DEBRE BERHAN UNIVERSITY

EVALUATING THE SUSTAINABILITY OF RURAL WATER SUPPLY SCHEMES: IN CASE OF EMEGWA KEBELE, MENZ MAMA WOREDA, ETHIOPIA

A MASTER THESIS

BY

TEKLESINODA ASBETSADIK

COLLEGE OF BUSINESS AND ECONOMICS DEPARTMENT OF MANAGEMENT MASTERS OF PROJECT MAMAGEMENT

JUNE, 2024

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A Thesis Submitted to the Department of Management in Partial Fulfillment of the Requirements for the Degree of Master of Project Management

COLLEGE OF BUSINESS AND ECONOMICS DEPARTMENT OF MANAGEMENT MASTERS OF PROJECT MAMAGEMENT

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APPROVAL SHEET – I

This certifies that the thesis titled ***"Evaluating the Sustainability of Rural Water Supply Schemes: The Case of Emegwa Kebele, Menz Mama Woreda, Ethiopia"*** fulfills the partial requirements for the Master of Science degree in Project Management offered by the Graduate Program of the Management Studies College of Business and Economics Department at Debre Berhan University.

Under my supervision, Teklesinoda Asbetsdik conducted the original research presented in this thesis under my supervision. I can confirm that no portion of this work has been submitted for any other degree or diploma.

Throughout the research process, any assistance received has been properly acknowledged. Therefore, I recommend accepting this thesis as fulfilling the requirements for a Master of Science degree.

Dagim W. (Assitant. Proffeser)  14/10/2016 E.C

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APPROVAL SHEET-II

The undersigned members of the examination board for Teklesinoda Asbetsadik's final thesis defense have thoroughly reviewed and evaluated his work titled ***"Evaluating the Sustainability of Rural Water Supply Schemes: The Case of Emegwa Kebele, Menz Mama Woreda, Ethiopia."*** We also examined the candidate genes involved in the defense process.

Based on this evaluation, we certify that the thesis has been accepted as fulfilling the partial requirements for the Master of Science degree in ***Project Management***.

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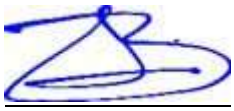
2. Bizuye Zegeye /phd Dr. /  21/10/2016 E.C

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STATEMENT OF THE AUTHOR

This thesis, titled ***"Evaluating the Sustainability of Rural Water Supply Schemes: The Case of Emegwa Kebele, Menz Mama Woreda, Ethiopia",*** is submitted in partial fulfillment of the requirements for the Master of Science (MSc) degree at Debre Berhan University. This is an original work, and all sources used have been appropriately acknowledged within the thesis. A copy of this thesis will be deposited in the university library, where it will be accessible to users under the library's regulations.

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ABBREVIATIONS

FGD Focused Group Discussion

GTP Growth and Transformation Plan

KIIs Key Informant Interviews

MDGs Millennium Development Goals

NGOs Nongovernmental Organizations

O&M Operation and Maintenance

RWSCs Rural Water and Sanitation Committees

RWSS Rural Water Supply and Schemes

RWSSM Rural Water Supply Scheme Management

SRWSMS Sustainable Rural Water Supply Schemes

UAP Universal Access Plan

UNDP United Nations Development Program

UNICEF United Nations Children's Fund

USAID U.S. Agency for International Development

VLOM Village-Level Operation and Maintenance

WASH Water, Sanitation & Hygiene

WHO World Health Organization

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Abstract

This research focused on evaluating the sustainability of rural water supply scheme in Menz Mama, Ethiopia, using a mixed methods approach. The data were gathered through household surveys, focus group discussions, key informant interviews, and field observations. Two-stage sampling thecniques wsed to select the Menz Mama Wereda, the Emegwa Kebele, and 109 sample households involved in managing the water supply scheme. The evaluation of the RWSS sustainability utilized nine indicators encompassing economic, social, and environmental aspects of the SDGs, reflecting local conditions. Descriptive statistics, including frequency, mean, minimum, maximum, and percentage, were employed for data summarization. The findings revealed 'moderate' levels for the environmental, economic, and social sustainability indices. Community involvement was 'Moderate' during the planning phase, 'High' during implementation phase, and 'Low' during monitoring and evaluation phase. Overall, both the sustainability of the RWSS and the level of community participation were evaluated as 'Moderate'. The study emphasizes the necessity of integrated support to address identified challenges and promote sustainable development in RWSS.

Keywords: Rural Water Supply Scheme, Sustainability, Community Participation, Socioeconomic-Environmental Sustainability, Sustainable Development

CHAPTER ONE

1 INTRODUCTION

1.1 Background

The significance of water in sustaining life is immeasurable. Safe drinking water is a fundamental necessity for humans to survive, maintain good health, and enhance productivity. As a resource that supports all life on Earth, water plays a crucial role in sustainable development (Dinka, 2018). \ to depend on unsafe water sources (Behailu et al., 2016). Many factors contribute to the global water crisis, including poverty, limited water availability in certain regions, and high numbers of people needing access. These challenges disproportionately impact rural communities, where environmental, social and economic hardships are often compounded by water scarcity (Gomez et al., 2019; Nkiaka, 2022). According to the Global Water Security 2023 Assessment, despite global progress, a significant portion of the world's population lacks access to safe water and sanitation. Globally, more than 70%, or approximately 5.5 billion people, do not have safe drinking water. This problem is particularly severe in Africa, where only 15% of the population enjoys this basic right. This lack of access to essential water, sanitation, and hygiene (WASH) services contributes to low water security across the continent. In Africa alone, more than 411 million people lack basic drinking water services, and a staggering 1.1 billion lack access to safe sanitation facilities, largely concentrated in sub-Saharan Africa, highlighting the ongoing challenges faced, particularly in Ethiopia (Hayes & Fawcett, 2023; Kilimo & Nambuswa, 2018; Tadesse et al., 2013). These issues have severely restricted development efforts and environmental, economical & social sustainability in rural areas across many countries.

In many rural communities across sub-Saharan Africa, including Ethiopia, access to safe water remains limited, disproportionately impacting women and children, who often bear the burden of collecting water for essential needs (Kilimo & Nambuswa, 2018). Recognizing the importance of water access for citizens' well-being, the Ethiopian government has implemented various initiatives to improve access to clean drinking water and sanitation facilities.

Like many African nations, Ethiopia struggles with water scarcity, sanitation issues, and limited access to clean water, particularly in rural areas (World Health Organization & UNICEF, 2023). To address this issue, the government prioritized expanding safe water supply coverage in both rural and urban settings (Kahn, 2019). Consequently, significant funding from national, regional, local, and international sources has been directed toward rural regions to improve access to clean water (Dos Santos et al., 2017; Tadesse et al., 2013). This has resulted in the construction of numerous potable water projects in various villages across the country. Ensuring access to safe water and sanitation is crucial for healthy communities, yielding substantial health, economic, and social benefits (Agenda 21, 1992). Agenda 21 defines sustainability as integrating environmental and development concerns to fulfill basic needs and improve living standards for all, highlighting the importance of sustainable water and sanitation practices.

While constructing these projects is crucial, it is not the sole answer. Increasing rural water access is intricately linked to ensuring the functionality and sustainability of water supply schemes. A study in the Amhara region revealed that 23% of the water points of the sample schemes were nonfunctional, highlighting the need for community capacity building in operation and maintenance (Muhabaw, 2020). This emphasizes the importance of addressing not only construction but also long-term sustainability through community involvement and capacity building. In light of this context, this research aims to evaluate the sustainability of the RWSS in the Menz Mama Werda, specifically focusing on the Emegwa kebele.

1.2 Problem statement

Despite the government of Ethiopia's prioritization of improved water and sanitation access, the country continues to face less coverage than other African nations (Tantoh & McKay, 2021). This complex challenge stems from various factors, including the selection of unsuitable technological solutions, budget constraints, insufficient skilled technicians, and project designs driven by supply rather than community needs. Additionally, a limited understanding of safe hygiene practices within communities further hinders progress (Jha, 2010).

Studies on the sustainability of RWSS management in Ethiopia are limited. Existing research indicates that the sustainable value of these schemes is negatively impacted by several socioeconomic factors, such as inadequate technical skills, insufficient funds, lack of community capacity, limited community engagement, absence of user fee collection systems, inadequate cost recovery mechanisms, poor design, substandard construction, weak institutional frameworks, limited coordination among stakeholders, and inadequate policy enforcement (Abebe & Tucho, 2021; Tessema & Getachew, 2022). Research gaps in RWSS sustainability include analyzing non-functionality reasons, incorporating user needs, developing long-term operation and maintenance strategies, integrating local knowledge, enhancing community involvement, and evaluating long-term impacts and management strategies.

Menz Mama Woreda, Emegwa Kebele, in particular, faces significant challenges regarding clean drinking water access, with issues such as nonfunctionality of existing systems and water shortages. Although the government, NGOs, and community have implemented various measures to address these problems, ensuring long-term sustainability remains a concern. A recurring issue in the region is the repetitive construction of rural water supply schemes by both the government and NGOs, often without translating into lasting solutions, as the management of these schemes remains unsustainable. This cycle of construction and eventual breakdown hinders progress in securing a reliable water supply for the community.

Although there is growing attention in the scientific literature toward the challenges of RWSS functionality and management, these issues persist and even worsen (Behailu et al., 2016; Machado et al., 2022). Therefore, a comprehensive evaluation of the current sustainability of rural water supply schemes is essential for informing the development and implementation of appropriate management strategies that address any identified weaknesses (Schweitzer & Mihelcic, 2012). This study aims to employ the Menz Mama Woreda, Emegwa Kebele RWSS, as a case study to evaluate its sustainability, utilizing indicators drawn from the social, economic, and environmental pillars of sustainable development. The findings from this research will contribute valuable evidence-based data on the sustainability of RWSS management practices, which can then be used to

inform strategies for improving RWSS management, functionality, and climate change adaptation efforts.

1.3 Research questions

- What is the present sustainability status of the rural water supply scheme in the study area?
- How is community participation integrated at various stages of the rural water supply scheme in the study area?
- What are the challenges encountered in sustaining rural water supply schemes in the study area?

1.4 Objectives

1.4.1 General Objectives

The major objective of the study is to examine the sustainability of rural water supply schemes in the study area.

1.4.2 Specific Objectives

- To evaluate the current sustainability status of rural water supply schemes in the study area.
- To examine the levels of community participation during different phases of rural water supply schemes management in the study area.
- To evaluate the challenges faced in sustaining rural water supply schemes in the study area.

1.5 Significance of the study

The results of this research on the sustainability of the rural water supply scheme in Menz Mama, Ethiopia, holds significant value for several reasons: such as:

- **Improved RWSS Management:** The research findings will enable local water authorities and non-governmental organizations to strengthen the sustainability of RWSS in Emegwa Kebele, Menz Mama Wereda. This includes addressing identified challenges such as technical issues, poor governance or low user engagement. Recommendations for improved design, operation and community involvement contribute to long-term service and water safety.

- **Informed Policy Decisions:** The study can inform policy decisions at regional and national levels. By identifying the effective practices and challenges faced by Emegwa Kebele in Menz Mama Wereda, it is possible to implement effective policies for sustainable rural water supply projects across Ethiopia. This may include capacity building, improved governance or funding mechanisms.
- **Knowledge Contribution:** This study adds to the existing knowledge on sustainable WSS management in rural areas. By analyzing the interaction between environmental, economic and social issues, the study provides useful information and recommendations for researchers and practitioners working in similar contexts.
- **Replication Potential:** The research findings can be used as a reference point to replicate successful experiences in other rural water supply projects scheme in Ethiopia. By identifying key factors that contribute to sustainability, the study provides a valuable roadmap for ensuring long-term water supply scheme in underserved communities.
- **Community Empowerment:** The research will enable the community of Emegwa Kebele, Menz Mama Wereda to be empowered by raising awareness about the concept of sustainability and its importance for their water supply plans. By understanding the challenges and solutions, communities can participate more effectively in managing their water resources.

Overall, this research has the potential to make a significant contribution to the sustainability of RWSS in Ethiopia. By providing valuable insights and practical recommendations, the study can lead to improved RWSS management practices, informed policy decisions, and ultimately, improved access to clean water for rural communities.

1.6 Scope of the study

This research was evaluating the long-term sustainability of the rural water supply scheme in Menz Mama, Ethiopia, focused on Emegwa Kebele. It was employed a mixed-method approach to evaluate environmental, economic, and social aspects of sustainability. Community participation throughout the project cycle and potential

challenges like technical issues or weak management wolud also were explored. The expected outcomes were a comprehensive evaluation with recommendations to enhance the scheme's sustainability and inform future projects in Ethiopia.

1.7 Organization of the paper

The structure of this paper comprises five sections. The initial section introduces the study and discusses the background, problem statement, objectives, scope, and overall organization of the study. The second part reviews the pertinent literature and fundamental concepts connected to the study topic. The third section elaborates on broader methodological approaches, detailing aspects such as the study area description, research design rationale, sampling methods, data sources and types, data collection tools, and analysis techniques. Section four presents the findings and discusses the findings, while the final section centers on summarizing the key points, drawing conclusions, and providing recommendations.

CHAPTER TWO

2 LITRATURE REVIEW

2.1 The concept of sustainability

The concept of sustainability originated in the environmental movement, aiming to protect finite natural resources and ecological systems from excessive extraction and pressure (Kourula & Halme, 2023). Various organizations have provided straightforward explanations for sustainable development, with three key aspects consistently emerging as fundamental elements: the constraints of existing resources, the interconnectedness of human activities for both current and future generations, and concerns regarding fairness in the allocation of benefits.

Sustainable development ensures the continuity of economic, social, and environmental aspects of human society and the nonhuman environment. It encompasses development that meets current needs while preserving the ability of future generations to meet their own needs (MW et al., 2023). This definition represents a significant departure from the previous focus on ecology to a broader emphasis on the economic and social aspects of development. For instance, economic sustainability is described as the ability to maintain a given level of expenditure over time. The Operations Evaluation Department of the World Bank (OED; 2003) defines sustainability as "the resilience to risk of net benefit flows over time." Furthermore, the concept also encompasses institutional or management sustainability, which is achieved when prevailing structures and processes can maintain their functions over the long term (DFID; 2000) (Sifile et al., 2021).

Achieving sustainability requires a holistic approach that considers the environment, the economy, and the community it serves. These three pillars are interconnected and essential for long-term success (Purvis et al., 2019).

In 2015, the United Nations (UN) launched the Sustainable Development Goals (SDGs), with SDG 1 targeting the eradication of extreme poverty in all its forms. This encompasses ensuring access to food, clean water, and sanitation while addressing emerging challenges from climate change and conflicts. SDG 1 goes beyond poverty alleviation for individuals, encompassing social policies that either perpetuate or

alleviate poverty, steer communities toward sustainable resource utilization and address issues such as inequality, inadequate clean water, poor sanitation, and a comprehensive set of 17 targets to combat poverty and hunger (Keesstra et al., 2018; Nations, n.d.). Environmental sustainability stands as a central focus of the SDGs, with the management of rural water supply project schemes playing a critical role in attaining this objective. The management activities of rural clean drinking water supply projects contributed to the achievement of multiple UN-SDGs. Specifically, as highlighted by (Baye, 2021; Shehu & Nazim, 2022), it directly contributes to the attainment of SDG 6, which is focused on clean water and sanitation for all. Additionally, it has indirect implications for other goals, such as SDG 1 (no poverty), SDG 3 (good health and well-being), and SDG 5 (gender equality). This implies that the collective contribution presents a noteworthy opportunity to advance numerous key objectives, establishing it as a multifaceted and pivotal element of the 2030 UN-SDG agenda. Although the government of Ethiopia, especially in the ANRS, has exerted substantial efforts in managing rural water supply schemes in partnership with local communities,

2.1.1 Environmental Pillars

The Environmental Pillar encompasses the technical and environmental dimensions of sustainability. It focuses on ensuring reliable water supply technology to safeguard water sources from threats such as over-extraction and contamination. By protecting the environment, the project ensures the sustainability of water resources for future generations. *Environmental sustainability involves preserving natural resources to meet present needs and those of future generations while safeguarding the ecological balance of the planet's ecosystem* (Henderson & Loreau, 2023). In this light, the environmental pillar can be considered a foundational element for achieving overall sustainability.

