gender, participation, community financial contributions and low-cost choices in technology. Based on the work carried out by Lockwood and Smits (2011), it is recommended that where community-based management is the method to help implementation, it should be improved through the legal recognition of committees and the formalization of their relationship with local government.

One of the major problems for most developing parts of the world is the persistent struggle to access safe and sufficient drinking water at an affordable and equitable rate. There is a debate that community-based water management (CBWM) ought to be part of a public management and governance structure that facilitates the approaches of decentralized and multi-actors to problems related to the delivery of public service. This makes service delivery more effective and sensitive, as it involves collaborations between public actors and service users. The central problem that frequently arises in terms of managing resources from common pool is how to properly engage and encourage state, private and local bodies in policy making so that governance can be strengthened.

Nonetheless, how to effectively engage and facilitate national, private, and local organizations using management systems is a fundamental problem that often arises

when managing common resources. Accordingly, this paper argues that rural communities' engagement in managing their water supplies would grow into higher levels of income, efficiency, and sustainability.

2.3.1.4 Environmental factors

On top of the other key factors, the sustainability of water supply systems has an inherent nexus to the water source types and the water sources being used (Harvey and Reed, 2004). A water supply system will function for a longer duration if the discharge extraction rate from the source will not exceed the recharge of the water source. The recharge could be from different sources including rainfall and surface runoff from seas, lakes, and rivers etc. (Lockwood *et al*., 2004) stated that depletion in the quantity of water from a water source will be of a key concern in areas with low precipitation or in low land areas were the rainfall amount is minimal and thus the recharge in to the ground water is limited.

However, even in areas where there is sufficient availability of water, the source can fail to satisfy demand, either due to population expansion or use of the supply for other purposes apart from domestic use. Climate change also affects water availability, especially in rural arid or semiarid climatic condition areas. Ground water table level depletion will be the major adverse effects of climate change. Water quality may also suffer from contamination from agricultural by-products, chemicals, and other surface contaminations from fecal coliforms for shallow water depth water supply sources. Hence, care must be taken in the design and implementation of water supply projects to determine the likely sustainability of the water supply systems over a long period of time, (Lockwood *et al*., 2004).

2.3.1.5 Policy environment

The Ethiopian Water resource Management Policy recognize that water supply is an integral part of the overall water resources management and incorporate water supply planning in the domain of comprehensive water resources management undertakings. The overall objectives of the Federal Water Resources Management Policy (1999) and the Water Sector Strategy (2001) are to promote national energies to make effective,

equitable and optimal use of Ethiopia's available water resources to attain substantial socio-economic growth. The available water resources should be managed based on sustainability as per the policy and strategy. Some of the policy's key principles are the transition of ownership to lower layers, the adoption and enhancement of management autonomy to the lowest possible level, encouraging the participation of all stakeholders, including the private sector; moving to a complete cost recovery for urban water supply systems and regaining of operating and maintenance costs for rural water supply systems and their associated management in an independent manner.

However, the issue of policy environment is not considered to be directly relevant to the tangible occurrences when assessing sustainability at village and community level (Parry-Jones *et al*., 2001). Harvey and Reed, (2004), showed wide range of government policies and strategies that affect rural water supplies, some directly, others indirectly. Many of these have a significant impact on the sustainability of water services, intentionally or otherwise

2.3.1.6 Financial factors

It is explicit that, the water supply sector has been hurt from under investment. This condition happened because of insufficient internal financial ability of developing countries to meet water supply and sanitation goals; lower policy decisions to distribute development aid; a general decline in development aid funding from time to time; and low-cost recovery potential in poor regions (Wallace *et al*., 2008).

This involves putting water supply tariffs and maintaining the fund in the operation and maintenance of water supply systems in the community-based management of rural water supply systems. A key problem facing the water supply systems (WSS) sector is the lack of sufficient funding to resolve the main constraints of water supply systems. In most cases of public partnerships, the issue of affordability and willingness to pay is generally not resolved. Those situations were entered into or during institutional arrangements being created. In the background of Ethiopia, government support has been limited for the maintenance and operations of rural water supply systems. Donor funds concentrate on developing new water-supply systems. Financing for the maintenance of unsustainable

infrastructure comes from numerous sources like the state, local government, sponsors, or external funding agencies.

To date there is insufficient empirical evidence to support these broader assumptions about the potential rule of the community in post- project support activities. While securing finance for operation and maintenance is a major part of the maintenance task, Shaw (2012) states that community members are usually unwilling to pay when everything appears to be functioning. Ideally, water tariffs should provide for future system upgrade, rehabilitation, and expansion costs as well as ongoing O&M financial requirements, this occurs rarely (Harvey and Reed, 2004). Nedjoh *et al.* (2003) contend that a lack of knowledge regarding operation and maintenance costs, inadequate tariffs, and high rates of nonpayment combined with ineffective collections practices and poor financial management undermines the ability of communities to establish and manage such finances on consistent mechanisms. Based on study carried out by Harvey and Reed (2004), one of the main constraints to this is the need for a transparent, secure and sustainable method of holding and investing finance for future use. However, community managed financing mechanisms are rarely able to fulfill these requirements.

Over and above to these, the success of cost recovery mechanisms, as a main post-project implementation element of sustainability, will be influenced by the extent to which individuals and management committees are reinforced, provided with refresher trainings, and directed in relation to tariff structures and broader scope of financial management (Gebrehiwot, 2006).

2.4 Conceptual framework

Based on the work of various authors, (Lockwood *et al*., 2004) classified the determinant factors for the coherent functioning of rural water supply schemes in to two main groups. These wide categories are factors of pre-implementation and post-implementation. Community participation, choice of technology, choice of sites, responsiveness to demand, quality of building, population and training are some of the variables of pre-implementation. And post-implementation variables are technical support, satisfaction of the community, technical institutional support, financial management, training, follow-

up and monitoring and readiness to maintain the installed water supply system facilities (Lockwood *et al*., 2004).

From the analysis of different research studies, the variables that directly influence consistent functionality of rural water schemes are; water, sanitation and hygiene committees (WASHCOs) capability, user fee collections, appropriate system for operation and maintenance and environmental factors including ground water variability. Training and satisfaction on the part of the society with the results of the water management committee on the part of the community are the dependent functions which affect the determinants.

Several frameworks were used to assess growth and sustainability, which include list of various sustainability determinants and testing the functions to decide the impact of each element. This assessment focuses on issues related to long-term constraints for managing rural water supply systems, encompassing issues associated to community-based management , institutional, technology, environmental, financial management and operation and maintenance (O&M) of rural water supply systems in Ethiopia, and thus the analytical framework revised as appropriate. Lockwood (2003) reviews the various mechanisms used to assess critical determinants influencing the efficiency of water supply systems, based on the following main categories

1. Technology, 2. Social, 3. Institutional Assistance, 4. Impacts on the environment, and 5. Economic matters

The variables can be divided in relation to this classification either within the realm of community control (willingness to pay, social capital or solidarity, and motivation) or out of the domain of the communities (legal structure, technological architecture, water supply, accessibility of spare parts, and institutional assistance). Not all factors are strictly internal or external and depend on variables from each. An example is the community's management power, which is influenced by the community's human resources (internal) but also by the institution's supply

Furthermore, other work also examines contributing factors such as diversity in male and female involvement, socio-economic status in the group and professional institutional support.

The following conceptual frameworks for achieving sustainability by Global Journal of Human – Social Science: H Interdisciplinary by Moses M. M. Daemane, 2015, "The Empirical Conceptual Framework for the Understanding of Factors Important for practicality of Rural Water Supply Systems Sustainability for Communities." 15(5):5-120, are designed to represent the scenario for community-managed rural water supply systems in Walmara woreda.

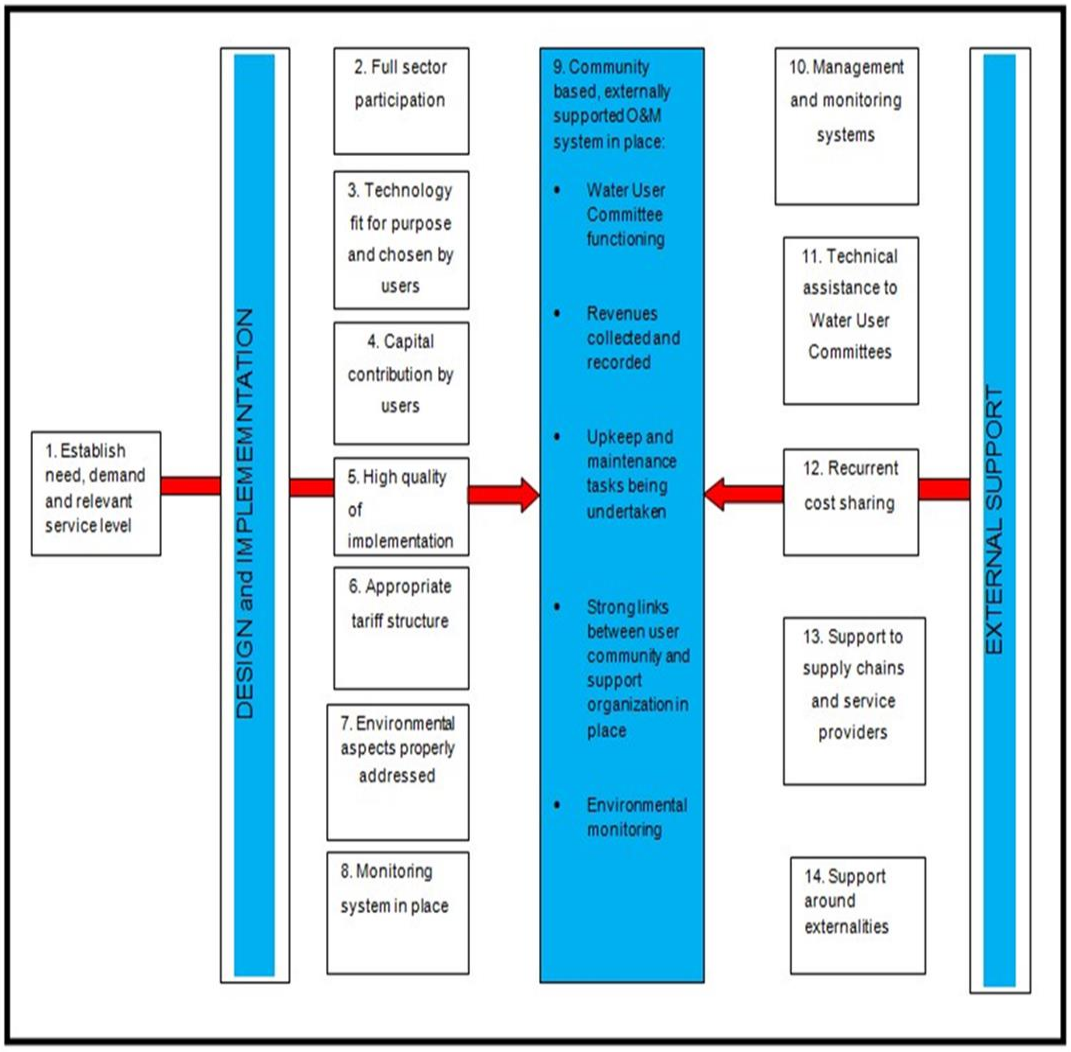

Figure 2: Conceptual Framework for Sustainable RWS Services (Daemane, 2015)

3. RESEARCH MATERIALS AND METHODS

3.1 Description of the study area

A) Location and demography

Walmara woreda is one of the 12 woredas located in the Finfinne special zone of Oromia region. This woreda is administratively divided into 34 rural kebeles and one urban kebele. It is bordered by Sebeta woreda on the South, Mirab Shewa on the West, Mulo on the North, Sululta on the North-East, and Burayu on the East. Mount Wechacha (3191 meters), situated in the Southern portion of the woreda, is the highest point in this woreda. The other prominent peaks accessible in the woreda are Mount Menagesha, ranging from 2800 meters above sea level to 2900 meters above sea level.

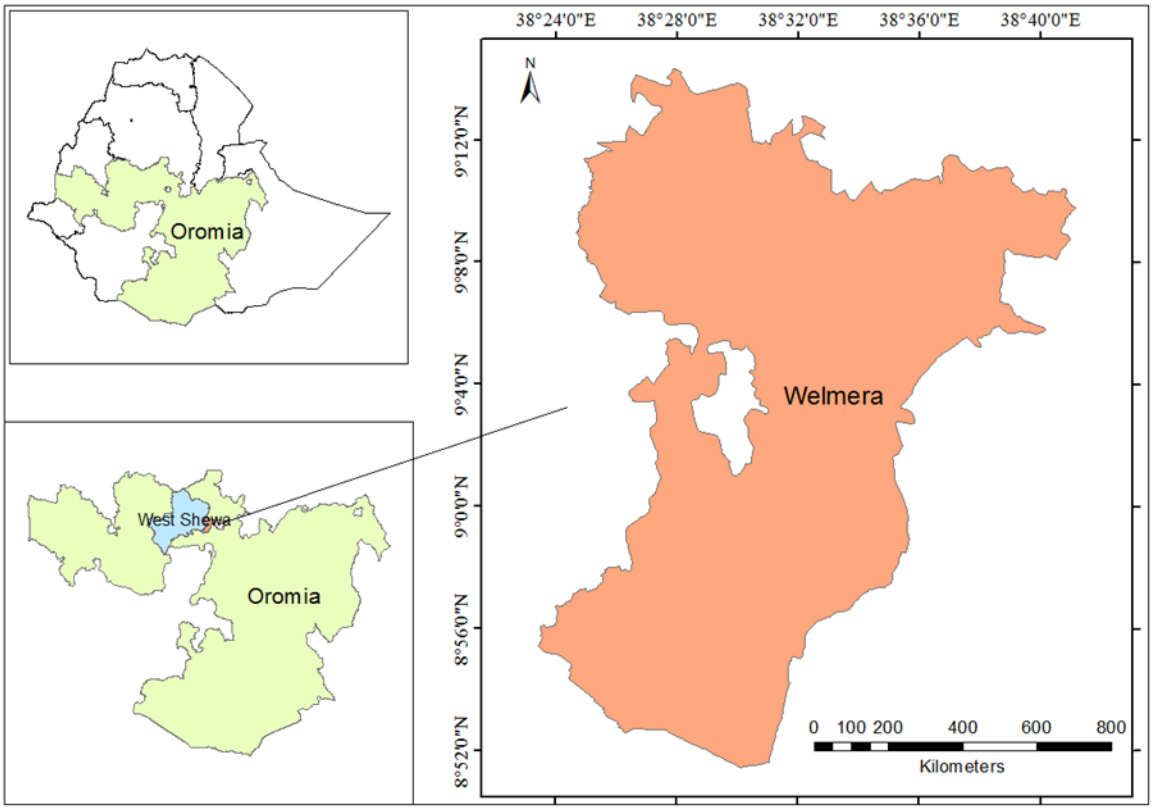

Figure 3: Map of Walmara woreda

Agriculture is the Woreda's primary economic source and 96% of the livelihood of the population depends directly or indirectly on this sector. Walmara Woreda's main crops

are wheat, teff, corn, beans, and hardly anything. The largest part of all other crops was the production of wheat.

For this woreda, the national census of 2007 recorded a complete population of 83,823, of which 42,115 were males and 41,708 were females; 3,352 or 4% were urban residents. Most of the residents said they practiced Ethiopian Orthodox Christianity, with 86.72% of the population reporting this faith, while 6.36% of the population practiced traditional faith and 4.61% were Protestant.

The woreda has an estimated area of 736.88 square kilometers. Walmara has an estimated population density of 218.6 people per square kilometer, which is greater than the zone average of 152.8 people per square kilometer.

B. Status of water supply in Walmara woreda

As pe the information obtained from Walmara woreda water resource development and energy office, the overall rural water coverage of the woreda in 2018 is 68.7%. There are 428 installed water supply schemes which are serving the community in the woreda, with respect to the distribution of installed water supply schemes, 117 are shallow wells having depths ranging from 45m- 75m, 252 hand dug wells, 54 are spring sources and 5 deep boreholes having depths ranging from 90m-250m.

The aforementioned water supply access coverage is calculated only relying on the number of the water supply facilities constructed so far and does not base on tangible current functionality levels of the constructed water supply systems. This is attributed to budget limitations, lack of logistics facilities and unavailability of technical supporting staffs to perform regular water supply functioning inventory across the rural kebeles of the woreda.

The below table summarizes the distribution of different types of rural water supply systems and their status in Walmara woreda

Table 1: Overview of rural water supply systems situations in Walmara woreda

No.	Type of Water Supply Systems	Total Number of Water supply systems	Functionality Status	
			Functional	Non-Functional
1	Hand dug wells	252	183	69
2	Shallow wells	117	68	49
3	Deep Boreholes	5	5	0
4	Spring Development	54	38	16
	Total	428	294	134

Source: Walmara woreda water resource development and energy office, 2020

Majority of the water supply systems installed by government and local/international NGOs concentrate on ground water supply sources because of existence low number of perennial surface water sources in the woreda. During the critical and extended drought seasons these water supply sources particularly hand dug wells could not provide water due to depletion of the ground water table below the pumping water levels. The principal reason for the drowning of the water level is the insufficiency of recharges coming into the water sources. These ground water table variabilities are associated to the repeated encountering of extended dry seasons and erratic rainfall occurrences. From this, it is easy to observe the extent how climate change impacts are worsening the life of the rural population and are also the prime contributor of such prevalence's.

Hence, this is one indication that multidimensional and multisectoral collaborations worth imperative at international, national, regional, and local level to lessen the adverse impacts of climate change on the life of the rural population.

3.2 Research methods

Mixtures of quantitative and qualitative research methods were used for this study purpose. Quantitative methods used to determine the factors attributed for consistency and achievement of functionality as well as reasons for non-functionality. On top of this,

to demonstrate the relationships between key factors examined in the literature review (financial, technical, technological, management, institutional, environmental, social, etc.) that might account for achieving sustainability. There was also use of qualitative methods to create a deep knowledge of the problems. And the study used a cross-sectional research design to collect information at a single stage in time for various instances.

Household beneficiaries, elderly and influential peoples, water, sanitation, and hygiene committees (WASHCOs) and the woreda water department were used to be the units of inquiry in this study. A community (a group of households in a specific location sharing one or more water supply facility) and water supply systems were regarded as a unit of evaluation in this research, while main informants, mostly water committee members, were regarded as observation units.

3.3 Research design

The research design which was employed is a descriptive research using a cross sectional study design to investigate the challenges contributing for the poor management of rural water supply systems in the woreda. Different methods of data collection like semi-structured questionnaires, interviews, discussions like focus group discussions (FGDs) and field observations employed to produce primary data. Moreover, secondary data were collected from existing documents, books, journals, reports, and other sources from sector offices and concerned bureaus inside and outside the woreda.

3.4 Sampling frame and procedures

In three purposively selected kebeles of Walmara woreda, nine community managed rural water supply systems were selected. Water sources those built over the previous ten years were selected and studied using a stratified sampling technique for functionality and non-functionality. The on the spot water supply sources for this study propose selected using random sampling from the list of the water supply sources from the woreda water office. The research focused on water supply systems installed between 2008 and 2017 GC. The ultimate reasons for these were, woredas commenced practicing implementing construction of rural water supplies by a budget source of the woreda very recently, the

issue of water supply system management by a community does not have a long year experience and lack of information may encounter due to reshuffling of committee members for different reasons , last but not least is ensuring the study is consistent and have a manageable scope.

A stratified random sampling technique used to select water sources within the study kebeles. A total of three water sources were selected in each kebele. The stratification was according to constituencies, the water supply systems for the study from the purposively selected kebeles were identified, combining the currently functional as well as non-functional water supply systems to help investigate their tangible constraints for the research analysis.

3.5 Sample size determination for household survey

As per the information obtained from the woreda water office, there are 428 installed water supply systems which are serving the community in the woreda, with respect to the distribution of installed water supply systems, 117 are shallow wells having depths ranging from 45m- 75m, 252 hand dug wells, 54 are spring sources and 5 deep boreholes having depths ranging from 90 - 250m.

For the purpose of this research, it is organized to perform assessment and investigation on the constraints of nine rural water supply systems which were being administered by community-based management approaches to be sampled for the analysis. The research carried out in three kebeles of the woreda. This is done purposively to manage the data collection and analysis appropriately within the limited financial and time resources available to the researcher.

A proportionate stratified sampling technique employed to decide the quantity of functional as well as non-functional water supply systems in the three kebeles, to be investigated and considered as sample. The stratification first considered the whole water supply systems in the three kebeles, secondly community managed water supply systems with hand dug wells, shallow wells and spring water sources taken with exclusion of deep borehole sources for the sampling and thirdly both functional and nonfunctional water

supply sources included based on the proportion of functionality and non-functionality of the water supply systems.

Thus, out of the existing 428 water supply systems in the woreda, 294 were functional and 134 were found to be nonfunctional. The functionality and nonfunctionally percentages the of the rural water supply systems in the woreda, 68.70% are functional and 31.3% are nonfunctional. Hence, for this study purpose, as the aim of the research is to investigate the constraints of the community managed rural water supply systems, six functional and three nonfunctional water supply systems were proportionately determined as the sample size for this study propose. Hence, two functional and one nonfunctional community managed rural water supply systems including hand dug wells, springs and shallow wells considered per kebele, taking in to account accessibility, distance, and feasibility concerns purposively. This is ultimately anticipated to assist in attaining a realistic result in this study, through assessing the concrete reasons contributing to functionality as well as to find key constraining factors contributing for non-functionality of community managed water supply systems.

However, the five complex deep borehole source water supply systems, which were assembled to submersible pumps and generators sets and being managed by intensive support of the woreda and zone water departments, were not considered in the sampling process. This is mainly because these water supply systems are not supported by the community-based management approach. Thus, six functional and three non-functional rural water supply systems which were managed by the community were sampled randomly from the three kebeles (Minjaro Watabacha, Ade Simbir Qotu and Barfata Tokkofa kebeles).

The beneficiaries who are and who have accessed the water supply service were the main sources of primary data sources in this research. Depending on the standard of the Ministry of Water Resource Development (MoWRD,2006), an estimated number of users per type of rural water source is hand dug well: 250 users; shallow borehole: 500 users; and on spot spring sources: 300 users. Based on this standard, an average of 350 (70 HH) beneficiaries are benefiting from one on the spot water supply source and

the sample size determined using a simple random sampling technique from this population to provide equal probability of being chosen.

To identify the number of households to be surveyed, in a statistically representative way, the following formula by Kendie, (2002), cited in Braimah and Fielmua (2011), was used. According to this author three factors are considered in the sampling of the households. The desired level of confidence (92%), the error tolerance level (8%), and the proportion of the population with access to potable water /water coverage in the woreda (68.7%). For the purpose of this research, the error tolerance level will be raised from (5%) to (8%), due to the assumption that the members of the community in this study area are socially, culturally and economically more or less homogenous.

The sample size was then determined using the following formula:

$$\mathbf{N = (z/e)^2 (p) (1\text{-}p)}$$

Where:

- N=sample size,
- z = standard score at 92% Confidence Level (1.76),
- e = sampling error allowed (0.08),
- p= water coverage/ proportion of population with access to potable water in the woreda (68.7%)

Therefore $N = (1.76/0.08)^2 (0.687) (1\text{-}0.687) = 104$

The assumption is that an equal portion of persons from households were benefiting from each water sources or the 9 sample water supply sources and which provided about 104 persons or households in total. Thus, the number of respondents for the household questionnaire survey from the nine water supply sources in the three kebeles has a sample size of approximately 104 households, which is nearly 11.56 households per water supply system. For the sake of equity in the distribution of respondents per water supply systems and to obtain a realistic result, 108 households considered as a sample size, with 12 respondents per each water supply system.

3.6 Data collection methods and tools

3.6.1 Household survey

Questionnaire-based survey used to administer to sample rural water supply systems beneficiaries or households (HHs) by using a questionnaire survey after obtaining the consent of the respondents as a research ethics.

Household heads were interviewed focusing on women (who are responsible for water collection and storage in the rural context of our country). The instruments of the research adopted is semi-structured questionnaires, basically cross-sectional primary data collected from households about their water use practices and constraints they have been encountering in managing water sources as well as accessing water from installed facilities.

The information required and gathered were related to technical, social, economic, management, sense of ownership and community involvement, sustainability, financial, institutional arrangement, support provided and key constraints in service provisions of the water supply systems. Under each factor several sub-factors/variables were considered.

The questionnaires used assisted to collect primary data related to the socioeconomic characteristics of the respondents, type of water sources, water supply systems status (functionality and non-functionality), community based management, accountability and responsibility of service delivery system, key constraints in the service delivery, participation of women, technical support, technology preference, availability of spare parts in their market, general perception of customers towards the service, level of consumer satisfaction for the service provided and other technical and institutional issues were collected through semi- structured questionnaires.

The questionnaire was prepared using English language and translated in to Oromiffa to ease data collection and maintain quality of the data collection. Data collectors were selected based on their language proficiency and have also the required knowledge of the local dialect for the sake of simplicity and to capture explicit information attributed to the constraints of the rural water supply system usage and management. The questionnaire

was edited in the light of the results of the study. Computer-based data cleaning were carried to check for the completeness, consistency, and accuracy of data and to identify errors that may occur during data collection or coding process.

3.6.2 Key informants' interview (KII)

In addition to the cross-sectional survey to be carried out, some key persons included in the sample water supply systems and the kebeles were interviewed to obtain relevant information. The KII were carried out with kebele administrators, development agents (DAs), health extension workers and woreda water office experts etc. Three interviews were conducted in the three kebeles at an average location to the three water supply sources in each kebele. The researcher utilized a semi- structured interview. This technique used assisted as they are flexible, allowing the researcher to pursue issues as they were raising.

An in-depth interview executed focused on organizing formal interview with the aim of facilitating open interaction between the key informant and the researcher through inviting key figures in the respective institutions relevant for the issue under discussion to participate in open dialogue forum. The KII employed a face-to-face dialogue and conversation with the participants.

3.6.3 Focus group discussion (FGDs)

Three focus group discussions (FGDs), one FGD per three water supply sources or one FGD per kebele was conducted, each FGD were made to have a size of eight participants. The composition of the participants incorporates elderly peoples, user households, WASHCOs, women water management committee members, community leaders and influential people to collect qualitative data using a semi- structured questionnaire guide. The participants were respectfully requested for their consent, time, and the information. Topics related to issues of the overall management of the water supply systems, functionality and non-functionality level of the water supply systems, the role of WASHCOs, technical issues, availability of spare parts, financial topics including cost recovery, community participation including involvement of women, constrains observed

in the water supply systems, opportunities and challenges encountered and the existing support from the government and NGOs were addressed in the FGDs.

3.6.4 Field observation

In addition to the above data collection methods, a field visits executed by the researcher to substantiate and augment the information obtained through other primary and secondary data collection tools. The types of technologies and water supply sources, quality of construction and protections, yield of the water supply sources, soil and water conservation physical structures accomplished in the upstream of the water supply sources, the management of the water supply facilities including fencing and proper drainages, role of the community, the presence of responsible body for the operation, consistency of the discharge during critical dry seasons, the appropriateness of the construction to be accessed including by vulnerable segments of the community and the degree to which the facilities were constructed being free of exposure to contamination were explored through the field observation.

3.6.5 Ethical considerations

In an effort carried out while performing this research, the researcher took major steps to address ethical considerations and discretions of the beneficiaries, including privacy and informed consent prior to conducting the interview. All the study participants were made to have an understanding about the purpose of the study; accordingly, an oral consent of the study concerns was gained earlier to the commencement of the data collection process from all the interviewees. On top of this, the partakers were also explicitly informed that they have full right to refuse in being involved in the information provision purpose for the study. It was ensured to the respondents that their names will not be revealed in the questionnaire and shared for other second party under any circumstances. All the interviews were taken place in a place which where convenient and in a closer proximity to the localities of the attendants. The respondents were also communicated that they are guaranteed for the information they provided, and the information will be kept confidential and utilized for the purpose of the research only. They were also made

sufficiently aware, that there were no problems they might encounter in relation to the information they provided for the purpose of this research.

3.7 Data analysis

The results of the study were analyzed using descriptive statistics based on frequencies and percentages. Inferential statistical analysis using Pearson's Chi-Square tests and ANOVA (Analysis of variance) were also used to determine if there were significant differences on selected variables across kebeles. Like, types of installed water supply systems and technologies as well as constraining factors contributing for functionality and non-functionality of the water supply systems in the study area.

In order to determine reliable results for the research, qualitative and quantitative data were gathered from beneficiary households, woreda water office professionals, elderly peoples, kebele administration, development agents and water management committees. The collected data were entered and evaluated using semi- structured questionnaire interviews and conversations for the study purpose. In order to maintain the quality of data, scientific principles and guidelines during questionnaire designing, data collection, data filling, encoding, data entry and processing were applied. Data collectors were made to be oriented on issues related to data collection procedures, ethics and confidentiality of the information provided by respondents.

4. RESULTS AND DISCUSSIONS

4.1. Characteristics of the survey households

Sex and age of the survey households

Characteristics of survey households are given in table 2. The analysis revealed that among the survey participants, 87% of them were male and 13% of them were female. Of all respondents, the majority (89.8%) were married, while 2.8% and 7.4% were divorced and widowed, respectively. The minimum and maximum ages of respondent were 24 and 67 years with an average age of 44 years old. However, from experience this neither necessarily generalize a natural distribution of age and neither sex of respondents nor indicative of the larger trends of the distribution of sex and ages of the rural community water supply systems users.