2.1.2 Economic Pillar

The economic pillar incorporates aspects of financial sustainability. This highlights the importance of adequate financial resources to cover the costs of operation, maintenance, and repairs. Ensuring financial sustainability is crucial for ensuring the long-term viability and effectiveness of rural water supply projects. *Economic sustainability involves promoting economic growth and development while ensuring that the needs of*

future generations are not compromised (Elsawy & Youssef, 2023). The Brundtland Report highlights the economic system's reliance on land and natural capital. This economic pillar acknowledges the interplay between human activity, the economy, the environment, and the responsible use of natural resources for the production of goods and services (Iten, 2020).

2.1.3 Social Pillar

The social pillar integrates institutional and social sustainability dimensions. It emphasizes the need for well-functioning institutions that provide services that meet users' expectations and sociocultural preferences. This pillar ensures that rural water supply projects are accessible, widely used, and valued by the communities they serve. *Social sustainability recognizes the interconnectedness of human livelihoods with ecological objectives, achieved through economic development that meets present needs while safeguarding the ability of future generations to meet their own needs* (Hajian & Kashani, 2021). It recognizes the crucial link between material conditions, social needs, and societal flourishing. In addition to promoting equity and opportunity, social sustainability paves the way for a better quality of life, as collective goals and human progress rely on collaboration (Iten, 2020).

2.2 Sustainability in Relation to the Rural Water Supply Scheme

The issue of sustainability in the rural water supply scheme (RWSS) sector has gained significant attention in recent literature and development efforts. Although the concept of maintaining a service or benefit over time is not novel, there is a growing focus on ensuring the long-term viability of interventions and investments across various disciplines. Organizations employ unique definitions of sustainability tailored to their specific objectives. Consequently, research conducted on water supply services has generated diverse definitions related to sustainability within the realm of water supply project schemes. The definition of sustainability plays a vital role in determining parameters critical for assessing and comprehending the influential factors that impact the potential for sustainability (Tadesse et al., 2013).

In the early days of discussing sustainability in water supply and sanitation, the focus was primarily on the financial side of things. This meant that ensuring projects could support themselves financially, and users were expected to contribute to the costs (Perry et al., 2012). Conversences around the sustainability of water supply and sanitation have evolved. Initially, focused on project finances, it now emphasizes a broader concept: a system's long-term ability to deliver benefits even after external support ends. This focus has shifted the emphasis from individual projects to the entire water supply scheme and the services it provides (Mishra et al., 2021).

The concept of sustainability in water supply and sanitation (WSS) has evolved alongside the growing importance of community management models. Initially, it focused solely on the community's ability to maintain service (Ashiq et al., 2020; Schweitzer & Mihelcic, 2012). However, recent studies acknowledge that most communities require ongoing external support for effective management. Therefore, a truly sustainable community-managed WSS system should not exclude access to continuous external backup assistance. According to (Kativhu et al., 2017; Machado et al., 2022), a sustainable water supply service should fulfill several key criteria. It must function effectively and be used by the community. The service should deliver sufficient, high-quality, convenient, and reliable water to everyone, including disadvantaged women and men. Additionally, community involvement is crucial, encompassing operation, maintenance, rehabilitation, and covering costs through user fees or other methods. Furthermore, the system should address gender equity issues and be operable and maintainable at the local level with minimal external support. Finally, it is essential to consider environmental impacts and avoid negative consequences. SDGs are a set of universal demands that balance economic, social, and environmental development and can be used to monitor and track progress toward sustainable development (Alemayehu & Bekele, 2023).

2.3 The concept of water supply and sanitation in Ethiopia

Reliable access to clean water and adequate sanitation infrastructure are essential for sustainable socioeconomic development in Ethiopia, benefiting both urban and rural communities. Tragically, a significant portion of the population lacks access to these

vital services, leading to the alarming spread of waterborne diseases, which account for more than 60% of contagious illnesses in the country (Aydamo et al., 2023).

The slow expansion of water services in Ethiopia can be attributed to various factors identified by (Loucks & van Beek, 2017), including the lack of comprehensive water legislation, inadequate investment, and the absence of a national water tariff policy. These issues, which have been relevant since the 1980s, continue to hinder progress in providing reliable water access. To address this limited access, Ethiopia pledged its commitment to the Millennium Development Goals (MDGs), particularly Target 10, which aimed to halve the proportion of people without access to water and sanitation by 2015 (Weststrate et al., 2019). However, despite advances, the Ministry of Water Resources found that approximately 33% of the country's water supply schemes are nonfunctional due to insufficient funds for operation and maintenance, inadequate community mobilization and commitment, limited community participation in decision-making, and a lack of spare parts (Beyene, 2012).

In Ethiopia, rural water supply systems are specifically designed to serve low-density, mostly unincorporated rural communities (Tadesse et al., 2013). However, these systems often fall short in meeting the demands of firefighting due to their primary focus on residential and livestock use (Ratnayaka et al., 2009). Rural water schemes are characterized by unlooped designs with numerous dead ends, as highlighted by (Haq, 2017; Tadesse et al., 2013). To manage these systems effectively, rural water associations and nonprofit organizations undertake the financing, construction, operation, and maintenance of water distribution networks.

Globally, the lack of access to safe water and sanitation remains a significant challenge, affecting a substantial portion of the world's population. Shockingly, approximately 5.5 billion people, or more than 70% of the global population, lack safe drinking water; with Africa being particularly affected (Hayes & Fawcett, 2023). In Africa alone, only 15% of the population enjoys the basic right to safe drinking water, while millions of people lack access to even basic drinking water services and safe sanitation facilities, which are mainly concentrated in sub-Saharan Africa (Hayes & Fawcett, 2023; Kilimo & Nambuswa, 2018; Tadesse et al., 2013). These ongoing challenges severely hinder

development efforts and environmental sustainability in rural areas across multiple countries. The consequences are dire, with water-related illnesses filling more than half of global hospital beds, affecting the health and well-being of half the developing world's population (Martínez-Santos et al., 2017).

Access to clean water and improved sanitation are fundamental for building healthy communities and play a vital role in promoting health, sustaining economic development, and driving social progress (Ambe, 2018; Barlow & Clarke, 2017; Kamruzzaman et al., 2013). Therefore, it is crucial to prioritize efforts and investments to address these challenges and ensure universal access to safe water and sanitation services, not only in Ethiopia but also worldwide.

2.4 The Concept of Rural Water Supply Scheme Management

In low- and middle-income countries, multivillage schemes (MVSs) are a promising solution for rural water supply schemes, linking numerous villages and small towns through expansive distribution networks. While traditional approaches emphasize community management, the sheer scale and complexity of MVSs demand innovative management strategies (Hutchings et al., 2020).

Rural water and sanitation committees (RWSCs) are often tasked with operating and maintaining local systems. However, studies in regions such as Maharashtra reveal that many rural water and sanitation committees/RWSCs/ lack the technical, administrative, and financial resources to do so effectively. Inadequate O&M planning and heavily subsidized water can further hinder rural water and sanitation committees'/RWSCs/, leaving them ill equipped to handle breakdowns or provide reliable year-round supplies (especially during times of peak demand). While groundwater-based systems offer convenience and rapid expansion of coverage, their reliance on potentially unsustainable sources can hinder long-term water security. Although surface water-based schemes may perform better in terms of equitable water distribution, coverage, and accessibility, they are not without challenges. One significant issue is that community-led initiatives have not been fully supported. Experts note that rural water and sanitation committees /RWSCs/ are often relegated to mere operation and maintenance, limiting their ability to drive demand-based solutions (Bassi & Kabir, 2016).

Ensuring the long-term sustainability of community-managed Rural Water Supply Schemes (RWSSs) remains a critical challenge in developing countries. Ideally, a sustainable RWSS provides reliable access to safe drinking water for rural communities over an extended period. While community management is broadly seen as a key factor for sustainability, it often faces social, technical, institutional, and financial hurdles that can compromise its effectiveness (Ashiq et al., 2020).

2.5 Community participation in Rural Water Supply Schemes

The success of rural water supply schemes in developing countries often hinges on strong community participation. To increase involvement, it is essential to consider arrangements that empower communities throughout the development and operation of these schemes. Unfortunately, the current procedures of many water departments may hinder rather than encourage this participation. To address this, local communities must have greater involvement in all stages of water scheme development. Establishing village water committees with the authority to mobilize community members to engage in planning and secure financing can be a highly effective way of achieving increased participation (Riswan, 2021).

Sustainable water supply schemes are crucial for providing clean water and improved sanitation in developing countries. This directly impacts health, reducing water-related illnesses and allowing communities to thrive. A demand-driven approach, emphasizing community participation, is key to the long-term sustainability of these schemes. However, primary stakeholders are often excluded from crucial stages such as project identification, planning, and implementation. This lack of involvement can lead to poor quality, limited ownership, and ineffective monitoring. To ensure sustainability, local communities must be actively engaged in every phase of water supply project schemes (Meniga, 2019). The community demonstrated strong participation during the implementation stage, resulting in a high overall rating (Bekele et al., 2023).

2.6 Expected benefit of RWSSM

Access to a safe and reliable water supply is crucial for the well-being and development of rural communities. In Ethiopia, the implementation of rural water supply schemes has

the potential to bring about a range of benefits. There are several expected benefits of rural water supply schemes in Ethiopia:

Environmental Benefits: Rural water supply schemes in Ethiopia can bring about significant environmental benefits. These schemes contribute to water resource conservation by providing reliable water sources closer to communities, thereby reducing the need for extracting water from natural sources such as rivers and streams. This helps conserve water resources and maintain the ecological balance of the surrounding ecosystems. Additionally, certain rural water supply schemes in Ethiopia incorporate techniques such as rainwater harvesting and groundwater recharge, which contribute to the replenishment of underground water reserves. These practices support the long-term sustainability of water availability in the region (Mekonnen & Hoekstra, 2016).

Economic Benefits: The implementation of rural water supply schemes in Ethiopia yields significant economic benefits for the country. These schemes enhance agricultural productivity by providing reliable water sources for irrigation, resulting in increased crop yields and higher incomes for farmers (Adugna & Abegaz, 2016; Luh et al., 2017). This boost in agricultural productivity contributes to food security and economic growth in rural areas (World Bank, 2019). Additionally, rural water supply schemes support livestock development by ensuring an adequate water supply for livestock rearing and related income-generating activities (G. Abebe, 2018; Tadesse, 2013). Reliable access to water improves livestock health and productivity, leading to increased market value and income for pastoral communities (World Bank, 2010). These economic benefits play a crucial role in uplifting rural livelihoods and fostering the overall economic development of Ethiopia.

Social Benefits: Rural water supply schemes in Ethiopia bring about significant social benefits for communities. One key benefit is improved health and sanitation, as access to clean water reduces waterborne diseases and specifically decreases diarrheal diseases, particularly among children (WHO, 2019; UNICEF Annual Report 2021, 2022). Additionally, these schemes save time and increase productivity by providing closer water sources, freeing up time previously spent collecting water. This time, liberation

benefits women and girls, allowing them to pursue education, income-generating activities, and community development initiatives (World Bank, 2016; Water Aid, 2023). Moreover, reduced water collection burdens empower women and girls, enabling their participation in education, income generation, and decision-making processes. This empowerment promotes gender equality and fosters social, economic, and political inclusion (UN Women, 2020); (FAO, 2021).

2.7 Challenges of Sustaining RWSS

Managing long-term rural water supply schemes poses significant challenges, especially in developing countries such as Ethiopia. This issue is multifaceted and influenced by a range of social, economic, and environmental factors. Several challenges have been identified in the management of rural water supply schemes in Ethiopia. (Muhabaw, 2020) highlighted challenges such as a lack of demand-driven approaches, insufficient user participation, inadequate committee training, inappropriate technology selection, inadequate project frameworks, ineffective project management practices, and technical issues in design or implementation. Similarly, (Marvin, 2021; Mehta, 2003, and Shumie, 2022) identified challenges, including limited financial resources, technical capacity and skills gaps, sustainability and operation and maintenance issues, climate change impacts, community participation and ownership, geographic accessibility and infrastructure, and inadequate monitoring and evaluation. These multifaceted challenges threaten the sustainability of rural water supply scheme management. Additional challenges, such as the lack of a comprehensive water policy, insufficient investment, and community capacity issues, have hindered progress in ensuring a sustainable water supply (Tadesse, 2013). Achieving sustainability requires considering social, economic, and environmental dimensions (Marti & Puertas, 2020; L. Zhao et al., 2019). Therefore, addressing these challenges and integrating the three dimensions is essential for sustainable rural water supply scheme management in Ethiopia.

2.8 Empirical Literature Review

In this section, the researcher was review the empirical evidence from various researchers on the sustainability of rural water supply schemes in the following ways. It

is important to note that these studies were conducted in different locations, with varying objectives, methodologies, and data collection mechanisms, leading to diverse outcomes.

The research, conducted by (Kilimo & Nambuswa, 2018), offers valuable insights for policy-making and reform efforts to enhance water project sustainability. This study analyzed the factors influencing the sustainability of rural water supply management in Kenya, specifically focusing on Marakwet West Subcounty. A descriptive design methodology was utilized, with a sample size of 259 selected through simple random sampling. Data collection involved personally administering questionnaires by the researcher. Key findings indicated a positive relationship between proposal management committees and the sustainability of water projects in the area. The study concluded that involving communities in leadership roles within the committee during proposal preparation enhances sustainability. Recommendations included empowering communities with technical expertise for equipment operation and maintenance, ensuring competent personnel for proposal management, aligning development proposals with community priorities, adopting modern technology for project sustainability, and promoting accountability.

Rresearch, conducted by (Kativhu et al., 2020) investigated how multiple water uses affect sustainability in Zimbabwe's rural water systems. Their research, which compared water points with combined uses (including community gardening) to those for domestic use only, revealed a positive influence on sustainability with multiple uses. However, this also led to increased conflicts and breakdowns. The study concludes that while allowing productive uses such as gardening can enhance sustainability, effectively managing these multiuse systems requires additional skills and resources. This highlights the need for a balanced approach to water use and sustainable management practices in rural communities.

Research conducted by (Arimoro & Musa, 2020) argues that sustainable water management is vital for achieving clean water access and sanitation goals in developing countries such as Nigeria. They emphasize the need for rural communities to actively participate in managing water resources to ensure long-term sustainability. This includes strategies for ensuring reliable public water supplies that improve quality of life, protect

ecosystems, and alleviate poverty. Recognizing the human right to water, this article highlights the importance of data-driven policies and successful community-based management practices to achieve sustainable water use in Nigeria. Overall, collaboration among local communities, policymakers, and stakeholders is advocated, aiming to achieve the UN's Sustainable Development Goals related to water resources. Research conducted by (Muniu et al., 2017) investigated the link between community involvement and the sustainability of water projects in Nyeri County, Kenya. Using a mixed-method approach with surveys, focus groups, and interviews, the research revealed a strong positive correlation: projects with higher levels of community participation in decision-making showed greater sustainability. This suggests that including beneficiaries throughout the project lifecycle, from planning to management, is crucial for long-term success in Kenyan water projects.

A review by (Ashiq et al., 2020) examined factors influencing the sustainability of community-managed rural water supplies in developing countries. By analyzing existing research, this study revealed that community management can be a successful model but faces social, technical, and financial hurdles. It emphasizes collaboration between the government, communities, and NGOs for improved service delivery and highlights the importance of community participation throughout the project lifecycle for long-term success. Although the study lacked a specific location, it underlines the need for tailored interventions to address sustainability challenges in community-managed water projects globally. A study by (Meniga et al., 2019) in Kilteawlaelo, Ethiopia, evaluated community participation in rural water projects. The research revealed low involvement in planning, construction monitoring, and financial contributions. Limited water user committee involvement was also noted, potentially due to socioeconomic barriers and complex technologies. This study highlights the importance of participatory planning and recommends strategies such as community mobilization, awareness rising, and simpler technology choices to improve community involvement in future projects.

Research conducted by (Muhabaw, 2020) investigated the effectiveness and sustainability of water projects in Debark Wereda, Ethiopia, focusing on social, technical, and managerial aspects. Using a mixed-methods approach with surveys and

secondary data, this research identified user participation, committee training, and appropriate technology as crucial factors. While 23.4% of projects were deemed salvageable, 54% fell short of standards, and 18% were nonfunctional. Importantly, community-managed projects fared better. These findings highlight the need for improved project approaches and increased community involvement for sustainable water management in Debark Wereda. A study by (Haylamicheal et al., 2012) assessed water quality in the Wondo Genet district, Ethiopia, to evaluate its impact on the sustainability of rural water supplies. Researchers have analyzed various parameters, such as pH, turbidity, and bacteria, according to the World Health Organization (WHO) guidelines. While most of the aesthetic quality aspects met the WHO standards, some of the water points exceeded the hardness and turbidity limits. Notably, most water points had detectable coliform bacteria, raising concerns about their bacteriological quality. This study recommends regular chlorination, particularly for dug wells, and household disinfection to improve water quality and service delivery sustainability in Wondo Genet.