Headship and size of respondents

The study finding showed that an average household (HH) size of survey households was 4 family members. Among the responding households, 89.8% were male headed, while the remaining (10.2%) were female headed households. The average household size is slightly lower than the average Ethiopian HH size, which is about 4.7 persons (CSA, 2007).

Table 2: Characteristics of the survey households

Characteristics	Categories	Frequency(N)	Percentage (%)
Sex	Male	94	87
	Female	14	13
Age	18-27	8	7.4
	28-37	27	25
	38-47	35	32.4
	48-57	20	18.5
	>=58	18	16.7
Head of Household	Male headed	97	89.8
	Female headed	11	10.2
Marital status	Married	97	89.9
	Divorced	3	2.8
	Widowed	8	7.4

Household (HH) size	Two	12	11.1%
	Three	15	13.9%
	Four	15	13.9%
	Five	16	14.8%
	Six	12	11.1%
	More than 6	38	35.2%
Educational level	Illiterate	32	29.6
	First cycle (1-4 grade)	29	26.9
	Second cycle (5-8 grade)	25	23.1
	High school (9-10 grade)	18	16.7
	Preparatory	3	2.8
	Diploma and above	1	0.9

Source: Own survey, February 2020

Educational level of respondents:

Regarding the education status of the respondents, 29.6% were illiterate, 26.9% attended first cycle (1-4 grade) school, 23.1% educated up to second cycle (grade 5-8) and 16.7% attended high school (grade 9-10) level education (Table 2). The proportion of survey households attended preparatory and above level of education were small (3.7%).

Survey household's livelihood and income sources

As showed in table 3, the majority respondents' (95.4%) occupations was agriculture in fact few of them have additional income from petty trading and daily labor works. Households whose livelihoods fully deepened on non-agricultural activities account about 4.6%, which they are mainly depending on daily labor work (3.7%) and petty trading (0.9%). The survey also revealed that very small number of the respondents whose livelihood majorly depending on agriculture also generate additional income from skilled labor works (0.9%) and petty trading (2.8%).

Table 3: Household income and other characteristics

Characteristics	Categories	Frequency (N)	Percentage (%)
Major occupation	Farming and other agricultural activities	104	95.4%
	Government employee	0	0.0%
	Daily labor	4	3.7%
	Petty trade	1	0.9%
Additional income	Employment as skilled laborer	1	.9%
	Income from petty trade	3	2.8%

Source: Own survey, February 2020

Water supply sources of the survey households

Concerning the water supply sources of respondent's majority fetch from shallow (46.3%) and hand dug (42.6%) wells for the household use, while only 11% use from protected springs (Table 4). Here attention should be paid that the potable water supply of people in the study woreda and kebeles was not 100%. As our analysis focused on functionality of water supply schemes, our study respondents were confounded only to households were using potable water sources. The highest numbers of water supply source (33.3%) were built in 2010 over the study periods, i.e., 2008 to 2017. Of the different water supply systems, 75.9% were built by government while the remaining 24.1% by NGOs.

Table 4: Water supply sources of the survey households

Characteristics	Categories	Frequency (N)	Percentage (%)
Types of water supply system	Hand dug wells	46	42.6%
	Protected Springs	12	11.1%
	Shallow wells	50	46.3%
Year the water supply schemes constructed	2008	24	22.22%
	2009	24	22.22%
	2010	36	33.33%
	2014	12	11.11%
	2017	12	11.11%
Bodies constructed the water supply scheme	Government	82	75.9%
	NGOs	26	24.1%
Total		108	100%

Source: Own survey, February 2020

4.2 Constraining factors for community managed rural water supply systems

4.2.1 Water supply systems in the study area

According to key informants interviews (KIIs) with woreda and kebele level officials, focus group discussions (FGDs) with community and field observation, in the studied three kebeles of the 9 water supply schemes, 6 were functional but 3 were non-functional at time of the study. These water supply systems were constructed between 2008 and 2017. Of the functional schemes, the types were 1 hand dug well, 5 shallow wells and of the nonfunctional, 2 were hand dug wells and 1 protected spring. Secondary data obtained from the respective schemes water committee and woreda water resource development and energy office shows that 2,844 beneficiary people have been using these water supply sources (Table 5).

Table 5: Status of water supply schemes and beneficiaries of the study kebeles

Kebele	Name of water source	Type of water source	No people using	Status	Year of construction (G.C)
Ade Simibera Ootu	Kite	Hand dug well	494	Non-functional	2009
	Maru	Hand dug well	461	Functional	2013
	Akuna	Shallow well	326	Functional	2010
Barfata Tokkofa	Guntuta Gadi	Hand dug well	100	Non-functional	2010
	Caancoo	Shallow well	111	Functional	2015
	Guntotu olie	Shallow well	312	Functional	2010
Minjaro Watabacha	Simbirit spring	Protected spring	250	Non-functional	2008
	Goro bila	Shallow well	749	Functional	2014
	Safara 2nd	Shallow well	353	Functional	2017
Total			2,844		

Source: Walmara woreda of water resource development and energy office

The study investigated factors influencing or constraining management of community-based rural water supply systems. The factors found were generally classified into institutional, technical, social, environmental, and financial.

As shown in table 6, the surveyed households indicated 33.33% of their water supply systems were not functional. Some of the water supply systems in the functionality range had low sustainability level which likely drop into the partially sustainable condition. The

high-ranking percentages of unsustainable water supply systems resembles literature on rural water supply would suggest being the case for developing countries. For example, Harvey and Reed (2004) reported that in the sub-Saharan Africa countries, the proportion of unsustainable water supply systems range between 20 and 40%. This implies that, although governments of developing countries continued to invest in new water supply infrastructure construction, communities are not enjoying the intended benefits of the investments due to sustainability reasons. Thus, for such investments to positively contribute towards the achievement of the sustainable development goals (SDGs) in the rural water supply sector, the underlying constraints for functional community management should be known since the provision of improved water supply system is not enough if the facilities are not managed sustainably.

Table 6 : Status of the water supply systems of the survey households

Question	Categories	Frequency (N)	Percentage (%)
What is the current condition of your water supply facility?	Functioning	72	66.7%
	Non-functional	36	33.3%
	Total	108	100%

From the focus group discussions, it was leant that most of the hand dug wells were found non-functional. The major causes of the non-functionality of the hand dug wells were drying of the wells and problems related to construction quality. It is true that, hand dug wells are water sources having a very shallow well depth and are prone for water table depletions in extended dry seasons. Apart from this, if the top of the water sources is not sealed firmly with concrete, possibility of being contaminated by external pollutants including human and animal wastes and toilet sewerages could occur. Hence, focusing on deeper water sources like shallow wells to reduce water shortage and quality concerns related to hand dug wells. In addition, technological functionalities and management remain to be the main matters for sustainable service delivery of the water supply systems.

4.2.2 Constraining factors influencing community-based rural water supply systems management

The factors which play significant role as constraints of community-based management of rural water supply systems as per this study are technical, institutional, social, environmental, and financial factors. These factors are discussed in the following sections.

4.2.2.1. Technical factors

Functionality of water supply systems

As discussed above the survey results show that across the three kebeles of the study area, 33.33% of the water supply systems were not-functioning. The level and reason of non-functionality of water supply systems are resembling across the three kebeles studied. High non-functional water supply systems negatively impact on the availability of potable water for domestic use. The chi square test results in the table 7 showed strong positive relationship between functionality and availability of spare parts for lifting technologies. The study shows that the proportion of functionality of the water supply systems is similar across the studied three kebeles.

Survey respondents gave different reasons for the non-functionality of the water supply schemes. Accordingly, as shown in the figure 4, 56% of the respondents attributed the non-functionality to lowering of the ground water table particularly for hand dug wells, which are having shallow well depths. On the other hand, 34% of attributed the non-functionality of water supply schemes to shortage and unavailability of spare parts for hand pumps in their locality and on the local markets in their vicinities. In addition, 10% of respondents attributed the reason of non-functionality of the water supply systems to poor management of schemes by the users.

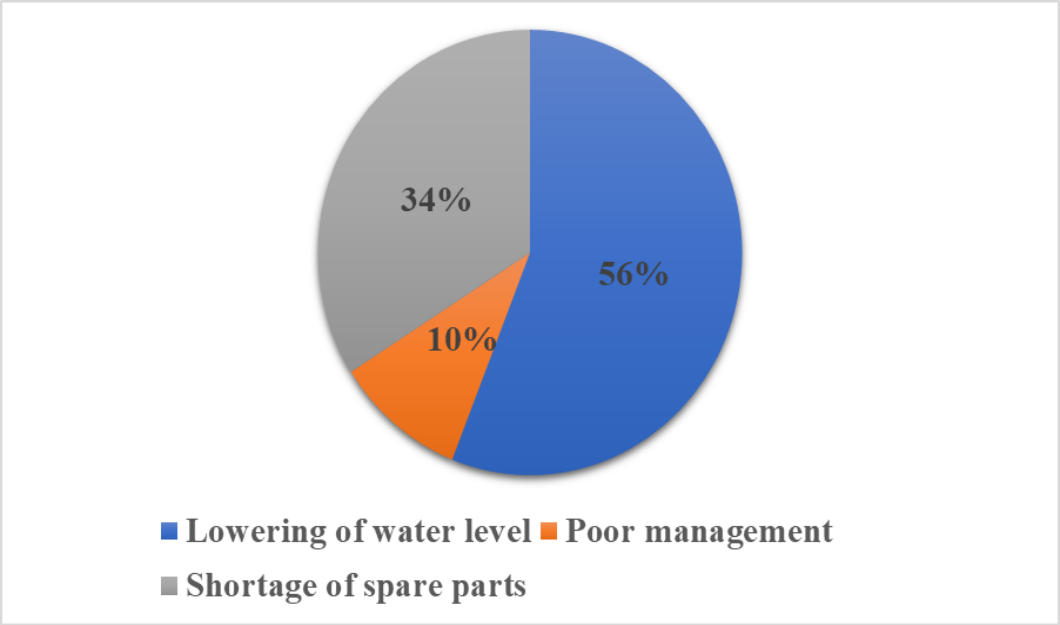

Figure 4: Reasons for non-functionality of water supply schemes

On the other hand, 56.5% survey households reported that the water supply schemes break very frequently even when the water supply sources have sufficient water. Among those who reported that there are heavy breakages on water supply schemes, 42.6% of the respondents indicated that the water supply systems encounter damage once or twice a year.

Schouten and Moriarty, (2003) indicated that availability of technical support through establishing effective spare-parts supply chains is very imperative in the rural water supply sector. The authors also underlined that focus should be placed on building capacities and technical skills of the community by offering training, so that the community can perform maintenance of water supply systems by their own effort when breakages occur without seeking external support.

Table 7: Major factors affecting water supply systems functionality

Questions	Factors	Households who responded yes		X^2	Point Probability
		Frequency (N)	Percentage (%)		
What are the greatest challenges to the proper functioning of the water supply sources	Fee contribution by users	3	2.78%	10.927	.053*
	Lack of technical support	0	0.00%		
	Lack of technical skill	5	4.63%		
	Shortage of spare parts	26	24.07%		
	Problems related to quantity of water	14	12.96%		
	Lack of community participation	15	13.89%		
	Other reasons	9	8.33%		
The most critical factors to ensure sustainability of water supply facilities	Community participation	59	54.63%	18.839	.001*
	Lack of management support from the woreda water office	1	0.93%		
	Lack of technical support from external bodies including NGOs	1	0.93%		
	Availability of spare parts in the market	8	7.41%		
	Other reasons	3	2.78%		

The major factors affecting the functioning of water supply systems includes unavailability/shortage of spare parts, lack of technical skill, limited water fee contribution of users, inadequate water yield that resulted in depletion of ground water table and lack of community participation (Table 7). As indicated in table 7, the chi square test showed that significant association between greatest challenges (X^2=10.927, p=.053), and critical factors (X^2 = 18.839, p= .001). These includes that the presence of fee contribution by users, lack of technical support, lack of technical skill, shortage of spare parts, problems related to quantity/quality of water source, and community involvement problems are associated with water supply systems functionality.

Among all survey participants 52.8% reported that over the past 12 months the water supply schemes were repaired once, while nearby 51% respondents said that repair of the non-functioning water supply schemes took over three months (Table 8). All underlined that the maintenance activities were accomplished by experts from the woreda water

resource office. Apart from this, almost all (99%) survey respondents indicated that they did not receive any training on operation and maintenance of water supply systems. Thus, they lack the technical skill to fix broken or malfunctioning parts even for simple problems.

Table 8: Rate of downtimes of water supply systems in the study kebeles

No	Questions	Responses	Frequency (N)	Percentage (%)
1	Do water supply source break very often?	Yes	61	56.5
		No	47	43.5
2	If yes, how many times?	Once in a year	26	42.6
		Twice a year	26	42.6
		Three times a year	9	14.8
3	Did water supply systems get repaired once over the past 12 months?	Yes	57	52.8
		No	51	47.2
4	Did water supply systems take over three months to get repaired?	Yes	55	51.0
		No	53	49.0

The average downtime of water supply systems ranged from once in a year to three times in a year. Most water supply systems in all the kebeles had an average downtime of more than three months which is above the 2 days downtime required for sustainable water supply systems (Dayal *et al*., 2000). The main reasons for long down time periods cited by the community were the unavailability of spare parts at local level and inadequate water volume at water supply systems particularly on schemes fitted with Afridev and Indian Mark-II hand pump lifting technologies. The availability of spare parts for the hand pumps at community level was mentioned as among major contributing factor to the shorter downtimes. This result clearly shows interlinkages among constraining factors for functionality of community managed water supply systems. Such relationships should be well known to enhance the overall management of rural water supply systems.

The study showed that functional water supply systems have had functional water and sanitation management committee. In converse, most of the non-functional water supply systems do not have functional water and sanitation management committees. From this, we can depict that the non-functionality of the schemes related with absence of functional water user committees. These results resemble with findings of (Marks *et al*.,2013), who reported that water supply scheme with functional water user committees were found

more functional as compared to schemes with non-functional committee. Other scholars (e.g., Harvey, 2008; Whittington *et al*., 2008) also emphasized the importance of functional water user committees in promoting sustainability. The authors indicated that such committees need to be capacitated in conflict management, managerial, technical, and financial skills through community based managed training to enhance functionality of the schemes over long period.