The study by (Tadesse, 2013) was conducted in Adama district, located in Central Ethiopia within the Oromia Region. The district's topography ranges from 1500 to 2300 meters above sea level and is characterized by surging plains with extensive agricultural activities, encompassing a predominantly rural population, with approximately 84% residing in rural areas. The data were collected via household surveys and interviews with key stakeholders, including community members, local authorities, and water supply organization representatives; household water use practices; community attitudes toward water safety; community contributions to water source protection and maintenance; and institutional approaches to enhancing water supply scheme sustainability. A purposive sampling technique was used to survey 300 households and interview key informants from local water supply organizations and community leaders, with data analysis employing qualitative and quantitative methods, including descriptive statistics for summarizing household water use practices and community attitudes, and thematic analysis to identify key themes regarding community contributions and institutional approaches for sustainability enhancement.

2.9 Conceptual Framework

This paper explores the concept of sustainable rural water supply schemes (SRWSSs) and proposes a conceptual framework for evaluating their success in Emegwa Kebele, Menz Mama Wereda, Ethiopia. Sustainability, encompassing various interpretations (Schroter et al., 2017), gained prominence at the 1992 Rio Summit and was defined as meeting present needs without compromising future generations' ability to do the same (Mirchooli et al. 2021). Sustainable RWSS utilities recognize the importance of community involvement and utilizing local knowledge. Including women in decision-making is crucial, as they often bear responsibility for water collection and are significantly impacted by RWSS management practices (Russo et al., 2014). Effective RWSS management requires a holistic approach that considers the interactions among social, economic, and environmental dimensions (Tadesse, 2013). Consequently, evaluating RWSS sustainability involves assessing these factors (Domínguez et al., 2019). Sustainability evaluation takes various forms, depending on its goals, scale, and scope. One way to measure sustainability is through indicators. Since sustainability is a multifaceted concept, RWSS sustainability evaluation is not based on a single indicator but rather on a set of indicators (Boggia et al., 2018). These indicators must be comparable across different regions and agreeable into a cohesive framework. This approach enables informed decision-making and prioritization of actions to improve overall RWSS sustainability. Sustainability evaluation, a complex task due to the multifaceted nature of sustainability itself, utilizes a set of indicators rather than a single metric (Taye et al., 2015). Ideally, these indicators are comparable across regions and can be combined for a cohesive framework. This approach provides valuable insights for policymakers to prioritize actions enhancing overall SRWSS sustainability. This paper prepared a novel evaluation framework (Figure 1) for evaluating the sustainability of a rural water supply scheme (SRWSS) in Menz Mama Wereda, Ethiopia. The framework utilizes a three-pronged approach to ensure its robustness: a literature review establishes a strong theoretical foundation; field surveys capture the local context and user needs; and expert consultations guarantee practical application and regional relevance. This comprehensive approach allows the framework to identify key sustainability indicators across the three core pillars of environmental compatibility (minimizing environmental

impact), economic viability (ensuring long-term operation and maintenance), and social acceptability (meeting user needs and fostering well-being).

These pillars, aligned with the three dimensions of sustainability, provide a foundation for sustainable RWSS management in Menz Mama Wereda. The framework utilizes 9 /nine/ key economic, social, and environmental indicators to evaluate and understand the sustainability of the region's RWSS.

This framework serves as a valuable tool not only for Menz Mama Wereda but also for informing decision-making, policy formulation, and future research related to the SRWSS in similar contexts across different regions.

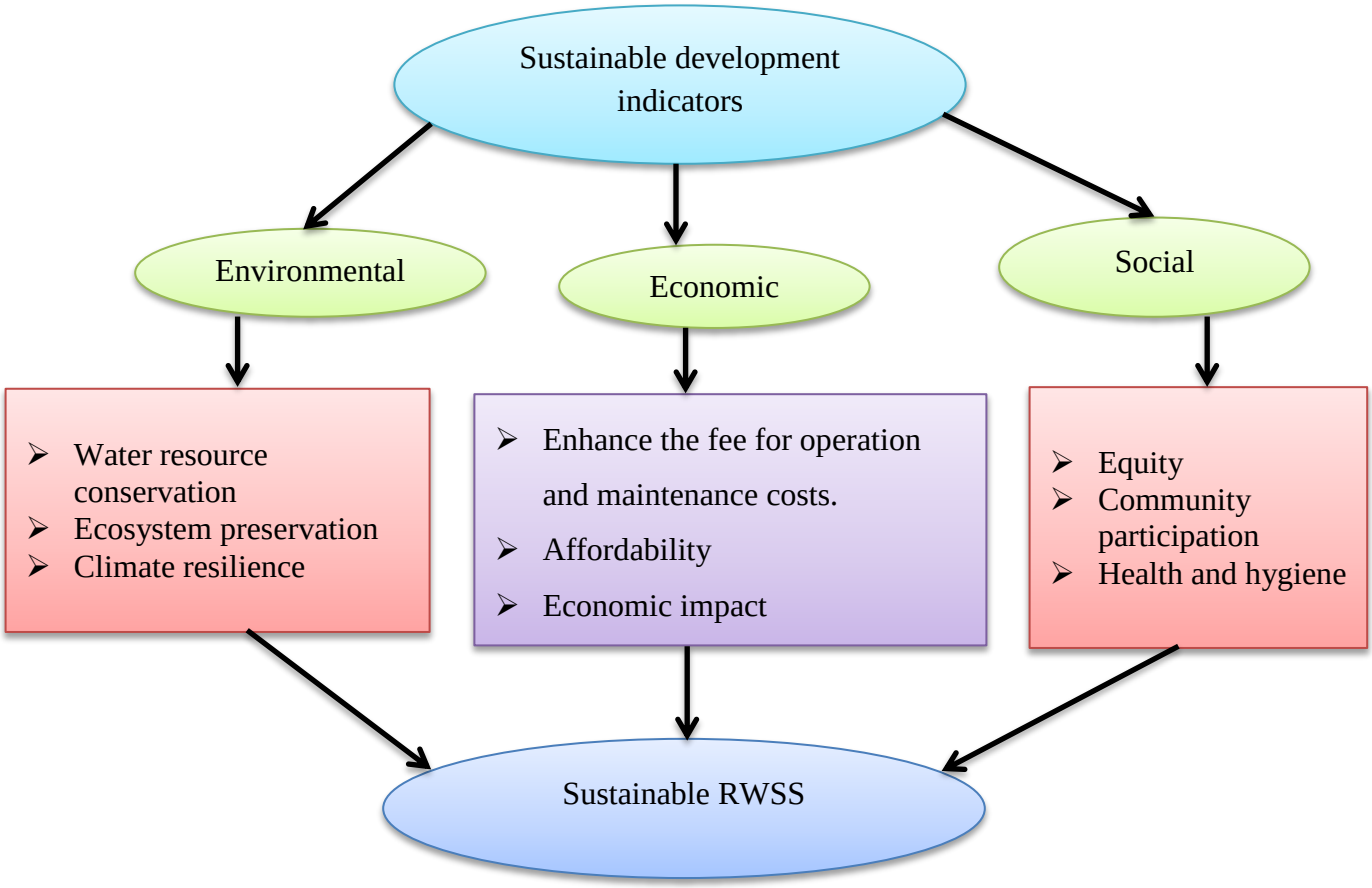

Figure 1: Conceptual framework of sustainable rural water supply schemes

Source: Author's construction

CHAPTER THREE

3 MATERIALS AND METHODS

3.1 Description of the study area

3.1.1 Location

This research was conducted in Menz Mama, a woreda (district) within the North Shewa Zone of Ethiopia's Amhara Region. Located approximately 254 kilometers north of the national capital, Addis Ababa, the capital city, Molale, is also 819 kilometers from the regional capital, Bahir Dar, and 124 kilometers from Debre Berhan, the capital of the North Shewa Zone. The district borders Moja Wedera and Termaber to the South, Moret Jiru and Baso Worena to the West, Menz Gera and Menz Lalo to the North, and Kewot and Efrata Gidim to the East.

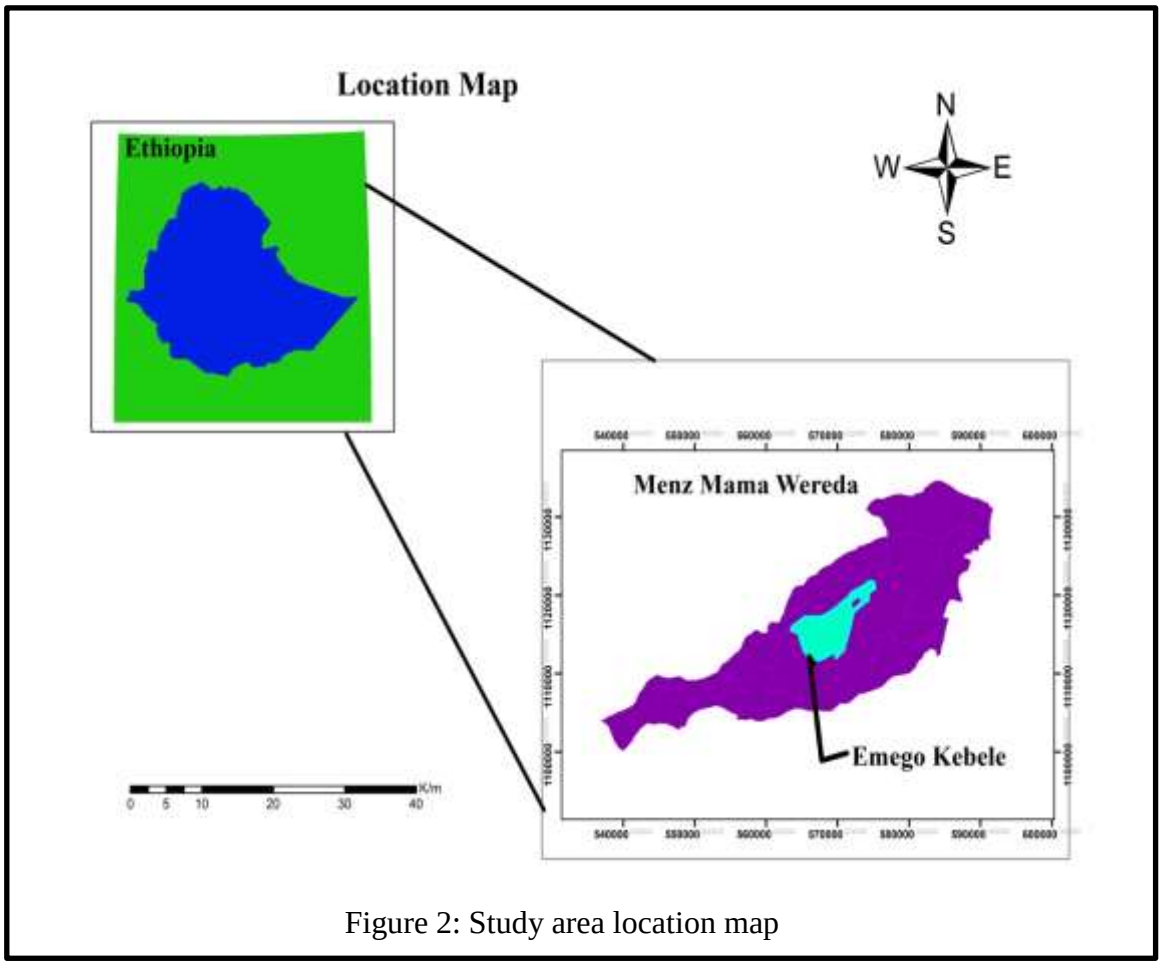

Figure 2: Study area location map

3.2 Research Approach

Research approach refers to the overarching strategy or plan that outlines how research questions or objectives will be addressed, often involving the integration of qualitative and quantitative methods for a comprehensive understanding (Dawadi et al., 2021; Ngulube, 2022). In this case, the research approach utilized is a convergent parallel mixed methods design, which involves collecting qualitative and quantitative data concurrently and integrating them later for a comprehensive understanding of RWSS sustainability.

The convergent parallel design in this study facilitated the gathering of quantitative data on sustainability challenges and qualitative insights into participation levels and specific challenges faced in Menz Mama Wereda, Ethiopia. This balanced approach addressed multiple research questions simultaneously and efficiently collected data for a comprehensive understanding of RWSS sustainability.

3.3 Research design:

Research design specifies the detailed blueprint or structure of the study, encompassing the specific methodologies, data collection processes, and analysis techniques employed to achieve the research goals (Dawadi et al., 2021; Ngulube, 2022). In this study, a descriptive research design with a mixed-methods approach was employed. This design leverages the strengths of both quantitative and qualitative methods to comprehensively assess the sustainability of RWSSs and community participation within them.

On the quantitative side, a household survey targeted a specific sample of households to gather relevant information. The questionnaire focused on demographics, socioeconomic background, and households' involvement in managing the RWSS. It also explored their perception of implemented interventions and their impact on the environment, economy, and social fabric of the study area. This data contributed to developing an RWSS sustainability index and measuring the level of community participation.

To complement the quantitative data and gain deeper insights, a qualitative approach was employed. Key informant interviews with individuals possessing specialized knowledge, focus group discussions to understand shared experiences, and direct

observations of RWSS management practices were conducted. The qualitative data focused on community participation throughout the RWSS management cycle, the current status of the system, environmental, economic, and social benefits derived from these activities, and the challenges faced in ensuring the long-term sustainability of RWSS management.

3.3.1 Data sources

This research employed a multifaceted approach to data collection, utilizing both primary and secondary sources to gain a comprehensive understanding of the research topic.

Primary data were collected directly from the study area through various methods. Household surveys were conducted to gather information directly from residents within the selected communities. Additionally, key informant interviews were held with individuals who held leadership positions or possessed specific expertise related to water resource management. This included representatives from the Menz Mama Wereda Water & Energy Office management team, community leaders, youths, and local elders. Finally, direct observations within the study area provided valuable contextual information.

Secondary data, on the other hand, were collected from existing published and unpublished documents. This included reports, government documents, and research on RWSS management practices in similar contexts.

3.4 Data collection tool

To gather additional information from the selected sources, the researcher employed the following data collection tools:

3.4.1 Questionnaire

A structured questionnaire employing closed-ended questions was designed to gather data from 109 randomly selected households. These surveys focus on their participation in and perceptions of RWSS management interventions. Specific areas of inquiry include the following:

- The perceived impact of these interventions on environmental, economic, and social conditions
- Challenges faced in ensuring the sustainability of RWSS management

Data collection for the household survey was conducted by three trained enumerators between March and April 2024. The questionnaire was initially prepared in English and then translated into Amharic, the local language, to ensure clear communication with participants.

3.4.2 Key informant interviews (KIIs)

To gain a deeper understanding of the social, economic, and environmental aspects of RWSS management, thirteen key informant interviews (KIIs) were conducted. The participants were selected strategically from twelve villages to ensure diverse perspectives within the community. The interviewees included Development Agents (3), Local Leaders (3), Elders (2), Religious Leaders (2), Youth Representatives (2), and one Woreda Water Resources Management Expert with at least 12 years of residence in the area who was strategically chosen. The KIIs focused on exploring key themes related to RWSS management, such as the perceived environmental, economic, and social impacts of RWSS interventions, the level of community participation in managing the RWSS, and the challenges faced in ensuring the long-term sustainability of the RWSS. To maintain consistency in data collection, a checklist was developed to guide the interview process and ensure standardized data collection across all informants.

3.4.3 Focused Group Discussion/FGD/

To gather comprehensive qualitative data on attitudes, experiences, and perceptions related to RWSS management, focus group discussions (FGDs) were utilized. This approach is particularly valuable for uncovering insights that may be challenging to obtain through other methods. The participants for the FGDs were chosen through purposive sampling to ensure diverse representations in terms of age and long-term residency within the study area. Two focus groups were conducted: the RWSS Committee FGD, consisting of ten members with equal representation of men and women who served on the rural water supply scheme committee, and the Community-Level FGD, also comprising ten members (five men and five women), including

knowledgeable and influential community members holding relevant information about RWSS management, such as community leaders, elders, development agents, and local experts. The FGDs were guided by a predefined discussion agenda that incorporated a mix of semistructured and open-ended questions to facilitate an in-depth exploration of the key themes.