Spare parts availability

Based on the information obtained from the respondents, 24.07% believed that the greatest challenge for functionality of schemes is spare parts unavailability (Table 7). Majority (80.6 %) responded that spare parts are not easily obtained on the local market that has been causing failure of hand pumps. Apart from identifying the above key problems, it was confirmed in the study that communities report the problem to the woreda water office whenever schemes failed to work. Of the survey respondents, 60.2% indicated that the water committees report problems to the woreda water office owing to maintenance support. FGDs participants indicated that sometimes the woreda water resource office provides technical and other support for the scheme's that require maintenance. Accordingly, 37% respondents verified that water user committee invites users to discuss about the problems and sought solutions.

Table 9: Spare part availability and conditions of water supply systems

Questions	Responses		Conditions of water supply systems			X^2	Point Probability
			Functioning	Non-functional	Total		
Do you get spare parts from the local market in case of failures due to wearing of fast-moving parts?	No	N	62	25	87	4.256	.038
		%	71.3%	28.7%	100.0%		
	Yes	N	10	11	21		
		%	47.6%	52.4%	100.0%		
	Total	N	72	36	108		
		%	66.7%	33.3%	100.0%		
Were spare parts provided by the woreda water office?	No	N	50	32	82	4.964	.020
		%	61.0%	39.0%	100.0%		
	Yes	N	22	4	26		
		%	84.6%	15.4%	100.0%		
	Total	N	72	36	108		
		%	66.7%	33.3%	100.0%		

Availability of spare parts on the local market in case of failures due to wearing of fast moving parts ($x2 = 4.256$, $p = .038$), and spare parts provision by the woreda water office ($x2 = 4.964$, $p = .020$) were found to be significantly associated (Table 9).

FGD and KII respondents indicated that spare parts for hand pumps were not available at community level in all the three kebeles and at woreda level as well, rather available at zonal water resource development office level. In connection to this, nearly 76% survey households indicated that as they are not getting spare parts for maintenance of their water supply schemes (Table 10). Structurally woreda water resource offices have operation and maintenance section which is responsible to support the community in rural water supply systems.

Table 10: Woreda office support on spare parts

Question	Response	Frequency (N)	Percentage (%)
Do woreda water office provided spare parts for you schemes maintenance?	No	82	75.9
	Yes	26	24.1
	Total	108	100.0

During the FGD, communities complained that they sometimes buy the spare parts from private dealers from Addis Ababa, where the private dealers sometimes supply sub-standard parts which resulted in frequent breakdowns of the parts and non-functionality of the water supply facilities. This was contributing to high non-functionality rate of the water supply systems; this is true particularly for hand dug wells fitted with Afridev or Indian Mark-II pumps. In fact, maintenance of hand pumps mostly performed by woreda water resource development and energy office technicians provided that the community able to avail spare parts. KII indicated that spare parts are available at zonal water resource development and energy office level, in operation and maintenance section. They also mentioned that zonal office does not have sufficient stack and the available spare parts are also of low quality. Hence, unavailability of affordable and quality spare parts at a closer location to the beneficiaries could be considered as key contributing factor for functionality of community managed rural water supply systems.

4.2.2.2 Institutional factors

Existence of water management committees and their performance

In relation to past and current performance of WASHCOs in the management of the water supply systems, the study revealed that 71.3% rated their level of satisfaction as satisfied with previous management condition of water supply system. On other hand, 15.7% and 12.96% respondents rated management of the previous WASHCOs as very good and poor, respectively (Figure 5). Surprisingly, satisfaction level of community on the existing WASHCOs reduced, as 44.4% of survey households rated the management of the current WASHCOs satisfactory and 34.3% as poor. In fact, 21.3% respondents rated that the management of the current WASHCOs as very good.

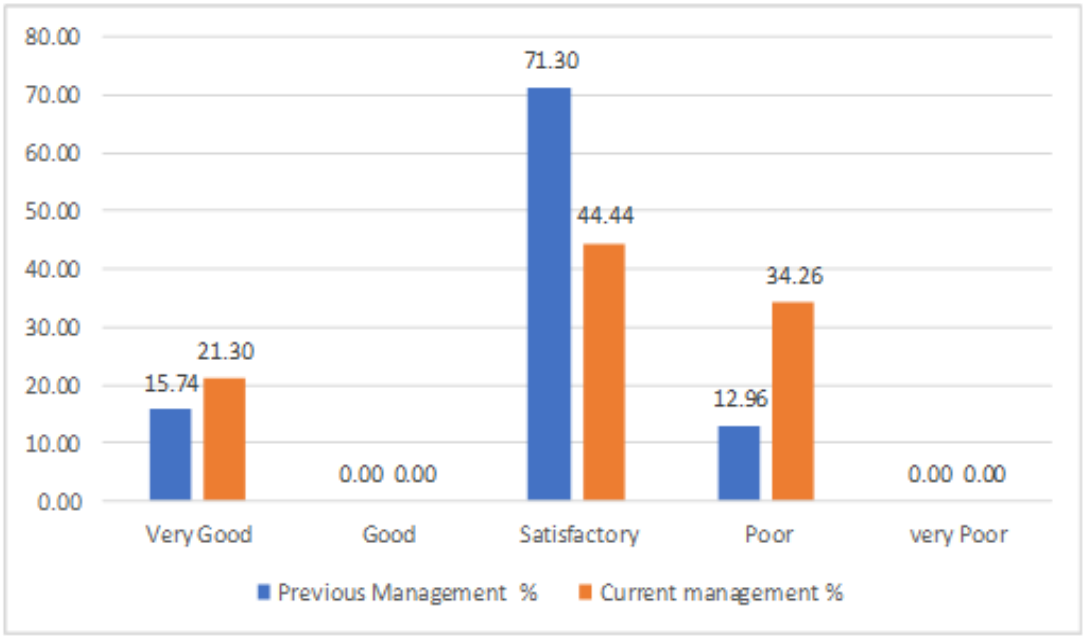

Figure 5: Satisfaction of participants on the performance of WASHCOs

Based on the results drawn from the respondents, the performance level of both the current and the previous management does not exceed an average satisfactory value of 57.87%. It could be interpreted from this that low level of performance by the water management committees has a contribution for the non-functionality as well as functionality of the rural water supply systems. The financial management is also very

low, which is a crucial constraining factor to ensuring operation and maintenance for the proper functioning of the water supply systems.

This analysis shows that knowledge of water management committees on the management, operation and maintenance is among the strategy for proper management of water supply systems and to ensure longer functionality of schemes. The WASHCOs are believed to consist of user members trained for basic management and maintenance of water supply systems. All the nine water supply systems in the study areas were found to have water and sanitation management committees. Similarly, studies show that knowledge of water management committees on the management, operation and maintenance is among the strategy to ensure proper management of water supply systems and contribution for functionality as well. In this regard, Harvey, and Reed (2004) emphasized that community involvement in operation and maintenance is essential for attainment of consistent functionality of rural water supply systems. Community participation is expected to reduce times due to immediate responses by beneficiaries during breakages.

Hence, from this study it could be deduced that water shortage from sources, unavailability of spare parts in closer markets and low level of willingness to pay for operation and maintenance are among principal constraints for functioning of community managed rural water supply systems and contributing factors for performance of the water management committees as well.

Training of water and sanitation management committees and involvement of women in the committees

Most survey respondents (94.4%) responded that they do not heard that the WASHCOs attended in any education or training related to use and management of water supply systems. As per the result, 61.1% respondents thought that the communities should manage water supply systems on their own way without any external support.

Participation of women is vital in the management of rural water supply systems, since they are the main stakeholders and responsible for fetching water for the household use. Women can be affected positively or negatively if they are not involved with the life

cycle of the project and water supply systems management. As presented in figure 6, 41.7% respondents reported that they participated at all stage (designing, implementation and utilization), while 3.7% involved in the planning and management, 12% participated in utilization only , 34.3% didn't have any participation at all and the remaining 8.3% participated at other stages. In fact, 75.9% survey households believed importance of women representation in the water and sanitation management committee particularly for functionality of the water supply systems. Nearly half (45.4%) of survey respondents and FGDs viewed that workload, cultural and religious concerns were the major reasons for limiting women's participation in the management of rural water supply systems.

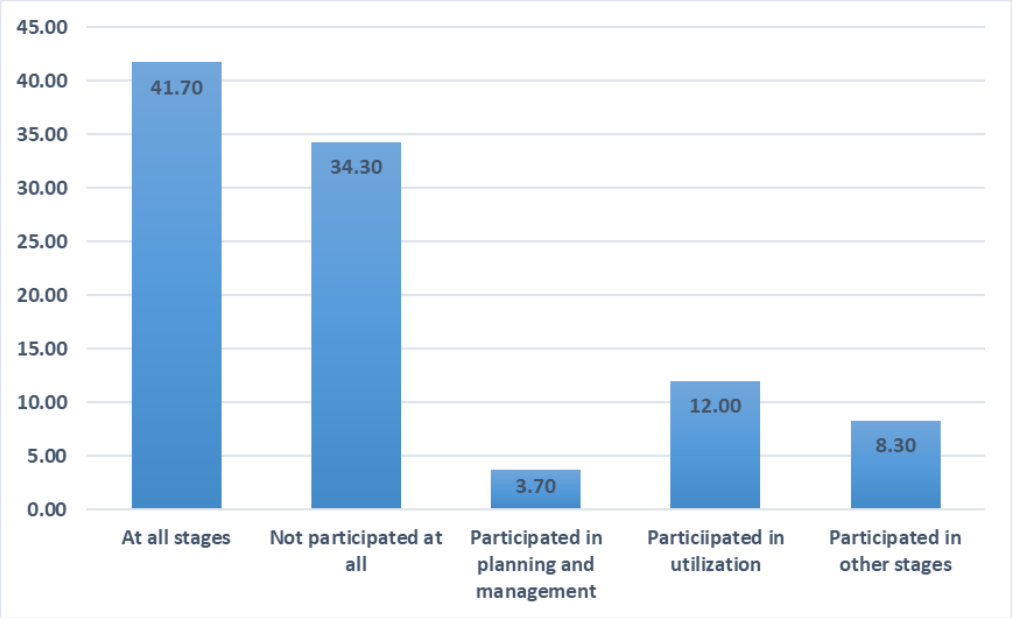

Figure 6: Percentage of community participation at different water supply systems implementations

Key informants and focus group discussions (FGD) indicated that in the last five years, no community-based management trainings have been facilitated by the government in their kebeles despite little training provided by some NGOs.

Studies clearly showed that water and sanitation management committees establishments and training them on technical and managerial skills regarded as software aspect of rural water supply development (Harvey and Reed, 2004; Quin *et al*., 2011). (Quin *et al*., 2011) underlined that training given to WASHCOs helps committee to be equipped with basic skills of management, operation, and maintenance of the schemes. Harvey and

Reed (2004) stressed the importance of providing the required knowledge and training of WASHCOs, for the sustainability of water supply systems. In the absence of WASHCOs, the communities cited poor coordination when collecting money for O&M.

4.2.2.3 External support

The provision of external support by institutions at woreda and national level to local communities is indispensable for sustainability to be achieved (Water Aid, 2011). KIIs and FGDs showed that communities lack trainings and monitoring support, face problem in repairing broken schemes mainly due to limitation of spare parts supply from institutions at woreda level. The institution that provide external support was only the woreda water office. FGD participants noted that whenever their scheme faces major breakdown, community are expected to contribute money for fuel and for technical team to come and fix the breakdown. This results in long stay of breakdowns to be fixed as the community unable to contribute sufficient money to cover all those costs. As for the supply of spare parts, it was noted that the availability of spare parts depended on the proximity of the market to the kebeles. Among the communities, 60.2 % of the participants confirmed that they report to the woreda water office to get support so that the water supply systems get repaired, 37 % reported that they discuss about the problems with the involvement of the community.

4.2.2.4 Environmental factors

Adequacy of water supply

The amount of water collected was considered inadequate by the respondents. Most water supply systems under study were not able to supply water to all year round. Almost all respondents (97%) indicated that hand dug wells were not supplying water to all beneficiary's year round. As per woreda KII, this problem is mainly attributed to the shallow depth of hand dug wells, decrease of yield with increase of dry season and the water table falls below the pumping level of the hand pumps.

In fact, 63.9 % of participants believed that there is a water shortage from source. Among those who said there is water shortage of water from the source, 94.2% of them believed that the water supply sources encounter water shortage during the dry season. During the

dry season when the water supply sources face water shortage, the community access water from an alternative water sources, in this case 61.1% uses open river, 31.5% use unprotected springs and 7.4% fetch from open ponds (Table 11). During the water shortage 63.8 % of participant reported that they travel longer distance to fetch water travelling up to 2 hours in round trip and on average they travel 25 minutes distance.

Table 11: Alternative water sources in case of water shortage in developed schemes

No	Type of alternative water sources and water shortages	Frequency (N)	Percentage (%)
1	Open rivers	66	61.1
2	Unprotected Spring sources	34	31.5
3	Water sources including open ponds	8	7.4
4.	Water shortage from source	69	63.9
5	Travel distance of 2hrs during water shortage	69	63.8
6	Hand dug well water sources not supplying water year-round	105	97.0

The impact of inadequate water supply on functionality was double. Firstly, communities were not keen to repair a water supply system when it breaks down towards its expected time of drying up hence result in long down time periods. Secondly, where communities had to use water points in nearby villages as alternative water sources, this put pressure on the existing water supply systems which resulted in frequent breakdowns thereby negatively influencing sustainability.

4.2.2.5 Social factors

Community participation in planning and construction

The study revealed that 98% survey households participated in the construction, 1% and 1% were participated in project implementation at inception stage and post construction, respectively. At construction phase, 52.77% communities reported that they contributed money, 23.15% contributed free labor and 15.74 % provided locally available materials and 8.4% contributed labor, money, and local available materials (Table 12).

In relation to the idea to construct the water supply project, 79.6% respondents stated that the community involved in initiation, 10.2% said government initiated the project but local leaders and NGOs were also part of it.

On other hand, the community was not consulted on selection and preference of the type of installed technology. Regarding, the type of technology and site selection of the project, 58.3% participants said that government experts were solely responsible for choosing the type of technology used (Table 12). Furthermore, it was noted that the care takers (WASHCOs) did not have the adequate skills to repair pumps while the tools for performing maintenance do not require special skill to use.

The percentage of respondents who indicated community involvement during water project's planning was 7.4%. This type of participation is known as passive involvement (Manikutty, 1997). Though respondents knew about the projects before they were introduced in the study field, they never engaged in needs assessment. Households either did not decide whether they wanted the projects or chose their preferred type of technology. It was learned that the applied technologies were the government experts' preference.