3.4.4 Field observation

To verify and contextualize the data obtained from questionnaires, interviews, and focus groups, the researcher conducted two field observations in March and April, with assistance provided. These observations were designed to achieve a more profound understanding of the current state of the RWSS. The tools used during the observations included a checklist to understand the relevant information. The areas of focus during the observations included verification of functionality, evaluation of the physical condition of the infrastructure, observation of current RWSS management practices, and identification of existing challenges related to the RWSS. This information has aided in validating the data collected through other methods and provides valuable insights into the real-world context of the RWSS.

3.5 Sampling methods

This study employs a two-stage random sampling approach to select the study area and households. In the first stage, Menz Mama Wereda was chosen due to its nonfunctional water supply scheme, limited clean water access, and climate vulnerability—all of which are factors relevant to the research objectives. This selection was based on Wereda listings provided by the North Shoa Zone Water and Energy Development Department.

The second stage focused on household selection. Emgewa Kebele, Twelve villages and water supply schemes were randomly chosen from the Kebele village and water supply scheme lists provided by the Wereda water and energy development office. These schemes serve a total of 499 beneficiaries. A statistically valid sample size (n) was determined to ensure that the chosen households accurately represented the larger population with the desired level of precision. The sample size (n) was determined by

using the (Cochran, 1977) method, with the population parameter inputs using two optional formulas:

A. $n_0 = \frac{z^2pq}{d^2} - - - -(equation\ 1)$ was used to calculate the desired sample size when the population was larger than 10,000; however,
B. Since the population of the selected village water supply schemes is less than 10,000, the second formula $fn = \frac{n_0}{1+\frac{(n_0-1)}{N}} - - - - - (equation\ 2)$ will be employed, using the additional input of equation 1.

Where Z is the 95% confidence limit, i.e., 1.96; p is 0.1 (the proportion of the population to be included in the sample, i.e., 10%); q is 1-0.1, i.e., (0.9); N is the total number of people, 499; and d is the margin of error or degree of accuracy desired (0.05).

Sample size $\boldsymbol{n = \frac{z^2 * p * q}{d^2} = n = \frac{1.96^2 * 0.1 * 0.9}{0.05^2} = n = \frac{0.345744}{0.0025} = 138.2976}$

Using the desired sample size (n) = 138.2976 and total households N = 499, the actual sample size fn) is calculated as:

Total sample size $fn = \frac{n_0}{1+\frac{(n_0-1)}{N}} = \frac{138.2976}{\left(1+\frac{(138.2976-1)}{499}\right)} = \frac{138.2976}{1+\frac{(137.2976)}{499}} = \frac{138.2976}{1.275145491} \approx 109$

Therefore, n = 109 will be the sample size of the research. These sample households will draw for data collection using a random sampling method depending on their determined percentage of each village held by the total target households.

In general, out of the 499 household units in 12 selected villages, the study focused on gathering data from a total of 109 sample households through questionnaires. Furthermore, the study included interviews with 12 respondents, comprising Development Agents (2), Local Leaders (3), Elders (2), Religious Leaders (2), Youth Representatives (2), and one Woreda Water Resources Management Expert who has resided in the area for at least 12 years and who has been strategically chased.

Table 1: Sampled Kebeles, villages, water supply schemes and sample sizes of the households.

No	Kebele	Village	Name of water supply schemes	Types of water supply schemes	Total HHs	Number of sample HH	Required sample size per village
1	Emegwa	Dasa Wonz	Dasa Wonz	Hand dug well	41	41*109/499 = 9	9
2		Atat Keba	Atat Keba	Hand dug well	60	60*109/499 = 13	13
3		Atat Keba	Mush	Spring	41	41*109/499 = 9	9
4		Tekula Gorea	Tekula Gorea	Spring	32	33*109/499 = 7	7
5		Arba Dfo	Arba Dfo	Spring	55	54*109/499 = 12	12
6		Zol	Korekonch	Spring	27	27*109/499 = 6	6
7		Dasa Wonz	Atat Keba No 2	Spring	23	23*109/499 = 5	5
8		Dasa Wonz	Dasa Wonz	Spring	41	41*109/499 = 9	9
9		Atat Keba	Atat Keba No 2	Hand dug well	42	42*109/499 = 9	9
10		Emegwa	Belay Mesk	Hand dug well	32	32*109/499 = 7	7
11		Emegwa	Knber Bele	Spring	50	50*109/499 = 11	11
12		Mnasariya	Chiggn Tabiya	Spring	55	55*109/499 = 12	12
Total (n)					499	492*109/499 = 109	109

Source: own compilation, 2024

3.6 Method of data analysis and index formulation

This study was employed a multifaceted approach to analyze the data and construct sustainability indices. Quantitative analyses were performed with SPSS 27, which enabled the statistical evaluation of challenges from survey data. This allowed comparisons across demographic groups to identify variations in perceptions and priorities. Complementing this, qualitative analysis of focus group discussions /FGD/, key informant interviews /KII/. It revealed the nuanced reasons and implications behind the identified challenges, going beyond the capabilities of statistical analysis. Additionally, trend analyses were tracked how these challenges have evolved over time, enriching the overall understanding of project dynamics.

3.6.1 Measuring levels of community participation at different phases of the RWSS

Effective and sustainable RWSSs rely heavily on community participation throughout the project lifecycle (Marks et al., 2014). This includes active involvement from all stakeholders during the planning, implementation, and monitoring and evaluation phases (Meniga et al., 2019). For evaluating community engagement at various stages of the

RWSS project, the criteria established by (Bagdi, 2002; Teressa, 2020). These criteria were originally used to measure participation in rural water supply scheme programs but have been modified to better reflect the local context and specific phases of the project cycle. This ensures a more accurate evaluation of community engagement within the study area.

$$PPI = \frac{mean\ participation\ score(p)}{maximum\ participation\ score} * 100$$

The researcher utilized the following formula, adapted from previous studies (Bagdi, 2002; Teressa, 2020), as indicated by the above formula.

$$CPI = \frac{mean\ participation\ score(p)}{maximum\ participation\ score} * 100$$

$$P = \frac{\sum_{i=1}^{N} pi}{N}$$

Where

CPI = Community participation index

N = Total number of respondents

$$pi = \sum_{j=1}^{k} (CPPj + CPIj + CPMj)$$

Where

CPPj = represents the total score achieved by respondent j for their participation in program planning.

CPIj = represents the total score achieved by respondent j for their participation in program implementation.

CPMj = total score obtained by a respondent due to participation in program monitoring and evaluation;

K = total number of statements on which the responses of the respondents were recorded;

Pi = Total participation scores obtained by individual respondents in planning, implementation, and monitoring and evaluation.

Community participation was evaluated and quantified in relation to the three stages of participation (planning, implementation, and monitoring) using a five-point continuum scale (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always) (Kyaw Soe et al., 2012; Muniu et al., 2017). To measure community participation, a tool comprising 15 activities was developed, with seven activities dedicated to the planning phase, four to the implementation phase, and four to the monitoring and evaluation phase. These activities were identified through a comprehensive process involving field surveys, consultations with local experts, and a review of relevant literature (Goodman et al., 2017).

Each activity was evaluated against three levels, 'low', 'moderate', and 'high', representing values of <50%, 50-75%, and >75%, respectively, to determine the levels of community participation at different phases of RWSS (Meniga et al., 2019). The scores for each activity were averaged to derive the overall levels of community participation.

Table 2: RWSS phase, activities, and descriptions

RWSSs phase	Activities	Description
Planning phase	Needs assessment and identification	Identifying water-related needs and challenges through surveys focus group discussions, and community mapping exercises (Meniga et al., 2019).
	Site selection for RWSS	During the planning phase of a RWSS, site selection refers to the process of identifying and choosing the most suitable location for the installation of water sources such as boreholes, wells, or intake points for water supply systems in rural areas (Secretariat, 2021).
	Setting project goals and objectives	Collaborative workshops should be held to discuss community priorities and aspirations for the RWSS (Woldesenbet, 2020).
	Formulation of RWSS users bylaw	The formulation of RWSS user's bylaws offers the advantage of promoting community ownership, ensuring sustainable management, fostering equitable access to safe water, and providing a framework for effective operation and maintenance of the water supply system in rural areas (Carter, 2021).
	Selection of appropriate technologies	Participatory demonstrations and discussions should help communities understand different water supply options and select the most suitable technology based on local context and preferences (Thompson et al., 2020).
	Identifying resource contributions	Communities should be involved in discussions and agreements regarding their contributions, such as financial resources (user fees) or labor contributions for construction (Chirenje et al., 2013).
	Establishing operation and maintenance plans	Community members participate in developing plans for cleaning, repairs, and overall management of the water supply system, ensuring long-term sustainability (Nelson et al., 2021).
Implementation phase	Mobilization of resources	Community members contribute by organizing fundraising activities, donating materials, or identifying local resources needed for construction (Lawrence, 2021).
	Construction and installation of infrastructure	Depending on skill levels and local agreements, community members should actively participate in construction activities, contributing labor or assisting with tasks (Agarwal & Buzzanell, 2015).

	Training and capacity building	Community members involve in training programs on operation and maintenance of the water supply system, ensuring long-term functionality (Mithi, 2022).
	Contributing to construction efforts	Track the level and type of resources (labor hours, materials) contributed by the community toward construction (Z.-Y. Zhao et al., 2016).
Monitoring and evaluation phase	Data collection on water quality, quantity, and usage	Community members trained to collect data on water quality, quantity, and usage patterns, contributing valuable information for monitoring purposes (McKinley et al., 2015).
	Identifying challenges and suggesting improvements	Encourage community members to report any challenges or issues encountered with the water supply system and suggest potential improvements (Gautam, 2020).
	Participating in performance evaluations and feedback sessions	Facilitate open discussions and feedback sessions where community members can share their perspectives on the system's performance and suggest improvements (Kadariya et al., 2023; Mamula Nikolić et al., 2020).
	Sharing responsibility for resolving operational issues	Encourage community members to participate in resolving minor operational issues, fostering a sense of ownership and shared responsibility (Daluwatte et al., 2020).

3.6.2 Evaluating sustainability in rural water supply schemes

The evaluation of the sustainability of RWSSs plays a vital role in informing decisions and implementing efficient management strategies (Domínguez et al., 2019). Through the evaluation of RWSS sustainability, decision-makers can gain valuable insights into the present conditions of these schemes and identify areas that necessitate intervention. The selection of evaluation approaches depends on the specific objectives, scale, and scope of the evaluation. These approaches encompass the utilization of indicators or indices, the integration of evaluation tools, or the use of a sustainability barometer (Mirchooli et al. 2021).

This study evaluates the sustainability of RWSS through a framework built on social, economic, and environmental indicators aligned with the core pillars of sustainable development. To ensure local context relevance, I adapted the criteria developed by (Alemayehu & Bekele, 2023) for measuring the sustainable development status of micro and small enterprises in Debre Berhan town. These criteria will be modified to specifically address the context and challenges of RWSS.

To establish an index of sustainable development, a total of 9 indicators were identified to represent the economic, social, and environmental dimensions of sustainability. These indicators were selected carefully, taking into consideration the local context and the existing conditions of the RWSS. The development of these indicators involves an extensive process, which includes literature reviews, on-site observations, and consultations with local experts (Abbasi et al., 2023); (Bonnet et al., 2021); (Alemayehu & Bekele, 2023). The indicators, along with their corresponding sub-indicators and their assumed relationships with sustainability, are presented in (Table 3). The construction of a sustainable development index involves the evaluation of weights assigned to various indicators to derive a final value that represents the current status of sustainable development in the RWSS. During the evaluation, these indicators were evaluated at three levels of sustainable development implementation, 'low', 'moderate', and 'high', which corresponded to values of <50%, 50-75%, and >75%, respectively. These values were measured to determine the extent to which sustainable development measures were implemented for each indicator. To determine the overall sustainability status of RWSS

management, the scores of the indicators were aggregated, meaning that they were combined or averaged in a manner reflecting their relative importance or contribution to the overall sustainability status, similar to the approach used in the community participation. Equal weights are assigned to each indicator, assuming that all indicators have equal importance in evaluating sustainability. This approach has both advantages and limitations. The advantage of using equal weights is the elimination of bias or subjectivity in the evaluation process and its ease of use. However, a limitation of equal weighting is that it might not accurately reflect the relative importance or significance of each indicator in reality (Alemayehu & Bekele, 2023).

Table 3: Indicators, sub-indicators, and assumed relationships with sustainability

Indicators	Sub-indicators	Assume relationship with sustainability
Environmental sustainability	Ensure water resource conservation	Sustainable RWSS management focuses on long-term water availability through practices like source protection, efficient use, and ecological balance (Lako & Çomo, 2024).
	Ensure ecosystem preservation	The impact of RWSS on local ecosystems, such as rivers, wetlands, and biodiversity, involves minimizing negative ecological impacts and promoting habitat conservation (Muluneh, 2021).
	Enhances climate resilience	Adapting RWSS to mitigate climate change impacts involves implementing water storage and management systems resilient to changing weather patterns and extreme events (Bartlett & Dedekorkut-Howes, 2022).
Economic sustainability	Enhance the fee for operation and maintenance costs.	Recovering the fee for operation and maintenance costs for RWSS through user fees or revenue streams determines the financial sustainability of the RWSS (Ashiq et al., 2020).
	Increase affordability	Local population's ability to pay for water services without financial hardship is evaluated based on income levels and community affordability thresholds (Goddard et al., 2021).
	Increase positive economic impact	Improved access to reliable and safe water services may lead to positive economic effects, such as increased agricultural productivity, reduced healthcare costs, and improved livelihood opportunities (Abanyie et al., 2023).
Social sustainability	Ensuring equity	Ensuring the fair distribution of water services and benefits among different social groups within the community considers factors like access to water, gender equality, and social inclusion (Assefa et al., 2021).
	Ensure community participation	Community involvement in decision-making processes related to the planning, implementation, and management of RWSS emphasizes inclusive and participatory approaches (Rijal, 2023).
	Ensure health and hygiene	Improved water supply's impact on public health and hygiene practices within the community includes factors like reduced waterborne diseases, access to sanitation facilities, and the promotion of safe hygiene behaviors (Tsekleves et al., 2022).

3.7 Reliability and Validity

3.7.1 Validity test

Validity refers to the extent to which the research accurately measures its intended objectives or the truthfulness of the research results. In essence, it assesses whether the research instrument effectively aligns with the research objectives (Kazemian, 2015). Similarly, (Kiprop et al., 2015) emphasized the attainment of validity through the inclusion of objective questions in the questionnaire, achieved by pretesting the instrument to identify and modify any ambiguous or offensive questions and techniques. In this study, the researcher ensured research validity by formulating objective questions, reviewing the literature, and adopting instruments from a previous study, thereby measuring the accuracy of the research results and the alignment of the research instruments with the research objectives (Gachanja, 2013).

3.7.2 Reliability test

The accuracy of an instrument refers to its reliability. It is crucial to assess the reliability of a measuring instrument because it indicates the extent to which the instrument consistently produces the same results in repeated situations. One widely used test for determining internal consistency is Cronbach's alpha. This test provides a coefficient that reflects the internal consistency of the scale. The coefficient ranges from 0 to 1, with a score of 0.7 or higher considered acceptable (Heale & Twycross, 2015).

In this study, Cronbach's alpha was used to measure the reliability of the scale. Prior to distributing the questionnaires to the entire sample, a pilot test was conducted. The pilot test serves to assess the reliability of the research instrument using Cronbach's alpha but on a smaller scale. It essentially collects data from respondents in a manner consistent with the larger study, serving as a guide or validation of the selected research procedures (Zikmund et al., 2013). According to (Perneger et al., 2014; Singh, 2022), a pilot test utilizing 20 to 50 cases, or at least 10-20% of the total sample size for the full-scale survey, is considered sufficient for the pilot sample size.