Table 12: Community participation in water supply systems planning and construction

No	Community participation variables		Frequency (N)	Percentage (%)
1	Community participation at planning stage	Yes	8	7.4
		No	100	92.59
2	Technology and site selection	Community	37	34.3
		Local leaders	8	7.4
		Government experts	63	58.3
3	Stages of participation in development and management	At project inception	1	1
		At construction	106	98
		Post construction/ scheme management	1	1
4	Contribution for water supply systems construction	Labour	25	23.15
		Money (in-cash)	57	52.77
		Local materials	17	15.74
		Local materials and cash	1	1
		Labour and cash	8	7.4

For this study, the following types and forms of participation were identified and used to assess the situation of community participation during the development of the water supply systems. There were major initiations from government side and the communities involved also in constructing the water supply systems including, in deciding on capital

or cost contribution for construction of facility, election of water management committees, determining hours of operation of facility and women's engagement based on the data collected from FGD participants. Under the literature review section of this paper, we have seen that demand-responsiveness at the household level is a determinant of overall sustainability primarily due to its role in increasing consumer satisfaction and willingness to sustain the system. Hence, one of the questions on issues of community participation was who initiated to build the water point? Almost all the participants of the FGDs indicated that majority of the limitation for project implemented by government, the community's initiation roles to construct the water supply system are weak.

Similarly, in responding to questions of whose idea was it to choose the source area of the project, all participants in the focus group discussion explained the process as follows. After being nominated to get new water facility by the woreda water office, site identification and feasibility study were done by experts of the contracting agencies and water development experts together with concerned government partners with a minimal consultation of the community.

On the other hand, the FGD participants reported that the community participates in all stages of the construction phase. Because according to them in the agreement it was clearly stated that the provision of available local construction materials, cash, and labor for constructing the water supply system was the sole responsibility of the beneficiary communities. Accordingly, participants during the discussion reported that the community contribute cash and in kind or both for the construction of the water supply systems. In addition, all FGD respondents believed that representation of more women in the water committee is good for the beneficiaries, which was not considered most of the times.

At the planning stage, communities were not given the opportunity to make choices about the type of project and/or technology to be used that result in frequent damage and long downtimes for hand pumps. This is reliable with most published empirical studies on community involvement, where non-use of local knowledge during the needs assessment phase preceded low sustainability of water supply systems (Manikutty, 1997; Prokopy, 2005). The research underlined that user groups should be given an opportunity to choose

applications that they can and are able to run and sustain to encourage functionality. This can only be achieved through active community participation during the planning stage.

Community participation in operation and maintenance

Three fourth (75%) interviewed households indicated that they were not willing to pay for operation and maintenance of the water supply systems. In terms of effectively managing the collected fund (water fee) 85.5% interviewee reported that the committees (WASHCOs) are effectively managing the fund collected from the community, while the remaining (7.4%) perceived that they don't believe that the committee is effectively managing the fund and 7.4% don't know whether the committee properly managing or not (Table 13). Furthermore, 44.4% of the community believed that the contribution is enough for the water supply systems operation and maintenance, while 27.8% believed the fund can cover only operation cost. Nearly quarter of respondents (25.9%) believe that the water fee can cover all operation, maintenance, and recovery costs while few (1.9%) respondents said that the fee can cover only maintenance costs. Almost 88.9% of participants know where the money is saved; of which 91.7% responded that the money is saved at the treasurer's hand and 7.3% indicated the money is saved at community bank account.

Table 13: Chi-Square test for contribution of funds for operation and maintenance

	X^2	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	4.074	1	.044	.062	.034	.024
Continuity Correction	3.188	1	.074			
Likelihood Ratio	4.392	1	.036	.062	.034	
Fisher's Exact Test				.062	.034	
Linear-by-Linear Association	4.036	1	.045	.062	.034	
N of Valid Cases	108					

The chi-square test (X^2 = 4.074 and p = .024) confirmed that contribution of fund for operational and maintenance has a significant relationship with functionality and non-functionality of water supply systems (Table 13).

The ANOVA test also stated that there is a mean difference on the proportion of functional and non-functional water supply systems with contributing fund for operation and maintenance (Table 14). The community's willingness to pay for operation and maintenance has a relationship with the condition of the water supply systems. If the community is not willing to pay for operation and maintenance of the water supply systems, the water supply systems will be 1.57 times more likely to be non-functional.

Table 14: ANOVA test for functionality and non-functionality due to fund contribution for operation and maintenance

What is the condition of water supply system now?					
	Sum of Squares	Df	Mean Square	F	Point Probability
Between groups	.905	1	.905	4.155	.044
Within Groups	23.095	106	.218		
Total	24.000	107			

It is well known that participation of user communities in operation and maintenance is indispensable for sustainability of rural water supply systems to be achieved (Harvey and Reed, 2004). Participation at this project stage is expected to reduce times due to immediate responses by user communities.

It is assumed that the presence of a continued O&M fund and the adequacy of financial contributions are essential to the sustainability of water supply systems. That is consistent with other studies (Baumann and Danert, 2008; Gine and P erez-Foguet, 2008). However, O&M funds which were found at most water supply systems were not sufficient to cover costs of repairing a water supply system particularly in cases where break down is frequent. FGD participants noted that priority was given to the other expenditures rather than preventive maintenance activities. This is because expenditures were more pressing for them than contributing towards O&M. Communities preferred to make financial

contributions towards O&M after a breakdown. Contributions after a breakdown were preferred as communities feel the need and urgency to pay for the repair of a water supply systems as pushed by water problem.

In this regard, the government ought to be in a position to capacitate the user communities so that they accomplish operation and maintenance activities with their own knowledge and capacities without looking for external intuitional support so that this plays a significant role for the water supply systems to function consistently.

4.2.2.6 Financial factors

Regarding fund obtained for water supply systems, 78% household survey participants believed that water user fee collection is necessary, 19% responded necessity of extra contribution by users, while 3% expect NGOs to cover such contribution (Figure 7). Almost half (46.3%) household's survey participants indicated that they require external support for spare parts to enable effective management of the water supply systems. In addition, 39.8% required maintenance of the water supply systems during break down time. The woreda water office and WASHCOs are the institutions to be contacted and report during breakages of water supply systems to get the system repaired.

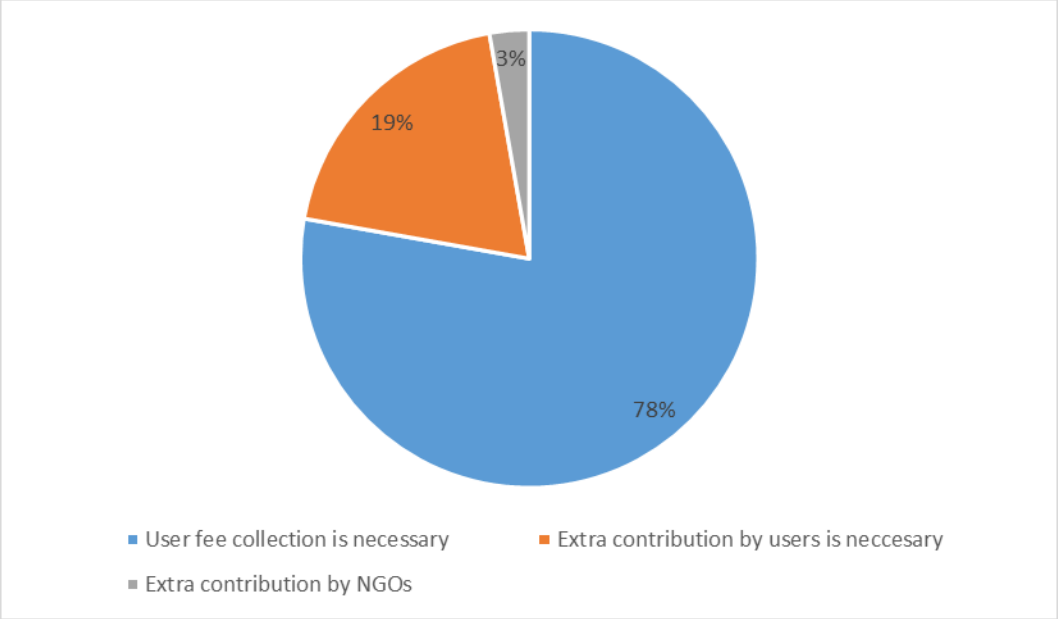

Figure 7: Perception of survey households on user fee collection mechanisms for operation and maintenance

O&M fund is of crucial importance for the maintenance of water supply systems (Schouten and Moriarty, 2003; Harvey and Reed, 2006). However, O&M funds which were found at most water supply systems were not satisfactory to cover costs of repairing a water supply system. FGDs indicated that priority was given to the other expenditures rather than preventive maintenance activities as they were more pressing than contributing towards O&M. Communities preferred to make financial contributions towards O&M after a break down.

The existence of an O&M fund and the adequacy of financial contributions are critical for the consistent functioning of rural water supply systems, this fact agrees with Baumann and Danert, (2008) findings. Nonetheless, it was distinguished that irregularity of fee contributions was negatively influencing on the sufficiency of available funds for O&M, which resulted in long downtimes of water systems. The predominant harsh financial conditions seemed not to spare the rural water supply sector. In such cases, communities lack financial contributions due to various reasons including poverty and absence of other financing mechanisms which need to be considered. The government may need to subsidize finance for spare parts availability, so that the subsidies contribute for making the spare parts to be affordable for beneficiaries and play a substantial role for maintaining and achieving sustainability.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

This paper has shown that a combination of technical, institutional, social, environmental, and financial factors are the major factors need to be considered to tackle constraints of community managed rural water supply systems. If these factors are not managed properly, they influence the consistent functionality of rural water supply systems.

Technical factors which were found to be constraints of the community managed rural water supply systems were type of lifting technologies and availability of spare parts for functionality of the water supply systems. The technical factors were related to the institutional factors and level of external support and role of institutions at woreda level to provide effective supply chains.

Institutional factors on existence and functionality of water and sanitation management committees were also found central for functionality of water supply systems. However, it was concluded that, the user committees shall be provided with appropriate and adequate technical, financial, and managerial skills to support the system functionality. Generally, it was also distinguished that the financial performance of most of the water supply systems was poor, this is particularly true in fee contributions for operation and maintenance activities, which have negatively influence on the systems sustainability.

In addition, climatic factors including inadequacy of water from sources play significant role; results show that communities were less willing to make financial contributions for repairs of water supply systems in long stoppages, like dry seasons when the hand dug well water sources deplete. However, further analysis show that some hand dug water supply sources were neglected only during the rainy season when communities have alternative water sources such as spring water sources, which were considered to be supplying water which was perceived to be having better discharge.

5.2 Recommendations

As this research is based on study of sampled rural water supply systems in Walmara woreda, the following propositions cited have specific relevance for the targeted woreda. However, it must also be viewed that some of the problems identified in this research are systematic and common to all other woredas in Oromia region. Therefore, part of the findings presented in this study may substantiate or can be applicable to many other similar woredas in Ethiopia. Thus, the below are some of the recommendations drawn for improving the constraints of community managed rural water supply systems:

- According to this study, the factors constraining functionality of rural water supply systems includes availability of enough water, availability of spare parts and management related complications are found crucial factors for sustainability of rural water supply systems. Working to resolve these shortages is one of the recommendations for consistent functionality of rural water supply systems.
- Capacitating the community-based water management of the studied water supply systems sounds for additional efforts to be exerted to make them effectively perform operation and maintenance and manage the water supply systems.
- All the water and sanitation management committee members need to get a kind of refresher training including on issues of financial management and technical skill for operation and maintenance of the water supply systems.
- Woreda water resource development and energy office and other relevant stakeholders working in the sector should develop long-term plans to work with water and sanitation management committees in post implementations of rural water supply systems.
- The government water resource departments and other stakeholders need to focus on capacitating the community, so that the community owns their water supply systems and manage sustainably, requiring limited external support.
- The community management ought to base on requiring very limited external support from government or other stakeholders working in the sector. Resolving the core pressing constraints will absolutely contribute for improving the community-based management of the rural water supply systems and thus for consistent functionality of rural water supply systems as well.

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Appendix 1: Questionnaire for Rural Community Water Supply User Households

I. Details of General Information

Consent of respondent

This tool is crafted to gather information for the study purpose on the constraints of community managed rural water supply systems in your localities, including factors those contributing for functionality and non-functionality of rural water supply systems. The valuable time you are taking to provide information and your consent in the response process assists to obtain key information's for the study purpose. I confirm that, the information's obtained from you will be used for this academic purpose only and all your responses will be managed ethically and confidentially. Hence, you are kindly requested to provide either your consent or disagreement in the information provision process by selecting one of the below choices.

1. Yes
2. No

Instructions (for surveyors): For each of the below questions, check the choices that best defines the situations of your water supply system (more than one choice may be an appropriate response for some of the questions) and circle on your choice/choices. In addition, please fill a concise information in the blank spaces provided when needed.

1. Name of the kebele
   1. Minjaro Watabacha
   2. Ade Simbir Qotu
   3. Barfata Tokkofa
2. Name of water source _____
3. Socio-Economic Features of beneficiary household heads

Questionnaire ID	Age	Sex	Household type	Marital status
		1.Male 2.Female	1. Male headed 2. Female headed	1.Single 2.Married 3.Divorced 4.Widowed

4. Educational level
    1. Illiterate
    2. First cycle (1-4 grade)
    3. Second cycle (5-8 grade)
    4. High school -complete
    5. Preparatory
    6. Diploma and above
5. What is your major occupation?
    1. Farming and other agricultural activities
    2. Government employee
    3. Daily labor
    4. Petty trade
    5. Specify, if other _____
6. Any source of income additional to your major occupation?
    1. Employment as a skilled laborer
    2. Income from petty trade
    3. From renting activities
    4. Other income generation activities
7. How many family members you have in your house including you?
    1. Two
    2. Three
    3. Four
    4. Five
    5. Six
    6. More than six
8. What are your water supply system sources /water technology?
    1. Hand dug wells
    2. Protected Springs
    3. Shallow wells
    4. Deep boreholes
    5. Unprotected water sources
9. No. of people using the water point/source_____

10. Year the water supply source constructed _____

11. The water supply system is constructed by

    1. Government
    2. NGOs
    3. Community contribution
    4. Other

12. Name of data collector_____

13. Date of data collection_____

II. Assessing factors contributing to non-functionality and functionality of rural water supply systems in the study area (Specific objective 1)

1. What is the condition of your water supply system now?

    1. Functioning
    2. Non-functional
    3. Semi-functional

2. If your answer to question 1 is nonfunctional, when did it stopped functioning? _____ year

3. If your answer to question 1 is nonfunctional, how long did it serve the community before it stopped functioning? _____

4. If your answer to question 1 is nonfunctional, what has made it not to be functional?

    1. Breakage of installed technology
    2. Shortage of spare parts
    3. Lack of technical capacity
    4. Lowering of water level
    5. Poor management
    6. Financial constraints to maintain
    7. Other reason

5. Does the water supply source break very often?

    1. Yes
    2. No

6. If it breaks, how many times breaks occur in a year?

    1. Once in a year
    2. Twice a year

3. Three times a year
4. More than three times a year

7. Have you (family members) ever received trainings on water supply system management and utilization?
   1. Yes
   2. No
8. Is the water point repaired over past 12 months?
   1. Yes
   2. No
9. If yes, days between breakdown & repair?
   1. Less than 2 weeks
   2. Less than one-month
   3. Less than 3 months
   4. Greater than 3 months
10. Who perform the maintenance of the water source?
    1. The water management committee care takers
    2. The woreda water office
    3. The Community
    4. Other
11. How do you think funds should be obtained for water system to be repaired?
    1. User fee collection
    2. Extra contribution by users
    3. Woreda water office
    4. NGOs
    5. If other please specify _____
12. Was there any shortage of water from the water source you are collecting?
    1. Yes
    2. No
13. If your answer for ‘Q12’ is ‘Yes’,

13.1 In which season was the shortage of water mostly occur?

1. Rainy season
2. Dry season
3. Other seasons

13.2 What problem was occurred due to shortage of water from the water source?

1. Travel longer distances for collecting water
2. Exposed to paying extra cost for getting water
3. Compelled to collect water from unsafe water sources
4. Occurrence of disease outbreaks
5. Other

14. Time, you take for the round trip to collect water from the water point? minute____.

15. Do you think the water you are getting from the water point has quality problem?

1. Yes
2. No

16. If your answer for 'Q15' is 'Yes',

16.1 What type of water quality problem you observed or tasted?

1.Test
2. Color
3. Occurrence of suspended martials
4. Other

16.2 Have you told the problem to the WASHCOs?

1. Yes
2. No

17. Have the community involved in performing surface water preservative measures near the water supply system?

1. Yes
2. No

18. If yes, what measures were taken?

1. Protecting the catchment area through afforestation
2. Construction of physical soil and water conservation structures
3. Flood protection measures upstream of the water source

4. Managing the watershed participatorily
5. If other measures, please specify_____

19. What type of external support service did you receive to enable you effectively to manage your water supply facility?
    1. Training
    2. Provision of spare parts
    3. Close follow up
    4. Maintaining the water source during breakage
    5. Other
20. When the water point got major breakdowns, do you know who to contact to carry out the maintenances?
    1. The care takers
    2. The woreda water office
    3. The WASHCOs
    4. NGOs
    5. Other
21. What do you think is the greatest challenge to the proper functioning of the water supply source?
    1. Management
    2. Operation and maintenance
    3. Spare parts
    4. Finance
    5. Tools for the maintenance work
    6. Other
22. Do you get spare parts from the local market in case of failures due to wearing of fast-moving parts?
    1. Yes
    2. No
23. Were spare parts provided by the woreda water office?
    1. Yes
    2. No

24. Who is responsible for the overall management of the water supply system?
    1. The water management committee
    2. The woreda water office
    3. The Community
    4. Other
25. Are there any water supply sources which are not being in use due to type of water sources or other cultural reasons?
    1. Yes
    2. No
26. What due think are the reasons which made water supply sources to function for longer durations?
    1. The type of the installed water technology
    2. The type of the water source
    3. Management by the community
    4. External technical support
    5. Technical skill within the community
    6. Other

III. Identify the roles of communities in the development and entire management of the water supply systems (Specific objective 2)

1. Have you participated in the development of the water supply system?
    1. Yes
    2. No
2. If your answer for ‘Q1’ is ‘Yes’

2.1. At which development stage you have participated?
    1. Project inception
    2. Planning
    3. Construction
    4. Post construction/scheme management

2.2. What was your contribution in the provision of water supply system?
    1. Labor
    2. Money (in-cash)

3. Local material
4. Other

3. Whose idea was to build the project.
   1. The community
   2. Local leaders
   3. NGOs
   4. Governmental offices
   5. Other
4. Whose idea was it to choose the site selection of the project?
   1. The community
   2. Local leaders
   3. NGOs
   4. Governmental offices
   5. Other
5. Whose idea was it to choose the type/ technology of the project?
   1. The community
   2. Local leaders
   3. NGOs
   4. Governmental offices
   5. Other
6. How severe are problems with water service in your community?
   1. Low
   2. Fair
   3. Strong
   4. Very severe
   5. No problem
7. For what purpose do you use the water from the water supply system in addition to domestic uses?
   1. Washing
   2. Cloth
   3. Animal watering

4. Gardening
5. Small scale irrigation
6. Other

8. Is the community willing to pay for Operation and Maintenance of the water supply?
   1. Yes
   2. No
9. Does your household contribute money for operation and maintenance cost of the scheme?
   1. Yes
   2. No
10. If your response for question 9 is yes, how much do you contribute?

    _____in birr/month/year

11. Who sets the user fee?
    1. The community itself
    2. The water committee
    3. Woreda water office
    4. Other
12. Do you have problems in paying user fees?
    1. Yes
    2. No
    3. Sometimes
13. Do you believe that the committee is collecting and effectively managing the money collected in the community?
    1. Yes
    2. No
    3. I don't know
14. If your response for questions 13 is yes, is the amount contributed enough for Operation, maintenance, recovery of the water point?
    1. Only for operation
    2. Only for maintenance
    3. Both for operation and maintenance
    4. For all operation, maintenance and recovery

15. Do you have any idea where the contributed money is saved?
    1. Yes
    2. No
16. If yes where is the money saved?
    1. At the treasurer's hand
    2. Community bank account
    3. Other
17. If your response for question 13 is no, what are your reasons for not contributing?
    1. Lack of finance
    2. Not satisfied by the service
    3. Fear of misuse
    4. Distance of the water source
    5. Less satisfaction on the quality
    6. Other
18. If you are not using the water supply service, what other alternative water source are you using currently?
    1. Open river
    2. Unprotected springs
    3. Other sources
19. How do you rate the performances of WASHCOs?
    1. Very good
    2. Good
    3. Fair
    4. Poor
    5. Very poor
20. Do you know if the committee meets?
    1. Yes
    2. No
21. Do they provide financial reports on expenditures to the community?
    1. Yes
    2. No

22. Has the committee ever used funds for other purpose than to what is intended?
    1. Yes
    2. No
23. Are you satisfied with the current water management?
    1. Yes
    2. No
24. Is there a person responsible for service provision?
    1. Yes
    2. No
25. What is your satisfaction about the responsiveness of service operator?
    1. Strongly not satisfied
    2. Not satisfied
    3. Fairly satisfied
    4. Strongly satisfied
26. What type of participation did women have in the overall project development?
    1. Planning and management
    2. Implementation
    3. Utilization
    4. At all stages
    5. None
27. Are women's members of the water management committee?
    1. Yes
    2. No
28. Do you think representation of more women in the water management committee is good for the functionality of the water supply system?
    1. Yes
    2. No
    3. Sometimes
    4. Other
29. What do you think are the reasons that prevent women from participating in the water management committee?
    1. Workloads

2. Cultural and religious reasons

3. The position of women's in the community

4. Other reasons

30. Are there any training sessions given in your communities regarding the proper use and management of water supply source?

1. Yes

2. No

3. I do not know

31. Do you think it is realistic that communities should manage water supply facility on their own without external support?

1. Yes

2. No

32. What is the greatest challenge to the proper functioning of the water supply source?

1. Fee contribution by users
2. Lack of technical support
3. Lack of technical skill
4. Shortage of spare parts
5. Problems related to quantity/quality of water sources
6. Community involvement problems
7. Other

33. How have you responded to the challenges?

1. Reporting to the woreda water office

2. Discuss and involve the community

3. Manage by your own capacity

4. Resolve by employing technicians

5. Other

34. What do you think are the most critical factors that are important in ensuring the water supply facility to be sustainable?

1. Community involvement

2. Manage the sources by the woreda water office

3. Look for external support including NGOs

4. Consistent fee collection from users
5. Availability of spare parts in the market
6. Other

IV. Investigate the current status and past performance of community managed rural water supply systems (Specific objective 3)

1. How was the management condition of your water supply system previously?
   1. Very good
   2. Satisfactory
   3. Poorly managed
2. How is the management condition of your water supply system currently?
   1. Very good
   2. Satisfactory
   3. Poorly managed
3. What do you think are the reasons contributing for your answer under 'Q 1'?
   _____.____,_____
4. What do you think are the reasons contributing for your answer under 'Q 2'?
   _____,_____,_____
5. What was the previous water management system?
   1. Community managed
   2. Supported by the woreda water office
   3. NGOs
   4. Other
6. What is the current water management system?
   1. Community managed
   2. Supported by the woreda water office
   3. NGOs
   4. Other
7. Which management system is satisfactory?
   1.The previous
   2. The current
   3. Both are not satisfactory
   4. Both are satisfactory

8. If your answer to ‘Q 7’ is ‘The previous’, Why?
    1. The management was participatory
    2. Problems were addressed faster during breakages
    3. There were closer follow ups and meetings of the management committee
    4. Other
9. If your answer to ‘Q 7’ is ‘The current’, Why?
    1. The management is participatory
    2. Problems are addressed faster during breakages
    3. There are closer follow ups and meetings of the management committee
    4. Other
10. What is the status of the current financial management system?
    1. Good
    2. Poor
    3. Very good
    4 Very poor
    5. Satisfactory
11. What was the status of the previous financial management system for your water supply source?
    1. Good
    2. Poor
    3. Very good
    4. Very poor
    5. Satisfactory
12. What are the previous and the current trends in paying user fees?
    1. Good previously
    2. Good currently
    3. User fees are collected sometimes
    4. The user fee collections trends are similar
    5. No trend of fee collection
    6. Good previously poor currently
    7. Good currently poor previously

13. What is the functionality condition of your water supply facility previously and now?
    1. Functioning previously and nonfunctional now
    2. Non-functional previously and functional now
    3. Semi-functional previously and fully functional now
    4. Semi-functional now and fully functional previously
14. If your answer to question 13 is 'Functioning previously and nonfunctional now', what are the reasons for nonfunctioning now?
    1. Depletion of ground water table
    2. Unavailability of spare parts
    3. Lack of technical skill
    4. Financial problems
    5. Lack of community preference on the water supply source
    6. Poor management by the water committee
15. If your answer to question 13 is 'Non-functional previously and functional now', what are the reasons for functioning now?
    1. Good discharge from the source
    2. Availability of spare parts
    3. Availability of technical support
    4. Good financial capacity
    5. Community preference to the water supply source
    6. Good management by the water committee
16. Who perform the maintenance of the water source previously?
    1. The water management committee care takers
    2. The woreda water office
    3. The Community
    4. Other
17. Who perform the maintenance of the water source currently?
    1. The water management committee care takers
    2. The woreda water office
    3. The Community
    4. Other

18. How was fund obtained for water systems to be repaired previously?
    1.User fee collection
    2. Extra contribution by users
    3. Woreda water office
    4. NGOs
    5. Other
19. How is a fund obtained for water systems to be repaired currently?
    1.User fee collection
    2. Extra contribution by users
    3. Woreda water office
    4. NGOs
    5. Other
20. Was there any shortage of water from the water source you are collecting water previously and this time?
    1. Yes
    2. No
21. If your answer to question 20 is 'Yes", When is the shortage recognized?
    1. Previously
    2. Currently
22. Are women's participating in the management of the water supply system currently?
    1.Yes
    2. No
23. Were women's participating in the management of the water supply system previously?
    1. Yes
    2. No
24. What are the current trends in operation and maintenance of the water supply system?
    1. Good
    2. Poor
    3. Very good
    4. Very poor
    5. Satisfactory

25. What were the previous trends in operation and maintenance of the water supply system?
    1. Good
    2. Poor
    3. Very good
    4. Very poor
    5. Satisfactory

Thanks for your sincere cooperation in the response process!!!

Appendix: 2 Focus group discussion with water management committee members including women members, community leaders and influential peoples

1. Name of kebele _____
2. How you were selected as a water committee management member?

   _____

3. When did you get the training and where the place of the training?

   _____

4. For how much days was the training given? And who provided the training?

   _____

5. Do you believe that you have the capacity to perform maintenance of the water supply system that need frequent maintenance?

   _____

6. Do you think that you obtained the required knowledge from the training to perform the maintenance of water supply system without external support? If not, why?

   _____

7. Have you maintained a failure(s) in the water supply system, how many times the system was maintained and made to function?

   _____

8. How was the maintenance cost covered?

   _____

9. After the training have you tried and failed to maintain the water supply system?

_____

10. Are there maintenance spare parts available in your surrounding?

    _____

11. What do you propose for sustainable use of rural water supply system?

    _____

12. Is there an external support from the concerned bodies like the woreda water supply office?

    _____

13. How do you manage the water supply system?

    _____

14. Do you contribute water use fees?

_____

15. If you contribute, how the contribution of water fee per month collected?

_____

16. Do you have rules and regulation that help to manage the water supply system?

_____

17. How many are members of the water committee? How many of them are women?

_____

18. What are the reasons for not having more women in the water committee?

_____

19. Who set the tariff for water collection?

_____

20. Do you have a community bank account? If so, who manage the account?

_____

21. What are the major problems encountered while managing of the rural water supply system?

_____

22. Do you give training for the community members about water use and willingness to pay?

_____

Appendix: 3 Key Informants interview with kebele administrators, woreda water office experts, development agents and health extension workers, Kebele administrators, Development agents and health extension workers

1. Name of kebele_____,
2. How were solutions provided to the challenges encountered during the management of the water supply system?
   1. The community act independently with their own knowledge and resources.
   2. With minor external assistance
   3. Significant external assistance for major repairs
   4. Community is dependent on external involvement for the majority of O and M.
3. How many times have you had to solicit help from outside the community?

   _____
4. Do you have a plan for preventive maintenance?
   1. Yes
   2. No
5. Is the community accessing water consistently throughout the year?
   1. Yes
   2. No
6. What are the primary constraints of the water supply system management?

   _____
7. What are the key problems the user community is complaining about the water supply system?

   _____
8. Do the health center/health post in the kebele get water from the water supply system?
   1. Yes
   2. No
9. How much time you provide for managing the system operation? _____hours/day

10. Have you attended a care takers training for O & M of the water supply system?
    1. Yes
    2. No
11. Are you happy with doing the operation and maintenance of the water supply system?
    1. Yes
    2. No
    3. Sometimes
12. What do you think is the greatest challenge to the proper functioning of the water supply system?
    1. Collecting the tariff
    2. Accounting
    3. Organizing meetings
    4. Physical repairs
    5. Technical knowledge/capacity
    6. Other

Woreda water office experts

13. How do you prepare the development of new water supply projects?

    _____

14. Did the communities participate in the implementation of the projects including site selection?
    1. Yes
    2. No
15. Did women participate in the entire processes?
    1. Yes
    2. No
16. How do you know the yield of the well or the spring that your organization constructing is enough for the community consumption?