In this case, the internal consistency reliability of the variables was examined using Cronbach's alpha on a sample of 24 questionnaires, which represented approximately 22% of the total sample. This step was performed before the questionnaires were

distributed to the entire population of 109 participants, as shown in Table 4. According to the guidelines of (Hair et al., 2003) regarding Cronbach's alpha coefficient size, an alpha coefficient value below 0.6 indicates poor internal consistency, while a value of 0.9 and above is considered excellent. Based on established guidelines for interpreting Cronbach's alpha coefficient values, different ranges indicate varying levels of internal consistency. The ranges and corresponding strengths of internal consistency are as follows: an alpha coefficient of less than 0.6 is considered poor, 0.6 to less than 0.7 is considered moderate, 0.7 to less than 0.8 is considered good, 0.8 to less than 0.9 is considered very good, and 0.9 and above is considered excellent. Considering these guidelines, the researcher conducted an internal consistency test to gain greater confidence in the reliability of the research findings. The results of the survey sample indicate that there is "good", very good and "excellent" internal consistency within each question. These findings are presented in detail in the test results (Table 4). By conducting the internal consistency test and achieving favorable results, the researcher gained greater confidence in the overall reliability of the research findings. Therefore, in this study, a 35-item scale was used with 24 respondents to assess the reliability of the evaluated questions, which were employed to measure the variables under investigation.

Table 4 Reliability test

No	Questions	Cronbach's alpha	Number of Items
1	Community participation in RWSSM	0.892	19
2	Environmental Sustainability in RWSS	0.973	3
3	Economical Sustainability in RWSS	0.903	3
4	Social Sustainability in RWSS	0.924	3
5	Challenges of RWSS Sustainability	0.753	7
	Reliability of all items	**0.79**	35

Source: SPSS Results, 2024

3.8 Ethical consideration

The study was conducted in strict accordance with ethical standards. Permission was obtained from the relevant authority at the College of Business and Economics, Debre Berhan University, following the receipt of an official letter. Participants were briefed on the study's objectives and only gave their consent after understanding them clearly. Data collected from the participants were stored securely to protect confidentiality.

CHAPTER FOUR

4 RESULTS AND DISCUSSION

4.1 Characteristics of the Respondents

4.1.1 Sociodemographic characteristics:

Sex of respondents: The survey data revealed that 19.3% (21) of the respondents were female, while 80.7% (88) were male (Figure 3). Furthermore, the results from focus group discussions (FGDs) and key informant interviews (KIIs) indicated that male farmers are more involved in RWSSM practices than female users are. This disparity can be attributed to factors such as labor-intensive tasks, traditional gender roles, and societal norms that assign women to domestic responsibilities. Consequently, these challenges and attitudes significantly impacted the sustainability of project management for the RWSS in the study area. These findings align with previous studies by (Assefa et al., 2021; Façanha, 2021; Team, 2024) emphasizing the negative consequences of isolating women from decision-making and project management, as well as the limited promotion of gender equality in sustainable RWSS projects.

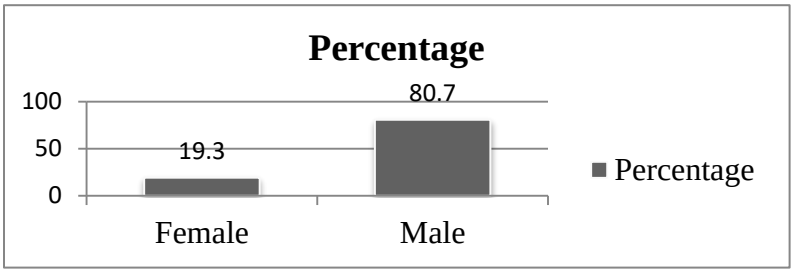

Figure 3: Sex of survey household

Age of the respondents: In the study conducted in the study area, the age range of the respondents varied from 25 to 71 years, with a mean age of 42 years (Figure 4). The majority of participants belonged to the 25-64 age group. These findings indicate that the productive age group dominates the population structure in the study area, suggesting a greater likelihood of labor-intensive practices in managing RWSS. This observation is consistent with a previous study by (Admassie et al., 2015), which identified the active working age group as typically ranging from 16 to 64 years. In addition, according to (Meniga et al., 2019), the active population within this age group demonstrates

significant engagement, actively participating in various endeavors. They possess a keen awareness of new technologies and exhibit a strong commitment to promoting the sustainability of the rural drinking water supply.

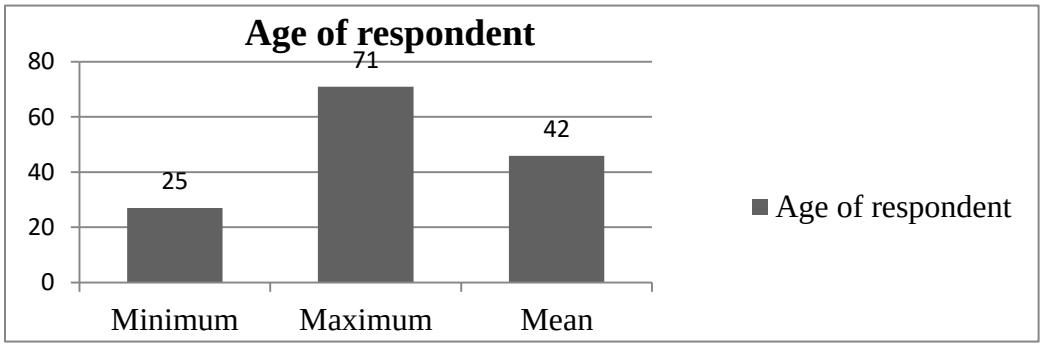

Figure 4: Age composition of the survey household

Marital status of the respondents: Based on the research results, most participants were in marital relationships and resided with their families. The study revealed that 78 individuals (71.5%) were married, while 17 (15.6%), 9 (8.3%), and 5 (4.6%) were divorced, widowed, and single, respectively, as illustrated in Figure 5. These findings indicate that a large portion of the study participants were married, with a smaller number having undergone changes in marital status, such as divorce, widowhood, or singlehood.

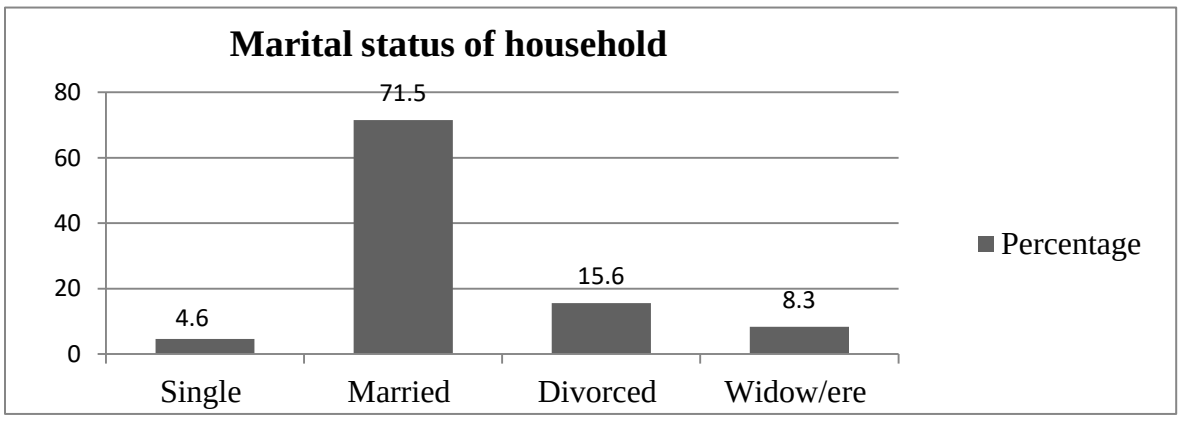

Figure 5: Marital status of the survey household

Educational status of the respondents: The research revealed that the respondents had diverse educational levels, ranging from illiterate to secondary (9-12) education, as

depicted in Figure 6. The majority of individuals had the following educational backgrounds: 9 individuals (8.3%) were illiterate, 55 individuals (50.4%) had received informal education enabling them to read and write, 33 individuals (30.3%) had completed primary education, and the remaining 12 individuals (11%) had finished secondary education. Research suggests that farmers with higher levels of education are more likely to comprehend and engage in activities related to rural water supply scheme project management (Sheikh et al., 2014). In this study, a significant proportion of the respondents (58.7%) were both illiterate or possessed only basic reading and writing skills. It was assumed that this lack of formal education might influence the community's involvement in rural water supply scheme project management activities. However, it is crucial to acknowledge that "education" encompasses diverse forms of knowledge and expertise. By focusing solely on formal education, Illiterate farmers with extensive experience and knowledge in rural water supply planning and management have been neglected by often focusing only on formal education. To foster sustainable management of rural water supply schemes, it is crucial to embrace participatory approaches that incorporate the collective wisdom and experiences of both literate and illiterate farmers. This inclusive approach acknowledges the valuable insights that individuals from different educational backgrounds can contribute. Furthermore, previous studies (Meniga et al., 2019) have highlighted that middle-aged farmers possess a deeper understanding of rural water supply scheme project management activities, likely influenced by their first-hand experience overcoming recent hardships.

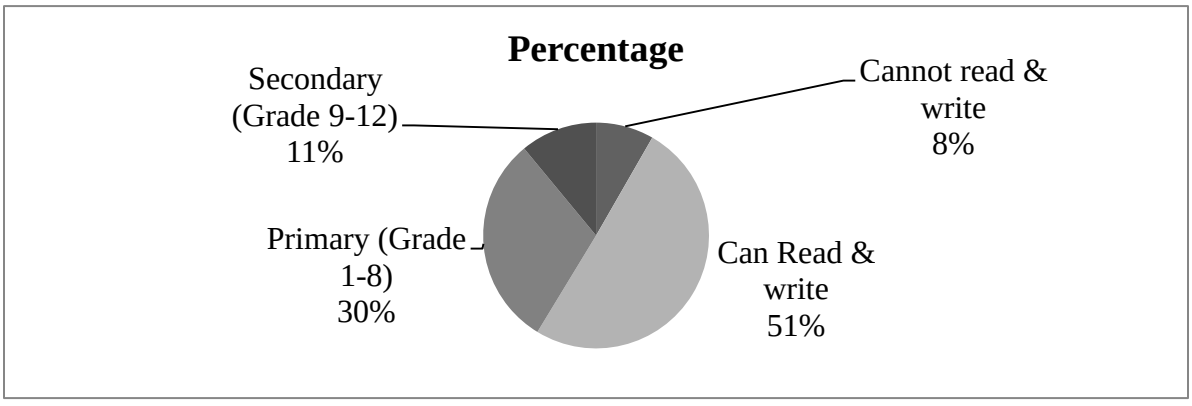

Figure 6: Educational status of the survey household

Family size of the respondent: The research showed that respondent family sizes ranged from one to seven members, with an average of 4 members per household (Figure 7). FGDs and KIIs revealed that larger families might have more members available to contribute labor to construction, maintenance, or other community activities related to the water supply project. This could lead to greater participation from these households. These findings are similar to those of a previous study by (Naiga et al., 2017), which revealed that the participation of a large number of families in RWSS project management activities is greater than that of small families.

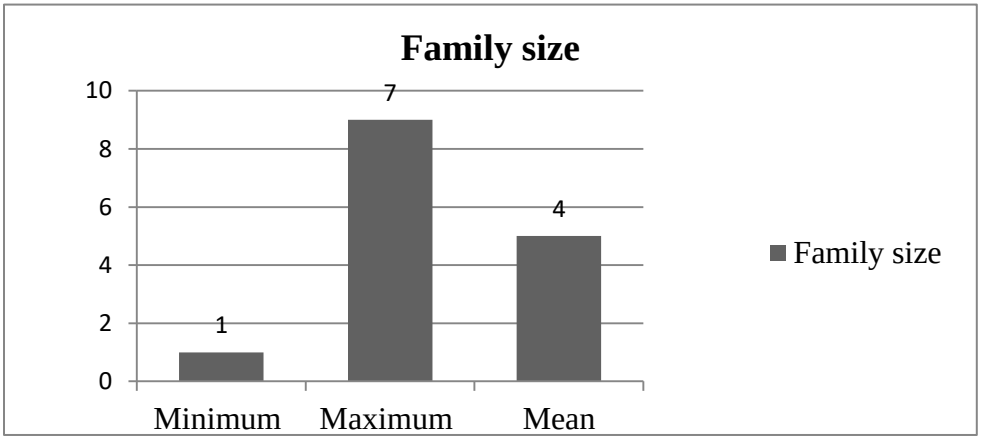

Figure 7: Family size of the survey households

4.1.2 Socioeconomic characteristics

Income sources of the respondents: Based on the survey results, mixed farming is the main income source for the community and respondents. Approximately 98 individuals, accounting for 89.9% of the total respondents, are currently involved in both crop production and livestock rearing, indicating a heavy reliance on combined agricultural activities for income generation. According to the findings from the FGD & KIIS, mixed farming intensifies the demand for a reliable water supply, incentivizing active community management and benefiting social and economic aspects. A sustainable water supply enhances agricultural productivity, boosting incomes and social well-being, potentially enabling financial contributions for long-term maintenance. Farmer knowledge on water resources and agricultural needs can be utilized through community participation to develop sustainable RWSS management practices and promote social

and environmental benefits. Similar to a study conducted by (Flint et al., 2024), these results align, indicating that income sources linked to mixed farming positively influence the practices of managing RWSS sustainably.

Table 5: Income sources of the survey respondents

Sources of income/livelihood	Yes		No	
	(N)	(%)	(N)	(%)
Crop production only	11	10.10	98	89.9
Livestock production only	0	0	109	100
Mixed farming (both crop and livestock production)	98	89.9	11	10.1
Of farm income source	48	44	61	56
Petty trading	15	13.8	94	86.2
Casual labor work	7	6.4	102	93.6
Skilled work (masonry, carpentry)	5	4.6	104	95.4
Local brewing (e.g., Araki, Tella, etc.)	11	10.1	98	89.9
Safety net (RSNP)	2	1.8	107	98.2
Remittance (support of family or others)	3	2.8	106	97.2
Employment (salary based)	5	4.6	104	95.4
Other (please specify)	0	0	109	100

Source: Own survey, 2024

The survey findings indicate that approximately 44% of the respondents, or their family members, are engaged in nonfarm income-generating activities alongside their primary farming activities. These activities include petty trading (13.8%), casual labor (6.4%), local beverages (such as Araki and Tella) (10.1%), salaried employment (4.6%), skilled work in masonry and carpentry (4.6%), safety nets such as RSNP (1.8%), and providing remittances for family or others (2.8%). This suggests that a significant proportion of the community has diversified its sources of income beyond traditional farming activities.

Land holding size: The distribution of farm sizes among the sample households is depicted in (Figure 8). Of the survey respondents, 98 individuals (89.9%) reported owning their own farmland. On average, each household possessed approximately 0.95 hectares of land. The range varied from households with 0.00 hectares of land holdings to those with a maximum of 2 hectares. Through discussions with key informants and focus group discussions (FGDs), it was revealed that landowners typically hold greater decision-making power in regard to water supply schemes, driven by their vested interest

in the scheme's success in agricultural activities. Their willingness to contribute financially or through labor is also greater due to the perceived benefits for their land. However, this dynamic may raise concerns of inequity among nonlandowners who may feel excluded or skeptical of the project's benefits, particularly if they perceive it as primarily serving landowners. Similar findings were reported in a prior study by (George-Williams et al., 2024; Vardhan, 2006), which identified land scarcity as a significant challenge in the management of rural water supply scheme projects.

Figure 8: Landholding size of the survey household

Livestock holding size: The household survey identified widespread livestock ownership, with 98 households (89.9%) owning animals, totaling 373.5 Tropical Livestock Units (TLU) and averaging 3.43 TLU per household (Table 5). Livestock rearing serves as a significant income source for households, covering essential expenses and enabling grain purchase during crop shortfalls. The focus group discussions and key informant interviews aimed to explore differences in RWSS project management engagement based on livestock holdings. Participants indicated that farmers with large animals exhibit lower levels of participation due to constraints in time and effort, prioritization of livestock care, and inadequate accommodation of their specific needs and schedules within the project structure, leading to a sense of exclusion. Additionally, conflicts regarding the implementation of desired facilities, such as livestock drinking troughs, contributed to their limited engagement in the project. Similar results were reported in a prior study by (Abera et al., 2021; Osei et al., 2016; Turner & Schlecht, 2019), indicating that farmers with substantial livestock holdings demonstrate limited involvement in RWSS project management initiatives.