    _____

17. Had your organization helped in the process of organizing the community in the formation of water committee members?
    1. Yes
    2. No

18. Do you think that the existence of water committee is helpful for the community and for the sustainability of the water supply system?
    1. Yes
    2. No
19. Have your organization adopted a community-based need approach in the development of water supply projects?
    1. Yes
    2. No
20. Did your organization help the community to own the water supply systems?
    1. Yes
    2. No
21. Do you think that your staff technicians are capable enough for providing support for the woreda water supply systems functionality?
    1. Yes
    2. No
22. Do you give technical support for the community members after construction of the project?
    1. Yes
    2. No
23. What problems do you see in the processes of implementing and managing rural water supply systems?

    _____

24. At what season does hand dug well water sources digging done?

    _____

25. Are discharges/yields from hand dug well water supply system sources are perennial throughout the year?

    _____

26. If the water from existing water supply system sources are non-perennial/seasonal, what other alternative water source are the community using?
    1. Open river
    2. Unprotected springs
    3. Other sources

Appendix 4: Afaan Oromo Questionnaire

Miiltoo 4: Afgaafii Waa'ee Dhiheessii Bishaanii Fayyadamtoota A/Warraa Hawaasa Baadiyaatiif Dhiyaate

I. IBSA TARREE ODEEFFANNOO WALIIGALAA

Heeyyama Deebii Kennitotaa

Gaaffiileen kun sirna dhiyeessii bishaan baadiyyaa hawaasaan hogganamu ilaalchisee gufuuwwan jiran qo'achuuf kaayyeffatee naannoo keessan irraa odeeffannoo funaanuuf kan qophaa'edha. Kunis wantoota sirna dhiyeessii bishaan baadiyyaa irratti dhiibbaa gaarii ykn hamaa qaban ni dabalata. Yeroo mi'aawaan keessan kan isin odeeffannoo kana nuuf kennuuf akkasumas heeyyamni deebii kana nuuf kennuuf isin nuuf laattan odeeffannoo murteessaa nuti qo'annoof barbaadnu akka argannu kan nugargaarudha. Odeeffannoon nuti isinirraa argannu kun kaayyoo qo'annoo jedhame kanaaf qofa kan faayidaa irra oolu fi deebiin isin laattan naamusaan fi iccitiin kan qabamu ta'uu nan mirkaneessa. Kanaafuu, adeemsa kenniinsa odeeffannoo keessatti heeyyama ykn diddaa keessan filannoo asiin gaditti argamu adda baasuun akka nuuf ibsistan kasummaan isin ni gaafannaa.

1. Tole
2. Lakki

Qajeelfama (Sarveeyarootaaf): Gaafiiwwan asiin gaditti argaman tokko tokkoo isaanitiif filannoo sirna dhiyeessii bishaanii keessan sirriin ni ibsa jettanii yaaddan itti maruun filadhaa. Gaafiiwwan tokko tokkoof deebii tokkoon ol ta'e kennuun ni danda'ama. Kana malees, iddoo duwwaa kenname irratti ennaa barbaachise odeeffannoo sirrii ta'e akka guuttan isin gaafanna.

1. Maqaa Gandichaa:
    1. Minjaaroo Watabeechaa
    2. Addee Simbir Qottuu
    3. Barfataa Tokkoffaa
2. Maqaa Burqaa Bishaanichaa _____
3. Haala Hawaas-diinagdee A/Warraa Fayyadamtootaa

Waraqaa Eenyummaa Gaafatamaa	Umurii	Saala	Gosa A/Warraa	Haala Gaa'elaa
		1. Dhiira 2. Dubartii	1. A/Warraa Dhiiraa 2. A/Warraa Dubartii	1. Baaqqeedha 2. Fuudheera/Heerumte 3. Hiikeera/Hiikte 4. Kan irraa du'e (duute) dha.

4. Sadarkaa Barnootaa
    1. Hin baranne
    2. Marsaa tokkoffaa (Kutaa 1 – 4)
    3. Marsaa lammaffaa (Kutaa 5 – 8)
    4. Sadarkaa lammaffaa kan xumur(t)e
    5. Qophaayina
    6. Dippiloomaa fi isaan ol
5. Hojiin idileen keessan maalidha?
    1. Qonna fi hojiilee qonnaan walqabatan biroo
    2. Hojjataa mootummaa
    3. Hojjataa guyyaa
    4. Daldala xixiqqaa
    5. Kan biraa (yoo ta'e adda baasuun ibsaa) _____
6. Madda galii hojii idileetiin ala qabdan yoo jiraate
    1. Qaxarrii ogummaa
    2. Galii daldala xixiqqaa irraa argamu
    3. Kiraa qabeenyaa irraa
    4. Sochiilee madda galii biroo
7. Isin dabalatee mana keessan keessa miseensota maatii meeqatu jira?
    1. Lama
    2. Sadi
    3. Afur
    4. Shan

5. Jaha
6. Jahaan oli

8. Maddi sirna dhiyeessii / teknoolojiin bishaanii keessan maalidha?
   1. Boolla harkaan qonforame
   2. Burqaa eegumsa qabu
   3. Boolla gadifageenya hin qabne
   4. Boolla gadifagoo qonforame
   5. Burqaa bishaanii kunuunsa hin qabne
9. Baay'inni namoota burqaa/madda bishaanii kanatti fayyadamanii meeqa? _____
10. Bara kami maddi bishaanii kun hojjatame? _____
11. Sirna dhiyeessii bishaanii kana kan hojjate:
    1. Mootummaa
    2. Dhaabbata miti-mootummaa
    3. Buusii hawaasaa
    4. Kan biraa
12. Maqaa ogeessa agaargoo (data) funaanuu _____
13. Guyyaa agaargoon sassaabame _____

II. SIRNA DHIYEESSII BISHAAN BAADIYYAA NAANNOO QO'ANNOO KEESSATTI WANTOOTA DHIIBBAA GAARII YKN HAMAA QABAN (Specific Objective 1)

1. Ammaantana haalli sirni dhiyeessii bishaanii keessan akkami?
   1. Hojjataa jira
   2. Hojjataa jin jiru
   3. Walakkaan hojjata
2. Deebiin Lk. 1 jalatti kennitan hojjataa hin jiru kan jedhu yoo ta'e, yoomi hojjachuu dhaabe? Bara _____
3. Deebiin Lk. 1 jalatti kennitan hojjataa hin jiru kan jedhu yoo ta'e, otoo hin dhaabatin dura yeroo hangamiif hawaasa tajaajile? _____
4. Deebiin Lk. 1 jalatti kennitan hojjataa hin jiru kan jedhu yoo ta'e, maaltu akka hojjachuu isa dhoorke?
   1. Cabiinsa meeshaa

2. Dhabama meeshaalee jijjiirraa
3. Hanqina dandeettii ogummaa
4. Gadi bu'iinsa sadarkaa bishaanii
5. Dadhabiinsa hoggansaa
6. Suphaaf hanqina maallaqaa
7. Sababa biraa

5. Burqaan bishaanii kun yeroo yeroon kan addaan citudha?
   1. Eeyyeen
   2. Lakki
6. Kan addaan citu yoo ta'e, waggaa keessatti yeroo meeqa addaan ni cita?
   1. Waggaatti altokko
   2. Waggaatti yeroo lama
   3. Waggaatti yeroo sadi
   4. Waggaatti yeroo sadiin ol
7. Hoggansa fi fayyadama sirna dhiheessii bishaanii ilaalchisee isin (miseensi maatii keessan) leenjii fudhattanii beektuu?
   1. Eeyyeen
   2. Lakki
8. Ji'a 12 darban keessatti madda bishaanii kanaaf suphaan raawwatameefii jiraa?
   1. Eeyyeen
   2. Lakki
9. Eeyyen jettan yoo ta'e, erga cabee hangamitti suphaan taasifameefi?
   1. Torban 2 otoo hin guutiin
   2. Ji'a tokko otoo hin guutiin
   3. Ji'a 3 otoo hin guutin
   4. Erga ji'a 3 darbeen booda
10. Qaama kamtu suphaa madda bishaanichaa gaggeessa?
    1. Miseensota koree hoggansa bishaanii
    2. Wajjira bishaanii aanaa
    3. Hawaasa naannoo
    4. Kan biraa

11. Maallaqni sirni bishaanii ittiin suphamu isin akkamitti argamuu danda'a jettanii yaaddu?
    1. Maallaqa fayyadamtoota irraa sassaabbamuun
    2. Buusii dabalataa fayyadamtootni gumaachaniin
    3. Wajjira bishaanii aanaatiin
    4. Dhaabbilee miti-mootummaatiin
    5. Kan biraa yoo ta'e, adda baasaa ibsaa _____
12. Maddi bishaan irraa waraabbattan kun hanqina bishaanii ni qaba ture?
    1. Eeyyeen
    2. Lakki
13. Deebiin gaafii Lk. 12 yoo "Eeyyeen" ta'e,
    13.1. Waytii kam keessa yeroo hedduu hanqinni bishaanii mul'ata?
        1. Waytii gannaa
        2. Waytii bonaa
        3. Waytiilee biro
    13.2. Sababa hanqinni bishaanii madda bishaanichaa irraa muudateen rakkina maaltu uumame?
        1. Bishaan waraabbachuuf daandii fagoo deemuu
        2. Bishaan argachuuf baasii dabalataaf saaxilamuu
        3. Madda qulqullina hin qabne irraa bishaan waraabbachuuf dirqamuu
        4. Tamsa'ina dhibee daddarbaa
        5. Kan biraa
14. Wiirtuu bishaanii dhaquun waraabbattanii deebi'uuf yeroo hangam isinitti fudhata? Daqiiqaa _____
15. Bishaan wiirtuu kana irraa argattan rakkina qulqullinaa ni qaba jettanii yaadduu?
    1. Eeyyeen
    2. Lakki
16. Deebiin gaafii Lk. 15 "Eeyyeen" yoo ta'e,
    16.1. Rakkina qulqullina bishaanii gosa akkamiituu isin muudate ykn isinitti dhagahame?
        1. Dhandhammii

2. Bifa
3. Waatuu keessaa mul'ata
4. Kan biraa

16.2. Rakkina kana WASHCO tiif ibsitanii jirtuu?

1. Eeyyeen
2. Lakki

17. Hawaasni kunuunsa bishaan lafgubbaa (surface water) naannoo sirna dhiyeessii bishaaniitti gaggeeffamu irratti hirmaannaa qaba?

1. Eeyyeen
2. Lakki

18. Yoo deebiin keessan "Eeyeen" ta'e, tarkaanfii akkamiitu fudhatame?

1. Naannoo sana bosoneessuun
2. Daagaa kunuunsa biyyoo fi bishaaniif oolu ijaaruu
3. Madda bishaanii kanaan olitti tarkaanfii galoo ittisuuf fudhatame
4. Lafa garagartuu nannoo sanaa (watershed) hirmaannaan kunuunsuu
5. Tarkaanfii biraa yoo ta'e, adda baasuun ibsaa _____

19. Tajaajila dhiyeessii bishaanii keessan haala bu'a-qabeessa ta'een hogganuuf qaama alaa irraa deggersa gosa kamii argattanii jirtu?

1. Leenjii
2. Dhiyeessii meeshaalee jijjiirraa
3. Hordoffii dhiyeenyaa
4. Ennaa miidhame madda bishaanichaa suphuu
5. Kan biraa

20. Ennaa wiirtuun bishaanii kanarra miidhaa cimaan gahe, akka suphamu qaama kam akka quunnamtan beektuu?

1. Miseensota koree hoggansa bishaanii
2. Wajjira bishaanii aanaa
3. Miseensota WASHCO
4. Dhaabbilee miti-mootummaa
5. Kan biraa

21. Maddi dhiyeessii bishaanii kun haala gaariin akka hojjatu taasisuuf rakkinni cimaan jiru maali jettanii yaaddu?
    1. Hoggansa isaa
    2. Hojjii fi suphaa isaa
    3. Meeshaalee jijjiirraa
    4. Faayinaansii
    5. Mi'awwan ittiin suphaa gaggeessan
    6. Kan biraa

22. Qaamoleen saffisaan socho'an ennaa dullooman meeshaalee jijjiirraa isaanii gabaa naannoo jiru irraa argachuun ni danda'amaa?
    1. Eeyyeen
    2. Lakki
23. Meeshaalee jijjiirraa wajjira bishaanii aanaatu dhiyeessaa turee?
    1. Eeyyeen
    2. Lakki
24. Akka waliigalaatti sirna dhiyeessii bishaanii kana kan hoogganu qaama kamidha?
    1. Koree hoggansa bishaanii
    2. Wajjira bishaanii aanaa
    3. Hawaasa naannoo
    4. Kan biraa
25. Sababa gosa burqaa isaa ykn aadaa naannoo sanaa irraa kan ka'een maddi dhiyeessii bishaanii faayidaarra hin oolle ni jiraa?
    1. Eeyyeen
    2. Lakki
26. Maddawwan dhiyeessii bishaanii yeroo dheeraaf akka tajaajilan sababni taasisu maalidha jettee yaadda?
    1. Gosa teknoolojii diriirfamee
    2. Gosa madda bishaanichaa
    3. Hoggansa hawaasaa

4. Deggersa tekniikaa qaama alaa
5. Ogummaa tekniikaa hawaasichi qabu
6. Kan biraa

III. SHOORA HAWAASNI SOCHII MISOOMAA FI HOGGANSA SIRNA DHIYEESSII BISHAAN BAADIYYAA KEESSATTI QABU ADDA BAASUU (Specific Objective 2)

1. Sochii misooma sirna dhiyeessii bishaan irratti hirmaattanii jirtuu?
   1. Eeyyeen
   2. Lakki
2. Yoo deebiin keessan Lk. 1 jalatti "Eeyyeen" ta'e,
   2.1. Sadarkaa misoomaa kami irratti hirmaattan?
      1. Jalqaba projektii
      2. Karoora
      3. Ijaarsa
      4. Ijaarsaan booda (hoggansa sagantaa)
   2.2. Sirna dhiyeessii bishaanii keessatti kan isin gumaachitan maalidha?
      1. Humna
      2. Maallaqa calla
      3. Galtee naannoo (local input/material)
      4. Kan biraa
3. Ijaarsi projektii kanaa yaada yaada eenyuun ka'edha?
   1. Hawaasa
   2. Hoggantoota naannoo
   3. Dhaabbilee miti-mootummaa
   4. Wajjiraalee mootummaa
   5. Kan biroo
4. Iddoo projektichaa kan filate eenyudha?
   1. Hawaasa
   2. Hoggantoota naannoo
   3. Dhaabbilee miti-mootummaa