Table 6: Livestock holdings of the sampled respondents by livestock type

Livestock type	Total amount in Number	Conversion factors /given/	TLU	Mean	Min	Max
Ox	86	1	86	0.79	0	2
Cow	125	1	125	1.15	0	3
Calf	80	0.2	16	0.15	0	2
Sheep	486	0.1	48.6	0.45	0	15
Goat	88	0.7	61.6	0.57	0	7
Donkey	48	0.7	33.6	0.31	0	2
Horse	27	0.1	2.7	0.02	0	2
Total			373.5	3.43		

Source: Own survey, 2024

4.2 Current statues of RWSS in the study area

4.2.1 Analysis of a Water Supply Scheme in Menz Mama, Ethiopia

The survey data from Emegwa Kebele in Menz Mama, Ethiopia, reveal interesting insights into community involvement and the functionality of the rural water supply scheme.

RWSS Project Initiation: The community itself initiated the idea for the water supply project, as reported by a significant majority (75.2%) of respondents, indicating a strong sense of local ownership and potential for sustainability. Limited involvement of external actors was noted, with only a small percentage (5.5%) mentioning local leaders' role in initiation and even fewer (19.3%) attributing the idea to NGOs or government offices. This underscores the community's proactive stance in identifying the necessity for enhanced water access.

Table 7: Project Initiation:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The community	82	75.2	75.2	75.2
	Local leaders’	6	5.5	5.5	80.7
	NGOs & Governmental offices	21	19.3	19.3	100
	Total	109	100	100	

Source: Own survey, 2024

Source Area Selection: Community Participation in Source Area Selection was evident, with 75.2% of the respondents highlighting the community's involvement in selecting the water Source Area. This emphasis on community engagement throughout the process indicates a collaborative and participatory approach to project design.

Table 8: Community participation in the source area selection of the project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The community	82	75.2	75.2	75.2
	Local leader's	6	5.5	5.5	80.7
	NGOs & Governmental offices	21	19.3	19.3	100
	Total	109	100	100	

Source: Own survey, 2024

Technology Selection: With a significant 75.2% of respondents once again indicating the community's involvement in selecting the type of technology used for the water supply project, this high level of participation could enhance user acceptance and promote effective operation and maintenance practices.

Table 9: Community participation in technology selection for the project

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The community	82	75.2	75.2	75.2
	Local leaders'	6	5.5	5.5	80.7
	NGOs & Governmental offices	21	19.3	19.3	100
	Total	109	100	100	

Source: Own survey, 2024

RWSS Functionality: Fortunately, 75% of respondents reported that their village's water supply scheme is currently functional, indicating that the project's success in meeting the community's water needs. However, a minority (25%) indicated nonfunctionality, underscoring the necessity for further investigation into the underlying reasons and potential solutions for improvement.

Table 10: Project functionality of the water supply scheme in the study area

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	82	75	75	75
	No	27	25	25	100
	Total	109	100	100	

Source: Own survey, 2024

The main reasons for the nonfunctionality of the 3/12 rural clean drinking water supply project facilities studied in Menz Mama, especially in Emegwa Kebele, as identified during the Focused Group Discussions (FGD) and Key Informant Interviews (KII) are as follows:

In the Arba Dfo Rural Water Supply scheme, challenges arose due to the inappropriate location chosen for the water tank/reservoir. This led to gravity and centering issues, preventing water from entering the reservoir. Consequently, the spring source was diverted, impacting water supply to clean drinking stations. Given the impracticality of repairs and user trust concerns, rebuilding this project is deemed necessary.

In the Zol Korekonch Rural Water Supply scheme, water pollution occurred when a solid waste disposal well was placed near the water supply facility, increasing treatment costs and rendering the water unsuitable for drinking. Inadequate partner collaboration and a lack of impact assessment further contributed to the scheme's nonfunctionality.

The Das Wonz Rural Water Supply scheme faces challenges such as user disinterest and financial constraints hindering facility restoration. User reluctance to utilize the scheme, combined with the presence of another nearby facility, reflects inequity in meeting user needs. The decision to construct an additional water supply facility against the wishes of some users raises fairness concerns and the potential for negative outcomes.

These reasons highlight the critical challenges facing the functionality and sustainability of rural water supply scheme facilities in the area, ranging from technical and environmental concerns to community dynamics and resource

allocation. (Andrés et al., 2018; Nolasco & Migone, 2007) demonstrated that incorporating community participation throughout the project design phase, from needs assessment to technology selection, can lead to more user-centric and sustainable solutions. This approach can help address issues such as a lack of user interest or redundant rural water supply project schemes, as seen in the Menz Mama case (Das Wonz scheme).

4.3 Community participation in the RWSSM

4.3.1 Community participation level during the planning phase

The activities related to the planning phase included needs assessment and identification, site selection for the RWSS, setting project goals and objectives, formulating RWSS user bylaws, selecting appropriate technologies, identifying resource contributions and establishing operation and maintenance plans for active workforces. (Table 11) shows that during the needs assessment and identification phase, only 75.2% of households actively participated. Participation levels varied, with 27.5%, 17.4%, 15.6%, and 14.7% engaging rarely, sometimes, often, and always, respectively. The remaining 24.8% of respondents never took part in the needs assessment and identification phase for RWSS, indicating a consistently high level of community involvement. Subsequent surveys revealed that 75.2% of the sample households participated in the site selection process, with 30.3%, 16.5%, 14.7%, and 13.7% participating rarely, sometimes, often, and always, respectively. Despite this, the remaining 24.8% had never engaged in this aspect, reinforcing the theme of high community participation during site selection. Moreover, only 39.4% of participants were involved in setting project goals and objectives, with varying levels of engagement noted among them. The data suggest a very low level of community involvement during this essential project phase. Additionally, 32.2% of respondents participated in formulating RWSS user bylaws, with 19.3%, 6.4%, 3.7%, and 2.8% participating at different frequencies. This indicates a low level of community engagement in this area. Furthermore, during the selection of appropriate technologies, 75.2% of respondents were involved, with participation rates varying at 34.9%, 15.6%, 12.8%, and 11.9% for rarely, sometimes, often, and always involved, respectively. Similarly, during the identification of resource contributions, 41.3% of respondents

participated, with 17.4%, 12.8%, 8.3%, and 2.8% showing different participation levels to various extents. Finally, when establishing operation and maintenance plans, 34% of the sample households participated, with 15.6%, 9.2%, 4.6%, and 4.6% contributing to different involvement levels.

Additionally, a knowledgeable Wereda-level expert specializing in water resources and institutional management, acting as a KII, noted that

> Current policies and best practices underline the importance of community involvement in the planning process of RWSSs. Despite this emphasis, translating these policies into tangible action presents challenges. These challenges stem from resource constraints, limited capacity building, lack of transparent guidelines, and restricted implementation, all of which have been identified as barriers to achieving effective community participation.

Table 11: Levels of community participation during the planning of RWSS practices

No	RWSSs activities at planning phase	Degree of participation in planning phase					Total participation
		Never	Rarely	Sometimes	Often	Always	
1	Needs assessment and identification	24.8%	27.5%	17.4%	15.6%	14.7%	75.2%
2	Site selection for RWSS	24.8%	30.3%	16.5%	14.7%	13.7%	75.2%
3	Setting project goals and objectives	60.6%	20.2%	7.3%	7.3%	4.6%	39.4%
4	Formulation of RWSS users bylaw	67.8%	19.3%	6.4%	3.7%	2.8%	32.2%
5	Selection of appropriate technologies	24.8%	34.9%	15.6%	12.8%	11.9%	75.2%
6	Identifying resource contributions	58.7%	17.4%	12.8%	8.3%	2.8%	41.3%
7	Establishing operation and maintenance plans	66.0%	15.6%	9.2%	4.6%	4.6%	34%
	CPI (%)	46.8%	23.6%	12.2%	9.6%	7.9%	53.2%

Source: Own survey, 2024

In general, the overall community participation index in the planning phase of RWSS project management was 53.2%, indicating moderate local community involvement in decision-making processes. The data suggests relatively strong community involvement in certain aspects of the planning phase, yet there is room for improvement in engaging

the community across all activities to ensure more comprehensive and sustainable outcomes for RWSS practices.

4.3.2 Community participation level during the implementation phase

The findings depicted in (Table 12) demonstrate that all the respondents participated in the mobilization of resources and the construction and installation of infrastructure. In the training and capacity building phase, 39.4% of the respondents participated, while 97.2% contributed to construction efforts. Notably, the majority (60.6% of respondents) never engaged in the training and capacity building phase, indicating consistently low community involvement in this aspect. To contribute to construction efforts, 97.2% of respondents were involved, with varying participation rates. The overall community participation index during the implementation phase of RWSS management was calculated to be 84.2%, indicating that the community had a 'high' level of participation. This aligns with the findings of (Muniu et al., 2018), indicating a 'high' level of participation during the implementation stage. This high level of community involvement during the implementation phase signifies stronger enforcement of labor contributions and other aspects through government and RWSS user bylaws. Effective community participation in the implementation phase promotes ownership, empowerment, shared responsibility, social network cohesion, local capacity building, and the sustainability of RWSS management initiatives (Nelson et al., 2021).

Table 12: Level of community participation during the implementation of RWSS practices

No	RWSS activities at implementation phase	Degree of participation in implementation phase					Total participate
		Never	Rarely	Sometimes	Often	Always	
1	Mobilization of resources	0%	4.6%	7.3%	32.1%	56%	100%
2	Construction and installation of infrastructure	0%	2.8%	4.6%	34.8%	57.8%	100%
3	Training and capacity building	60.6%	33%	3.7%	1.8%	0.9%	39.4%
4	Contributing to construction efforts	2.8%	63.3%	21.1%	11%	1.8%	97.2%
	CPI (%)	15.9%	25.9%	9.2%	21.1%	29.1%	84.2%

Source: Own survey, 2024

4.3.3 Community participation level during the M&E phase

The effective monitoring and evaluation (M&E) of water supply projects rely heavily on community involvement. Ideally, community members should actively participate in activities such as collecting data on water quality, quantity, and usage; identifying challenges; suggesting improvements; contributing to performance evaluations and feedback sessions; and sharing responsibility for resolving operational issues. However, the data in (Table 13) reveal a low level of community engagement in the M&E phase. Only 24.7% of respondents participated in data collection activities, suggesting a lack of information sharing or discussion within the community. Similarly, participation in other key areas remained low: identifying challenges and suggesting improvements (31.2%), participating in performance evaluations and feedback sessions (32.1%), and sharing responsibility for operational issues (45.9%). This translates to an overall community participation index of just 33.5%, which falls within the "low" participation category. Such limited involvement hinders effective project oversight and long-term sustainability. Moving forward, efforts to improve communication, build trust, and encourage active community participation throughout the entire project cycle, including the M&E phase, are crucial.

Currently, 25% (3 out of 12) of the Rural Water Supply Schemes (RWSS) in Menz Mama, Emegwa Kebele are non-functional due to technical issues and various human activities. To tackle this issue effectively, authentic community engagement is essential for ensuring sustainable management of RWSS. Past studies and local experiences highlight the significance of community involvement in successful planning, execution, monitoring, and evaluation of RWSS management activities, emphasizing the vital role of community participation in ensuring sustainability (Meniga, 2019; Mgoba & Kabote, 2020; Oduor & Murei, 2020).

Table 13: Status of community participation in the M&E stage of RWSS practices

No	RWSS activities at evaluation phase	Degree of participation in M&E stage					Total participate
		Never	Rarely	Sometimes	Often	Always	
1	Data collection on water quality, quantity, and usage	75.2%	11.9%	7.3%	4.6%	1%	24.8%
2	Identifying challenges and suggesting improvements	68.8%	17.4%	9.2%	2.8%	1.8%	31.2%
3	Participating in performance evaluations and feedback sessions	67.9%	12.8%	9.2%	7.3%	2.8%	32.1%
4	Sharing responsibility for resolving operational issues	54.1%	24.8%	9.2%	7.3%	4.6%	45.9%
	CPI (%)	66.5%	16.7%	8.7%	5.5%	2.6%	33.5%

Source: Own survey, 2024

4.3.4 Overall community participation in the RWSPSM

This study examines community participation in a rural water supply projects scheme (RWSPS) throughout different project phases, revealing variations in engagement. During the planning phase, the community participation index is 53.2%, indicating moderate involvement in decision-making processes. However, participation varies across different planning activities, with insufficient engagement in crucial phases like establishing operation and maintenance plans and goal setting. This inadequate involvement can impact project alignment with community needs, potentially affecting long-term sustainability and success. In the implementation phase, the overall community participation index reaches 84.2%, demonstrating a high level of involvement in resource mobilization and construction efforts. This active engagement promotes ownership, empowerment, shared responsibility, social network cohesion, local capacity building, and the sustainability of RWSS management initiatives. However, during the monitoring and evaluation (M&E) phase, the community participation index drops to 33.5%, indicating limited involvement in activities such as data collection, identifying challenges, suggesting improvements, and participating in performance evaluations and feedback sessions. Insufficient community engagement in M&E may hinder effective project oversight, impacting long-term sustainability and impeding the identification of necessary improvements. Overall, the Community Participation Index (CPI) stands at 57%, reflecting a moderate level of community

involvement across all phases (Table 14). While implementation demonstrates strengths, the lower participation during planning and M&E phases highlights the need for comprehensive strategies to enhance community engagement throughout the project cycle. These strategies aim to achieve more comprehensive and sustainable outcomes for RWSS practices. This finding is aligning with (Meniga et al., 2019). In general, the findings emphasize the critical role of robust community participation throughout the RWSSM project cycle to ensure projects are tailored to local needs, foster community ownership, and promote long-term sustainability. Addressing barriers to effective community participation—such as resource constraints, limited capacity building, lack of transparent guidelines, and restricted implementation—becomes vital for enhancing the effectiveness and impact of RWSSM initiatives. By valuing and incorporating the insights of the community, the overall project outcomes are likely to be improved and better aligned with the community's needs and aspirations (Amin, 2022).

Table 14: Overall community participation in RWSSMs

No	Participation phase	CPIs values	Level
1	Planning	53.2%	Moderate
2	Implementation	84.2%	High
3	Monitoring and evaluation	33.5%	Low
4	Overall CPI (%)	57%	Moderate

Source: Own survey, 2024

4.4 Sustainability status of RWSSM

4.4.1 Environmental sustainability:

The evaluation of the environmental sustainability of managing rural water supply project schemes was conducted by evaluating the preservation and protection of natural resources in the delivery of rural water supply schemes. Key indicators, such as ensuring water resource conservation, ensuring ecosystem preservation, and enhancing climate resilience, were used to determine environmental sustainability. The investigation revealed that the sub-indicators ensuring water resource conservation and ensuring ecosystem preservation were both rated at high levels, scoring 75.2% and 75.2%, respectively. However, the indicator for enhancing climate resilience was evaluated at

the moderate level, with a value of 67.9%. The overall evaluation of environmental sustainability yielded a score of 72.8%, which falls within the moderate level (Table 15).

In the realm of managing sustainable rural water supply projects scheme, the survey reveals positive outcomes for two key aspects. Both the conservation of water resources and the preservation of ecosystems were found to be at high levels. These findings suggest that the efforts undertaken to maintain the management of rural water supply projects have effectively mitigated the levels of water resource conservation and ecosystem preservation.

A 65-year-old man highlighted the following regarding the rural water supply project.

> The government's rural clean water projects initially lacked community inclusivity and needs-based implementation, leading to low usage and potential failure. However, recent progress shows improved community engagement and support, with communities now actively participating and contributing. Despite this, high community demand still outpaces current provisions.

Strategic interventions can be implemented to enhance the sustainability of rural water supply schemes, leveraging positive findings on water resource conservation and ecosystem preservation. These interventions involve fostering robust community engagement for local ownership and needs alignment, organizing education campaigns for responsible water use, and adopting integrated water resource management strategies focusing on ecological balance and sustainable sourcing. Furthermore, the findings from the FGD and KIIs discussions revealed that implementing ecosystem protection measures, establishing robust monitoring systems, advocating for supportive policies, and reinforcing governance structures can also play pivotal roles in sustaining these schemes. The comprehensive approach outlined here draws on the critical importance of conserving water resources and ecosystems in rural areas to ensure long-term viability. These strategies are supported by evidence and best practices in water resource management and sustainability, as highlighted in the publication by (Ashiq et al., 2020; Miller et al., 2019) and UN Water titled "Water and Ecosystems". This reference provides further insights and guidance on the interplay between water management and ecosystem preservation, which is crucial for the success of rural water supply initiatives.

Table 15: Environmental sustainability of the Menz Mama and Emegwa kebele RWSPSMs

Indicators	Sub-indicators	Percentage	Status
Environmental sustainability	Ensure water resource conservation	75.2	High
	Ensure ecosystem preservation	75.2	High
	Enhances climate resilience	67.9	Moderate
Overall/aggregate		72.8	Moderate

Source: Own survey, 2024

4.4.2 Economic sustainability:

The evaluation of economic sustainability regarding the management of rural water supply schemes focused on enhancing overall well-being by optimizing natural resource utilization. An analysis of the survey data showed that among the three sub-indicator values, an increase in the fee for operation and maintenance costs, increased affordability, and increased positive economic impact were found at the 'moderate' level, with scores of 67%, 64.2%, and 63.3%, respectively. The indicator wise evaluation of economic sustainability had a score of 64.8%, which was considered the moderate level (Table 16). In the FGD and KII discussions, participants emphasized the objective of enhancing overall well-being through optimizing natural resource utilization within the economic sustainability evaluation of rural water supply scheme management. Survey data analysis revealed that the fee for operation and maintenance costs, affordability, and positive economic impact were all rated at the moderate level. These findings stress the imperative of further enhancing economic sustainability in rural water supply schemes. To fortify economic sustainability, several strategies should be considered. Critical to this objective is optimizing the fee structure for operation and maintenance costs to ensure the financial viability of the schemes. Additionally, conducting cost–benefit analyses and exploring innovative financing mechanisms can contribute to more sustainable funding models. Furthermore, improving affordability is pivotal in ensuring equitable water supply access for all community members. Targeted subsidy programs, income-based pricing mechanisms, and community-driven cost-sharing arrangements tailored to the rural population's socioeconomic conditions can address this aspect. The discussions also emphasized the importance of augmenting the positive economic impact of water supply plans. Initiatives such as establishing rural clean drinking water service associations, small enterprises for supplying spare parts,

and income-generating activities associated with water supply can strengthen the economic sustainability of these plans. The sustainable utilization of rural water supply scheme and the creation of local job opportunities can substantially boost overall economic value. The discussions extensively highlighted the significance of moderate payment levels for operation and maintenance costs, affordability, and positive economic impact in strengthening the economic sustainability of rural water supply schemes. The implementation of strategies designed to enhance cost efficiency, build capacity, and maximize positive economic outcomes was also underscored to ensure the long-term viability and efficacy of these plans. This finding is highlighted by (Domínguez et al., 2019; Tadesse, 2013).

Table 16: Economic sustainability status of the Menz Mama and Emegwa kebele RWSSs

Indicators	Sub-indicators	Percentage	Status
Economic sustainability	Enhance the fee for operation and maintenance costs	67.0	Moderate
	Increase affordability	64.2	Moderate
	Increase positive economic impact	63.3	Moderate
Overall/aggregate		64.8	Moderate

Source: Own survey, 2024

4.4.3 Social sustainability:

The evaluation of the social sustainability of rural water supply scheme management focused on evaluating the impact of management practices on community well-being, social cohesion, equitable resource distribution, stakeholder engagement, livelihoods, access to social services, and governance. The survey indicated varying levels of sustainability across the three sub-indicators. Ensuring equity scored at 75.2%, classified as high sustainability, while ensuring community participation and ensuring health and hygiene scored moderate sustainability at 71.6% and 65.1%, respectively. The overall evaluation for social sustainability received a score of 70.6%, indicating a moderate level (Table 17). In general, these findings suggest that the rural water supply schemes have achieved a relatively high level of equity, indicating fair and equal distribution of resources. However, there is room for improvement in terms of community participation and maintaining health and hygiene standards. This indicates the need for increased

efforts to actively involve the community and ensure proper health practices in order to enhance social sustainability (Ruj & Ghosal, 2022; Schweitzer & Mihelcic, 2012).

During FGDs aimed at evaluating the impact of rural water supply project scheme management on community awareness, participants shared their views on the topic.

> The authors noted an enhancement in public awareness regarding the management of rural water supply scheme plans, particularly in response to the positive impacts on the environment, economy, cooperation, and social relations. However, insights from the FGD discussion revealed that the level of success in improving public awareness in Emegwa Kebele, Menz Mama Wereda, did not meet expectations.

Furthermore, an expert at the district office of Water and Energy, a key informant, explained that

> Initially, the evaluation of the rural water supply project's influence on community awareness and ownership was not a primary consideration for senior officials or field experts. Their attention was primarily on project adaptation, promoting user benefits as government beneficiaries, and independently handling repairs and reinstatements without community engagement. Given these aspects and others, the sustainable results of the rural water supply project management scheme are deemed unsatisfactory.

Hence, a key social challenge identified in this study is insufficient community awareness, which impedes the sustainability of rural water supply project scheme management. One of the social challenges found to impede the sustainability of rural water supply project scheme management in the study area is the community's lack of awareness. Research by (Bennett et al., 2015; Schweitzer & Mihelcic, 2012; Tadesse et al., 2013) indicated that inadequate community awareness poses a barrier to the sustainability of rural water supply scheme management projects.

Table 17: Social sustainability status of the Menz Mama and Emegwa kebele RWSSs

Indicators	Sub-indicators	Percentage	Status
Social sustainability	Ensuring equity	75.2	High
	Ensure community participation	71.6	Moderate
	Ensure health and hygiene	65.1	Moderate
Overall/aggregate		70.6	Moderate

Source: Own survey, 2024

4.4.4 Overall sustainability status of RWSSM

The overall sustainability of rural water supply scheme management encompasses environmental, economic, and social aspects (Table 18). Environmental sustainability score of 72.8% indicates a moderate level of achievement in this aspect. Water resource protection, ecosystem protection and climate resilience standards were contribute to this overall result. The findings indicate that efforts to conserve water resources and protect ecosystems have been relatively successful, but clearly show that there is still a need room for improvement in developing climate resilience measures. The findings indicated the need to further strengthen water resources conservation, ecosystem protection and climate resilience measures to maximize the environmental sustainability of rural water supply schemes. Improved security strategies and resilience practices are critical to ensuring long-term environmental sustainability.

The economic sustainability score of 64.8% reflects a moderate level of performance in economic aspects. While indicators such as the fee structure, affordability, and economic impact received moderate ratings, there is a need to focus on optimizing the fee system, exploring better financing mechanisms, and improving affordability to strengthen economic sustainability further. The moderate rating in economic sustainability emphasizes the importance of addressing fee structures, affordability, and economic impact to bolster the financial resilience of the water supply schemes. Improving financial mechanisms and ensuring affordability are essential for sustaining the economic aspects of the projects.

The social sustainability score of 70.6% indicates a moderate level of social sustainability achieved. The high rating for equity and moderate scores for community participation and health/hygiene emphasize the importance of addressing community

engagement and health awareness to enhance overall social sustainability. Challenges in these areas may require targeted interventions to improve community involvement and health practices. The moderate social sustainability score underlines the significance of enhancing community participation, health, and hygiene practices to improve the overall social sustainability of the projects. Targeted efforts towards community engagement, health awareness, and equitable resource distribution will be key in fostering social resilience.

Thus finding are align with relevant research and best practices in water resource management and sustainability (Ashiq et al., 2020; Tadesse, 2013). The overall sustainability score of 69.4% signifies a moderate level of sustainability for the Menz Mama and Emegwa kebele RWSPSs. While specific aspects like environmental, economic, and social sustainability have shown moderate performance levels individually, the aggregate score suggests that there is scope for enhancing overall sustainability through comprehensive improvements across all three dimensions. The aggregate moderate sustainability score indicates a balanced performance across environmental, economic, and social dimensions. To elevate the overall sustainability of the RWSPSs, a holistic approach focusing on environmental conservation, economic viability, and social well-being is necessary. Striving for improvements in all three dimensions will foster a more sustainable and resilient water supply scheme management system.

The evaluation of the Emegwa Kebele, Menz Mama rural water supply scheme management shows a moderate overall sustainability status, encompassing environmental, economic, and social sustainability. This suggests that the sector is not comprehensively addressing economic, social, and environmental sustainability factors in its operations. To achieve sustainable results, it is crucial to align the objectives of managing rural water supply project schemes with those of the SDGs to comprehensively address environmental, social, and economic sustainability. The sustainable management of rural water supply projects must be in harmony with the environment, be financially feasible, and be socially embraced. This necessitates integrated and holistic approaches representing a shift toward sustainable utilization and

system-based management. Sustained investment in sustainable rural water supply project management practices, community involvement, skill enhancement, and conservation of natural resources can play a role in enhancing the overall sustainability of rural water supply project scheme management in the Emegwa Kebele, Menze Mama rural water supply project scheme. By addressing the identified areas for improvement and building on existing initiatives, it is possible to bolster the sustainability of rural water supply project scheme management and contribute to the realization of the SDGs in the ANRS and beyond.

Table 18: Overall sustainability status of the Menz Mama and Emegwa kebele RWSPSs

Indicators	Score in %	Status
Environmental	72.8	Moderate
Economic	64.8	Moderate
Social	70.6	Moderate
Overall/aggregate	69.4	Moderate

Source: Own survey, 2024

4.5 Community Participation and Sustainability in RWSSM

The relation /correlation/ between the sustainability of rural water supply scheme management (RWSSM) and community participation holds significant importance. In a recent study, both the overall sustainability status of RWSSM and the level of community participation were classified as “moderate”. Notably, the environmental, economic, and social sustainability indices of rural water supply project scheme management were also moderate. Specifically, community participation peaked during the implementation and planning phase, while the evaluation phases experienced a moderate level of involvement, indicating discrepancies in participation across different project stages. This finding underscores the potential impact of limited community involvement during the monitoring & evaluation phases on the sustainability of rural water supply project scheme management. Additionally, research by (Marks et al., 2014; Meniga, 2019) identified a correlation between insufficient community engagement and constraints on the sustainability of rural water supply project scheme management programs in Ethiopia.

To achieve sustainable outcomes and address the challenges facing rural water supply project scheme management, aligning objectives with sustainable development goals (SDGs) is crucial for comprehensively addressing environmental, social, and economic aspects. This integrated approach is essential for ensuring the long-term sustainability of rural water supply project scheme management practices. Therefore, understanding the association between the sustainability status of rural water supply project scheme management and community engagement is vital for realizing lasting positive environmental and socioeconomic impacts. Prior research has indicated that increased community involvement leads to improved sustainability outcomes (Tadesse, 2013).

Additionally, to address the challenges and achieve sustainable outcomes related to community participation in rural water supply project scheme management, several key strategies have been identified. The implementation of comprehensive capacity-building programs during the planning and evaluation phases is vital for empowering local communities. This includes training on project management, leadership, and decision-making processes, as emphasized in the studies by (Nurbaiti & Bambang, 2018; Riswan, 2021). Furthermore, fostering continuous, transparent communication with stakeholders throughout all project phases is essential to ensure active involvement and well-informed decision-making. According to (Mukherjee, 2002) presented effective communication strategies to enhance stakeholder engagement. Integrating participatory approaches into planning and evaluation processes ensures the meaningful involvement of community members in decision-making, goal setting, and performance assessment, as highlighted in the study by (Thwala, 2010). Finally, establishing supportive legal and policy frameworks mandating community participation at all project phases is critical for the sustainability of rural water supply schemes. (Gakuu, 2017; Muniu et al., 2017) explored the impact of policy frameworks on community participation in water supply projects. By implementing these solutions, informed by the referenced literature, the challenges of limited community participation in the planning and evaluation phases can be effectively addressed, ultimately fostering sustainable outcomes for rural water supply project scheme management.

4.6 Challenges faced in sustaining the RWSPSM

The findings from household surveys, group discussions, key informant interviews, and previous studies (Chepyegon & Kamiya, 2018; Marks et al., 2014; Muhabaw, 2020; Sanchez-Cobaleda, 2018; Tadesse, 2013) indicate that rural water supply project scheme management faces economic, social, and environmental challenges across different timelines—historical, current, and prospective. These challenges pose obstacles to achieving sustainable management of such schemes, resulting in diverse impacts. Specifically, the rural water supply project scheme in Menz Mama, Emegwa, Ethiopia, has encountered multiple challenges, including the lack of a needs-based approach, insufficient user and committee participation, inappropriate technology selection, inadequate project frameworks, ineffective project management practices, and technical issues in design or implementation. A comprehensive explanation and discussion of these challenges are presented below, addressing their specific implications for the scheme's sustainability.

4.6.1 Lack of a demand-driven approach

As indicated in (Table 19), all survey participants highlighted the lack of a needs-based approach as a significant obstacle to sustaining rural water supply project scheme management. Among the household survey respondents, 83.5% rated this issue as ‘high’, while 11.9% and 4.6% rated it as moderate and low, respectively. Consequently, the absence of a demand-driven approach ranks as the first most significant challenge. Without actively involving communities and considering their specific needs and priorities, water supply project risk has been disconnected from actual demand, leading to limited acceptance, underutilization, and reduced sustainability in the investigated area. The KII and FGD results also revealed that the lack of demand-based in rural water supply projects scheme is a major challenge. A study by (Tadesse, 2013; Tadesse et al., 2013; Tigabu et al., 2013) also emphasized that water supply projects often do not sufficiently involve and understand the specific needs and preferences of local communities, leading to solutions that do not effectively address their concerns in Ethiopia.

4.6.2 Insufficient user participation

Table 19 provides a clear outline of the challenges experienced by RWSPSM practice users. From the results, it is evident that all the survey respondents identified insufficient user participation as a significant social issue in the study area. The majority of surveyed households (78%) characterized the extent of this problem as 'high', with 12.8% rating it as moderate and 9.2% as low. During the FGD, participants highlighted that the second most significant challenge is the insufficient engagement of end-users in decision-making processes and project implementation. This lack of user participation results in a deficit of ownership, cooperation, and long-term sustainability, which has had a direct impact on the success of water supply projects in the studied area. Additionally, (Mekonnen & Hoekstra, 2016) identified instances where project outcomes did not align with the actual water needs of communities due to inadequate consultation and engagement with end-users, leading to sustainability issues and restricted benefits.

4.6.3 Inadequate committee engagement

The findings in (Table 19) underscore the significant issue of insufficient committee participation as a challenge for sustaining the management of rural water supply project schemes. In the household survey, 76.1% of respondents rated this problem as 'high', while 21.1% and 2.8% classified it as moderate and low, respectively. Furthermore, participants in the FGD stressed the vital role of the committees responsible for managing water supply schemes. Ineffective engagement and participation of these committees can lead to poor decision-making, accountability issues, and difficulties in addressing emerging issues, ranking as the third most significant challenge directly impacting the success of water supply projects in the studied area. Additionally, (Lencha, 2012; Madon et al., 2018; Meniga et al., 2019; Muniu et al., 2017) highlighted the criticality of community participation for project sustainability, emphasizing that a lack of committee involvement can lead to accountability gaps, ineffective decision-making, and project management challenges.

4.6.4 Inappropriate technology selection

The data in (Table 19) emphasize the significant issue of inappropriate technology selection as a challenge for sustaining the management of rural water supply project schemes. In the household survey, 75.2% of respondents regarded this problem as 'high', with 20.2% and 4.6% categorizing it as moderate and low, respectively. Participants in the FGD also emphasized that the selection of technologies that do not align with the local context ranks as the fourth most significant challenge. Inappropriate technology selection can result in inefficiencies, high maintenance requirements, and cultural mismatches, affecting the effectiveness and longevity of rural water supply schemes and thereby directly impacting the success of water supply projects in the studied area. Furthermore, inappropriate technology selection presents a challenge that affects the effectiveness and longevity of rural water supply schemes. Without considering factors such as water availability and affordability, projects may encounter inefficiencies. This issue has been highlighted in studies such as (Tadesse et al., 2013).

4.6.5 Inadequate project frameworks

The analysis presented in (Table 19) reveals that 45% of participants identified inadequate project frameworks as an obstacle to maintaining the sustainability of rural water supply project scheme management. The survey households categorized this problem as 'high', 'moderate', or 'low', with reported percentages of 24.9%, 12.8%, and 7.3%, respectively. Inadequate project frameworks, encompassing unclear objectives, insufficient planning, and monitoring and evaluation mechanisms, rank as the fifth most significant challenge. These inadequate frameworks hinder efficient implementation and make it challenging to assess project outcomes and sustainability. Participants in the FGD also highlighted that inadequate project frameworks and ineffective project management practices hinder the sustainability of rural water supply projects. Moreover, inadequate project frameworks, along with poor coordination and resource allocation, can impede timely and efficient implementation, directly impacting the success of water supply projects in the studied area. These challenges have been discussed in various studies, such as (Meniga, 2019; Tadesse et al., 2013).