4. Wajjiraalee mootummaa
5. Kan biroo

5. Gosa teknoolojii projektichaa kan filate eenyudha?
    1. Hawaasa
    2. Hoggantoota naannoo
    3. Dhaabbilee miti-mootummaa
    4. Wajjiraalee mootummaa
    5. Kan biro
6. Hawaasa keessan keessatti rakkinni bishaanii hangama cimaadha?
    1. Gadi’aanaa
    2. Omaa hin jedhu
    3. Cimaa
    4. Baay’isee cimaa
    5. Rakkinni hin jiru
7. Mana keessa malee bishaan sirna dhiyeessii bishaanii kanarraa argattan maaliif itti fayyadamtu?
    1. Dhiqaaf
    2. Miiccaaf
    3. Horii obaasuuf
    4. Oddoo misoomsuuf
    5. Jallisii sadarkaa xiqqaaf
    6. Kan biraa
8. Hawaasni hojii fi suphaa dhiyeessii bishaanitiif kanfaluuf fedhii ni qabaa?
    1. Eeyyeen
    2. Lakki
9. Gatii sochii fi suphaa sagantaa kanaaf barbaachisu maatiin keessan maallaqa ni gumaacha?
    1. Eeyyeen
    2. Lakki
10. Yoo deebiin keessan Lk. 9 jalatti “Eeyyeen” ta’e, hangam gumaachitu?
    Ji’aan/waggaan Qr. _____

11. Qaama kamtu gatii fayyadamaa murteessa?
    1. Hawaasicha ofiisaatiin
    2. Koree bishaanii
    3. Wajjira bishaanii aanaa
    4. Kan biraa
12. Gatii fayyadamuu irratti rakkinni isin muudateera?
    1. Eeyyeen
    2. Lakki
    3. Altokko tokko
13. Koreen bishaanii maallaqa hawaasa irraa haalaan funaanee milkaa'inaan ni hooggana jettanii ni amantuu?
    1. Eeyyeen
    2. Lakki
    3. Ani hin beeku
14. Deebiin Lk. 13 jalatti laattan "Eeyyeen" kan jedhu yoo ta'e, hangi maallaqaa hojii, suphaa fi kunuunsa wiirtuu bishaanii kanaaf gumaachame gahaadhaa?
    1. Hojiif qofa
    2. Suphaaf qofa
    3. Hojiif suphaadhaaf
    4. Hojii, suphaa fi kunuunsaaf
15. Bakka maallaqni gumaachame kun itti kuusamu ni beektuu?
    1. Eeyyeen
    2. Lakki
16. Deebiin keessan yoo "Eeyyeen" ta'e, maallaqichi eessatti kuusama?
    1. Harka abbaa horii (qabaa maallaqaa)
    2. Herreega baankii hawaasaa keessatti
    3. Kan biraa
17. Deebiin keessan Lk. 13 jalatti "Lakki" yoo ta'e, sababni isin hin gumaachineef maaliif?
    1. Rakkina faayinaansii
    2. Tajaajilichi garaa nan geenye

3. Ni qisaasama jedheen sodaadha
4. Fageenya wiirtuu bishaanichaa
5. Qulqullina isaa quubsaa waan hin taaneefidha
6. Kan biraa

18. Tajaajila dhiyeessii bishaanii kanatti kan hin fayyadamne yoo ta'e, ammaantana madda bishaanii biraa kamitti fayyadamaa jirtu?
    1. Laga yaa'aa
    2. Burqaa kunuunsa hin qabne
    3. Maddawwan biroo
19. Raawwii hojii WASHCO akkamitti isin madaaltu?
    1. Baay'isee gaariidha
    2. Gaariidha
    3. Bayeessa
    4. Dadhabaadha
    5. Baay'isee dadhabaadha
20. Koreen walgahii taa'u fi dhiisuu ni beektuu?
    1. Eeyyeen
    2. Lakki
21. Baasii ilaalchisee hawaasaaf gabaasa faayinaansii ni dhiyeessuu?
    1. Eeyyeen
    2. Lakki
22. Koreen maallaqicha kaayyoo yaadameefiin ala fayyadamee ni beekaa?
    1. Eeyyeen
    2. Lakki
23. Hoggansa tajaajila bishaanii amma jiru isiniif quubsaadhaa?
    1. Eeyyeen
    2. Lakki
24. Dhiyeessii tajaajilaa ilaalchisee namni gaafatama qabu ni jiraa?
    1. Eeyyeen
    2. Lakki

25. Hojiin hojjataa dhiyeessii bishaaniitti isiniif hangam quubsaadha?
    1. Tokkoo quubsaa miti
    2. Quubsaa miti
    3. Hanga muraasa quubsaadha
    4. Haalaan quubsaadha
26. Gabbisa projektichaa waliigalaa irratti dubartootni hirmaannaa gosa kamii qabu?
    1. Karoora fi hoggansa
    2. Raawwii
    3. Fayyadama
    4. Sadarkaalee hunda irratti
    5. Gonkumaa
27. Dubartootni koree hoggansa bishaanii keessatti miseensummaa qabu?
    1. Eeyyeen
    2. Lakki
28. Sirni dhiyeessii bishaanii kun hojimaata gaarii akka qabaatu koree hoggansa bishaanii keessatti miseensummaan dubartootaa gaariidha jettanii ni yaaddu?
    1. Eeyyeen
    2. Lakki
    3. Altokko tokko
    4. Kan biraa
29. Dubartootni koree hoggansa bishaanii keessatti akka hin hirmaanne sababni isaan dhoorku maalidha jettanii yaaddu?
    1. Baay'ina hojii
    2. Sababa aadaa fi amanteen walqabate
    3. Iddoo dubartootni hawaasa keessatti qaban
    4. Sababilee biro
30. Fayyadama fi hoggansa madda dhiyeessii bishaanii ilaalchisee hawaasa keessan keessatti leenjiin kenname ni jira?
    1. Eeyyeen
    2. Lakki
    3. Ani hin beeku

31. Deggersa qaama alaa otoo hin barbaachisne hawaasni tajaajila dhiyeessii bishaanii mataa iaatiin hogganachuu qaba jechuun ni danda'amaa?
    1. Eeyyeen
    2. Lakki
32. Rakkinni cimaan maddi dhiyeessii bishaanii kun akka haala gaariin hin hojjanne taasisu kamidha?
    1. Maallaqaa fayyadamtootni kanfalan
    2. Hanqina deggersa tekniikaa
    3. Hanqina ogummaa tekniikaa
    4. Hanqina meeshaalee jijjiirraa
    5. Rakkina hanga/qulqullina madda bishaanichaan walqabate
    6. Rakkina hirmaannaa hawaasaa
    7. Kan biraa
33. Rakkina kanaaf furmaata akkamii laattan?
    1. Wajjira bishaanii aanaaf gabaasuu
    2. Hawaasa waliin mari'achuu fi mariisisuu
    3. Dandeettii keessaniin hogganuu
    4. Ogeessota tekniikaa qaxaruun furuu
    5. Kan biraa
34. Wantootni ciccimoon tajaajilli dhiyeessii bishaanii kun akka itti-fufiinsa qabaatu taasisuuf barbaachisan maal maalidha jettanii yaaddu?
    1. Hirmaannaa hawaasaa
    2. Maddawwan gama wajjira bishaanii aanaatiin hoggansiisuu
    3. Dhaabbilee miti-mootummaa dabalatee deggersa alaa barbaaduu
    4. Fayyadamtoota irraa gatii tajaajilaa walfakkaatu (consistent) fuudhuu
    5. Gabaa irratti argamuu meeshaalee jijjiirraa
    6. Kan biraa

IV. QORANNOO SIRNA DHIYEESSII BISHAAN BAADIYYAA HAALA AMMA IRRA JIRU FI RAAWWII HOJII HOGGANSA HAWAASAA KANAAN DURA TURE

1. Kanaan dura haalli hoggansa sirna dhiyeessii bishaanii keessan akkam ture?
    1. Baay'isee gaarii

2. Quubsaa
3. Hoggansa dadhabaa

2. Ammaantana haalli hoggansa sirna dhiyeessii bishaanii keessan akkam jira?
    1. Baay'isee gaarii
    2. Quubsaa
    3. Hoggansa dadhabaa
3. Deebii gaafii Lk. 1 jalatti laattaniif sababootni isaa maalidha jettanii yaaddu?

    _____

4. Deebii gaafii Lk. 2 jalatti laattaniif sababootni isaa maalidha jettanii yaaddu?

    _____

5. Sirni hoggansa dhiyeessii bishaanii kanaan duraa ture kan akkamiiti?
    1. Hawaasaan hogganamaa ture
    2. Wajjira bishaanii aanaatiin deggeramaa ture
    3. Dhaabbilee miti-mootummaan
    4. Kan biraa
6. Sirni hoggansa dhiyeessii bishaanii amma jiru kan akkamiiti?
    1. Hawaasaan hogganamaa ture
    2. Wajjira bishaanii aanaatiin deggeramaa ture
    3. Dhaabbilee miti-mootummaan
    4. Kan biraa
7. Hoggansa isa kamitu quubsaadha?
    1. Kan duraanii
    2. Isa ammaa
    3. Lamaanuu quubsaa moti
    4. Lamaanuu quubsaadha
8. Deebiin gaafii Lk. 7 jalatti laattan "Kan duraanii" kan jedhu yoo ta'e, sababni isaa maali?
    1. Hoggansi isaa hirmaachisaa ture
    2. Ennaa miidhame rakkinni daddaffiin hiikama ture
    3. Koreen hoggansa dhiyeenyatti hordoffii fi walgahii taasisaa ture
    4. Kan biraa

9. Deebiin gaafii Lk. 7 jalatti laattan “Isa ammaa” kan jedhu yoo ta’e, sababni isaa maali?
    1. Hoggansi isaa hirmaachisaa ture
    2. Ennaa miidhame rakkinni daddaffiin hiikama ture
    3. Koreen hoggansa dhiyeenyatti hordoffii fi walgahii taasisaa ture
    4. Kan biraa
10. Haalli sirna hoggansa faayinaansii ammaantana jiru akkami?
    1. Gaarii
    2. Dadhabaa
    3. Baay’isee gaarii
    4. Baay’isee dadhabaa
    5. Quubsaa
11. Haalli sirna hoggansa faayinaansii duraanii akkam ture?
    1. Gaarii
    2. Dadhabaa
    3. Baay’isee gaarii
    4. Baay’isee dadhabaa
    5. Quubsaa
12. Adeemsi kanfaltii gatii fayyadaminsaa duraanii fi ammaa akkami?
    1. Duraan gaarii ture
    2. Amma gaariidha
    3. Kanfaltiin gatii fayyadaminsaa altokko tokko funaanama
    4. Adeemsi funaannii kanfaltii gatii fayyadaminsaa walfakkaata
    5. Adeemsi funaannii kanfaltii gatii fayyadaminsaa walfakkaatina hin qabu
    6. Duraan gaarii ture, amma garuu dadhabaadha
    7. Amma gaariidha, duraan garuu dadhabaa ture
13. Haalli hojimaata tajaajila dhiyeessii bishaanii keessan kan duraanii fi ammaa akkami?
    1. Duraan ni hojjata ture, amma garuu hin hojjatu
    2. Duraan hin hojjatu ture, amma garuu ni hojjata
    3. Duraan walakkaan hojjata ture, amma garuu guutummaan hojjata

4. Amma walakkaan hojjata, duraan garuu guutummaan hojjataa ture

14. Deebiin gaafii Lk. 13 jalatti laattan “Duraan ni hojjata ture, amma garuu hin hojjatu” kan jedhu yoo ta’e, sababni inni hin hojjanneef maali?
    1. Sadarkaan bishaan lafjalaa waan gadi bu’eefidha
    2. Hanqina meeshaalee jijjiirraa
    3. Hanqina dandeettii ogummaa
    4. Rakkina faayinaansii
    5. Hawaasni waan madda dhiyeessii bishaanichaaf fedhii hin qabneefidha
    6. Hoggansi koree bishaanii dadhabaa waan ta’eefidha
15. Deebiin gaafii Lk. 13 jalatti laattan “Duraan hin hojjatu ture, amma garuu ni hojjata” kan jedhu yoo ta’e, sababni inni amma hojjatuuf maali?
    1. Madda irraa bishaan haala gaariin waan argamuufidha
    2. Argamiinsa meeshaalee jijjiirraa
    3. Argamiinsa deggersa ogummaa
    4. Humni faayinaansii gaarii waan ta’eefidha
    5. Hawaasni waan madda dhiyeessii bishaanichaaf filatuufidha
    6. Hoggansi koree bishaanii gaarii waan ta’eefidha
16. Duraan suphaa madda bishaanichaa kan raawwataa ture eenyudha?
    1. Miseensota koree hoggansa bishaanii
    2. Wajjira bishaanii aanaa
    3. Hawaasa naannoo
    4. Kan biraa
17. Ammaantana suphaa madda bishaanichaa kan raawwataa jiru eenyudha?
    1. Miseensota koree hoggansa bishaanii
    2. Wajjira bishaanii aanaa
    3. Hawaasa naannoo
    4. Kan biraa
18. Duraan maallaqni sirni bishaanichaa ittiin suphamu eessaa argama ture?
    1. Maallaqa fayyadamtoota irraa sassaabamu
    2. Buusii dabalataa fayyadamtootni gumaachan
    3. Wajjira bishaanii aanaa

4. Dhaabbilee miti-mootummaa
5. Kan biraa

19. Ammaantana maallaqni sirni bishaanichaa ittiin suphamu eessaa argama?
    1. Maallaqa fayyadamtoota irraa sassaabamu
    2. Buusii dabalataa fayyadamtootni gumaachan
    3. Wajjira bishaanii aanaa
    4. Dhaabbilee miti-mootummaa
    5. Kan biraa
20. Maddi bishaanii duraan ture fi kan ammaa hanqina bishaanii ni qabaa?
    1. Eeyyeen
    2. Lakki
21. Deebiin gaafii Lk. 20 jalatti laattan “Eeyyeen” kan jedhu yoo ta’e, yoomi hanqinichi mul’ate?
    1. Duraani
    2. Ammaantana
22. Ammaantana dubartootni hoggansa sirna dhiyeessii bishaanii irratti hirmaachaa jiruu?
    1. Eeyyeen
    2. Lakki
23. Duraan dubartootni hoggansa sirna dhiyeessii bishaanii irratti hirmaachaa turaniiruu?
    1. Eeyyeen
    2. Lakki
24. Adeemsi hojii fi suphaa sirna dhiyeessii bishaanii ammaantana jiru akkami?
    1. Gaarii
    2. Dadhabaa
    3. Baay’isee gaarii
    4. Baay’isee dadhabaa
    5. Quubsaa
25. Adeemsi hojii fi suphaa sirna dhiyeessii bishaanii duraanii akkam ture?
    1. Gaarii
    2. Dadhabaa
    3. Baay’isee gaarii
    4. Baay’isee dadhabaa
    5. Quubsaa

Deebii kennuun deggersa nuuf taasistaniif baay’isnee isin galateeffanna!!!