4.6.6 Ineffective project management practices

The analysis in (Tabel 19) indicated that 68.8% of participants identified inadequate project frameworks as a barrier to sustaining the sustainability of the rural water supply project scheme management. Survey households classified this issue as 'high', 'moderate', or 'low', with reported percentages of 46.8%, 14.7%, and 7.3%, respectively. Poor project management practices, including coordination challenges, insufficient resource allocation, and weak stakeholder engagement, rank as the sixth most significant challenge. Ineffective management practices can impede the timely delivery, coordination, and successful implementation of water supply projects. Participants in the FGD also emphasized that ineffective project management practices pose significant challenges, characterized by poor coordination among stakeholders, insufficient resource allocation, weak stakeholder engagement, and inadequate monitoring and evaluation. These issues hinder the smooth implementation and success of projects, directly impacting the success of water supply projects in the studied area. Various studies, such as those by (Behailu et al., 2016; Dirwai et al., 2018; Phali et al., 2022), have addressed these challenges.

4.6.7 Technical issues in design or implementation

The data presented in (Table 19) indicate that 70.6% of participants recognized inadequate project frameworks as a hindrance to sustaining the sustainability of the rural water supply project scheme management. Survey households classified this issue as 'high', 'moderate', or 'low', with reported percentages of 44%, 17.4%, and 9.2%, respectively. Technical challenges in design or implementation are considered the least significant challenge. Even though important, these challenges can be mitigated through meticulous planning, quality control measures, and continuous monitoring and maintenance. Participants in the FGD also stressed that technical issues in design or implementation aggravate the existing challenges in rural water supply project scheme management. Design deficiencies, construction quality issues, and operational inefficiencies can undermine the functionality and effectiveness of water supply schemes, directly influencing the success of water supply projects in the researched area.

Various studies, such as those by (Behailu et al., 2016; Loucks & van Beek, 2017; Machado et al., 2022), have addressed these challenges.

Table 19: Challenges faced in sustaining rural water supply project scheme management

No	Challenges	Level of challenge				
		Not	Low	Moderate	High	Total
1	Lack of demand-driven approach	0.0%	4.6%	11.9%	83.5%	100.0%
2	Insufficient user participation	0.0%	9.2%	12.8%	78.0%	100.0%
3	Inadequate committee engagement	0.0%	2.8%	21.1%	76.1%	100.0%
4	Inappropriate technology selection	0.0%	4.6%	20.2%	75.2%	100.0%
5	Inadequate project frameworks	55.0%	7.3%	12.8%	24.9%	45.0%
6	Ineffective project management practices	31.2%	7.3%	14.7%	46.8%	68.8%
7	Technical issues in design or implementation	29.4%	9.2%	17.4%	44.0%	70.6%

Source: Own survey, 2024

CHAPTER FIVE

5 SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1 Summary

This study evaluates the sustainability of the rural water supply scheme in the Menz Mama Werda, Emegwa Kebele, located in the North Shewa Administration Zone of the ANRS, Ethiopia. The evaluation considers social, economic, and environmental indicators of sustainable development to measure the RWSS sustainability.

The findings indicate a moderate level of overall sustainability, with moderate levels observed in economic, environmental and social dimensions. To achieve sustainable outcomes, it is crucial to align the objectives of the RWSS management with the SDGs and comprehensively address environmental, social, and economic pillars of sustainability.

Concerning environmental sustainability, the survey reveals a high level of water resource conservation and ecosystem preservation. These positive results indicate successful efforts in sustaining the management of the RWSS, specifically in mitigating water resource depletion and preserving ecosystems.

Regarding economic sustainability, the current status is moderate, with room for improvement. Enhancing economic sustainability measures is essential to ensure the continued success of the RWSS and the well-being of local communities. In terms of social sustainability, the Menz Mama Werda, Emegwa Kebele RWSS demonstrates a moderate level. The study emphasizes the critical role of community participation at different stages of RWSS management. Higher levels of community participation during implementation were observed, while moderate and low levels were seen during planning and evaluation phases, respectively. The varying levels of community involvement impact the overall sustainability of RWSS management. The study highlights the strong association between sustainability and community participation, emphasizing its importance throughout planning, implementation, and evaluation phases.

Sustaining RWSS management encounters environmental, economic, and social challenges, including the lack of a needs-based approach, insufficient user and

committee participation, inappropriate technology selection, inadequate project frameworks, ineffective project management practices, and technical issues in design or implementation. Addressing these multifaceted challenges is crucial for ensuring sustainable RWSS.

5.2 Conclusions

This study evaluates the sustainable development status of the Menz Mama Werda, Emegwa Kebele, emphasizing the crucial role of community participation in the management of RWSS. The level of community involvement significantly impacts the overall sustainability of the initiative, affecting ownership, willingness to participate in operation and maintenance, and follow-up on the schemes, there by influencing its long-term sustainability.

The findings indicate a moderate level of environmental sustainability. However, two key sub-indicators, water resource conservation and ecosystem preservation, demonstrate high levels of achievement. These results reflect the success of implemented efforts in mitigating water resource depletion and preserving ecosystems. Economic and social sustainability are also moderately achieved, with areas that require improvement. Aligning RWSS management objectives with the Sustainable Development Goals (SDGs) is essential to comprehensively address environmental, social, and economic aspects of sustainability.

The study highlights various environmental, economic, and social challenges that affect the sustainability of RWSS management in the study area. Addressing these multifaceted challenges requires an integrated approach.

In general, the study emphasizes the importance of an integrated and holistic approach to RWSS management, encompassing environmental, social, and economic factors. It underscores the need for continuous community participation throughout all phases and addresses the multifaceted challenges to achieve sustainable outcomes.

5.3 Recommendations

Drawing on the insights from this study, the following recommendations aim to enhance the sustainability of rural water supply schemes (RWSSs)

A. Prioritizing Community Engagement from the Start:

- ✓ Conduct comprehensive needs assessments and design projects based on local water demands to ensure effective outcomes.
- ✓ Integrate participatory approaches throughout all project phases (planning, implementation, evaluation) to foster co-ownership and empower communities for long-term management.

B. Ensuring Technical Expertise and Sustainability:

- ✓ Employ skilled personnel and implement quality control measures to address technical challenges.
- ✓ Select appropriate technologies and robust project frameworks that consider the local context, user preferences, and long-term ecological balance.
- ✓ Implement integrated water resource management practices that promote sustainable water sources and equitable distribution.

C. Strengthening Policy, Awareness, and Financing:

- ✓ Establish supportive legal frameworks that mandate community participation and align project objectives with the Sustainable Development Goals (SDGs) for holistic sustainability.
- ✓ Conduct targeted awareness campaigns to promote responsible water use and community ownership.
- ✓ Optimize fee structures and explore innovative financing mechanisms to ensure affordability and equitable access for all.

D. Continuously Improving for Long-Term Sustainability:

- ✓ Implement robust monitoring and evaluation mechanisms to track progress and identify areas for improvement.
- ✓ Establish effective maintenance procedures to ensure the ongoing functionality of water supply schemes.
- ✓ Foster collaboration among stakeholders, including government, communities, and technical experts, to achieve sustainable management of RWSS.

5.4 Suggestions for future research

Building on this study's insights, future research on rural water supply schemes (RWSS) in Menz Mama Wereda, Ethiopia, should adopt a multifaceted approach to enhance sustainability. Here are key areas for investigation:

A. Co-Creating Solutions with Communities:

- ✓ Develop participatory needs assessment methodologies.
- ✓ Utilize co-creation workshops to collaboratively identify community needs and priorities for water supply.
- ✓ Integrate user-friendly technology to gather ongoing community feedback and ensure project designs reflect actual demands.

B. Empowering Users for Long-Term Sustainability:

- ✓ Explore innovative strategies to enhance user participation throughout the project lifecycle.
- ✓ Implement capacity-building programs to equip users with knowledge and skills for informed decision-making.
- ✓ Empower local leaders to champion user engagement and create feedback mechanisms leveraging technology (e.g., mobile surveys).

C. Strengthening Committee Capacity for Effective Management:

- ✓ Investigate strategies to strengthen water supply scheme management committees.
- ✓ Design targeted capacity-building initiatives to enhance their technical and managerial skills.
- ✓ Develop frameworks for improved governance and equitable representation within committees.

D. Selecting Technologies for Long-Term Sustainability:

- ✓ Conduct research to develop decision-support tools for selecting appropriate technologies for RWSS projects.

- ✓ These tools should consider factors like local context, user preferences, operation and maintenance capabilities, and long-term sustainability.

E. Optimizing Project Frameworks and Management:

- ✓ Analyze successful project management models from other regions for adaptation in Menz Mama Wereda.
- ✓ Develop guidelines for effective resource allocation based on project needs and community priorities.
- ✓ Design training programs to improve capacities for project monitoring and evaluation, ensuring data-driven decision-making.

F. Addressing Technical Challenges for Improved Implementation:

- ✓ Conduct research to identify and address technical challenges in RWSS design and implementation.
- ✓ This may involve evaluating construction standards, quality control measures, and exploring the implementation of advanced design practices suitable for rural contexts.

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Appendix

Appendix A: Questionnaire for Selected HH

Dear respondent,

I would like to express my gratitude for your willingness to participate in this survey. The survey will be administered to ***Teklesinoda Asbetsadik***, a postgraduate student studying at Debre Berhan University. ***Teklesinoda*** is currently conducting research for his thesis titled ***"Evaluation of sustainability in the Menz Mama Woreda rural water supply schemes, particularly at Emega Kebele."*** The purpose of this questionnaire is to gather data on rural water supply scheme management and sustainability. Your response holds significant value for this study.

I assure you that the interview results will be used exclusively for the aforementioned purpose. Please feel free to describe and explain your ideas, knowledge, and experiences in rural water supply scheme management without any hesitation or stress. The interview is expected to take approximately 30 minutes, so I kindly request your patience until you have completed the questionnaire.

Table in the Appendix 1: Code of Respondents

	Code of Respondents	Woreda	*Kebele*	Village
		Menz Mama	Emega	----------
Respondent name				
Date of interview DD/MM/YY				
Name of Interviewer				

I. Respondents' demographic characteristics

1. Sex of the respondent: 1) Male _____ 2) Female _____
2. Age of the household head (in years): _____
3. Marital status of the household head: 1) Single, 2) Married, 3) Divorced/separated, 4) Widow(er)
4. Educational status of the household head: 1) Cannot read and write, 2) Can read and write, 3) Primary (grades 1-8), 4) Secondary grade (grades 9-12), and 5) Diploma holder or above
5. Family size (including yourself): How many people are living in your household? 1) Male: _____ 2) Female: _____ 3) Total: _____

II. Questions on Household Head Socioeconomic Characteristics

1. What types of farming activities are you currently engaged in? 1) Crop production only 2) Livestock production only 3) Mixed farming (both crop and livestock production)
2. Do you have any sources of off-farm income generation? 1) Yes 2) No
3. If you answered "yes" to question #2, could you please provide details about the type of activities?

Table in the Appendix 2: Sources of off-farming income for respondents

No	Sources of Income/Livelihood Means	Respondant answer
		1) Yes 2) No
3.1	Petty trading	
3.2	Casual labor work	
3.3	Skilled work (masonry, carpentry)	
3.4	Local brewing (e.g., Araki, Tella, etc.)	
3.5	Safety net (RSNP)	
3.6	Remittance (support of family or others)	
3.7	Employment (salary based)	
3.8	Other (please specify)	

4. Do you own land? 1)Yes 2) No
5. If your answer to question #4 is "yes," how many hectares of farmland do you have? Please specify in hectares. _____
6. Do you own any livestock? 1) Yes 2) No
7. If your answer to question #6 is "yes," please identify from the following list the types of livestock you own: the source of drink water for your own livestock

Table in the Appendix 3: Livestock ownership and drinking sources

No	Livestock type	Unit	Quantity	Sources of drink water	
				1) from RWSS	2) from Other sources place list it
7.1	Ox	No			
7.2	Cow	No			
7.3	Calf	No			
7.4	Sheep	No			
7.5	Goat	No			
7.6	Donkey	No			
7.7	Horse	No			

III. Tangibility Questions Regarding the Sustainability Status of Rural Water Supply Scheme Management in the Study Area

1. How many years have you lived in this area? _____
2. Whose idea was it to build the project? 1. The community 2. Local leaders' 3. NGOs & Governmental offices 4. Do not know
3. Whose idea was it to choose the source area of the project? 1. Community 2. Local 3. NGOs & Governmental offices 4. Do not know
4. Whose idea was it to choose the type technology of the project? 1. The community 2. Local leaders' 3. NGOs & Governmental offices 4. Do not know
5. Is your village's water supply scheme currently functional? 1. Yes 2. No

IV. Questions Regarding the Environmental Sustainability Status of Rural Water Supply Scheme Management

1. From your perspective, has the implementation of RWSSM practices in your area ensured the long-term availability of water resources? 1 = Yes 2 = No
2. In your opinion, has the implementation of RWSSM practices in your area ensured ecosystem preservation? 1 = Yes 2 = No
3. In your view, has the application of RWSSM practices in your area enhanced climate resilience? 1 = Yes 2 = No

V. Questions Regarding the Economic Sustainability Status of Rural Water Supply Scheme Management

1. In your view, has the application of RWSSM practices in your area improved cost recovery through user fees or other revenue streams? 1= Yes 2 = No
2. In your view, does the RWSSM user have the ability to pay for water services without experiencing financial hardship? 1 = Yes 2 = No
3. In your view, have the RWSSM practices in your area increased agricultural productivity, reduced healthcare costs, and improved livelihood opportunities? 1 = Yes 2 = No

VI. Questions Regarding the Social Sustainability Status of Rural Water Supply Scheme Management

1. In your view, does the RWSSM practice in your area ensure a fair distribution of water services and benefits among different social groups within the community, ensuring that no one is left behind? 1 = Yes 2 = No

2. In your opinion, does the RWSSM practice in your area ensure the involvement and engagement of the local community in decision-making processes related to the planning, implementation, and management of the rural water supply scheme? 1 = Yes 2 = No
3. In your opinion, have the RWSSM practices in your area had a positive impact on improving the water supply and public health and hygiene practices within the community? 1 = Yes 2 = No

VII. Questions Regarding Community Participation in RWSS Management

1. In which rural water supply scheme do management activities you have or any member of your family participate in the planning phase? Place answer the following table carefully

Table in the Appendix 4: Community participation in the planning phase

No	Planning phase Activities	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
1.1	Needs assessment and identification					
1.2	Site selection for RWSS					
1.3	Setting project goals and objectives					
1.4	Formulation of RWSS users bylaw					
1.5	Selection of appropriate technologies					
1.6	Identifying resource contributions					
1.7	Establishing operation and maintenance plans					

2. In which rural water supply scheme do management activities you have or any member of your family participate in the implementation phase? Place answer the following table carefully

Table in the Appendix 5: Community participation in the implementation phase

No	implementation phase Activities	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
2.1	Mobilization of resources					
2.2	Construction and installation of infrastructure					
2.3	Training and capacity building					
2.4	Contributing to construction efforts					

3. In which rural water supply scheme management activities do you have or any member of your family participates in the monitoring and evaluation phase? Place answer the following table carefully

Table in the Appendix 6: Community Participation in the M&E phase

No	Monitoring and Evaluation phase Activities	Never (1)	Rarely (2)	Sometimes (3)	Often (4)	Always (5)
3.1	Data collection on water quality, quantity, and usage					
3.2	Identifying challenges and suggesting improvements					
3.3	Participating in performance evaluations and feedback sessions					
3.4	Sharing responsibility for resolving operational issues					

VIII. Questions Regarding the challenges of sustaining rural water supply scheme management (RWSSM)

1. In your opinion, what are the major challenges of sustaining rural water supply scheme management in your area?

Table in the Appendix 7: Level of challenge in sustaining RWSSMs

No	Challenge of Sustainable rural water supply scheme management	Level of challenge in sustaining RWSSMs			
		Not (1)	Low (2)	Medium (3)	High (4)
1.1	Lack of demand-driven approach				
1.2	Insufficient user participation				
1.3	Inadequate committee training				
1.4	Inappropriate technology selection				
1.5	Inadequate project frameworks				
1.6	Ineffective project management practices				
1.7	Technical issues in design or implementation				

Appendix B: questionnaire for key informant interview /KII/

General Information

(NB: local administrators, elders, youth and experts are included in the interview)

Name of informants_____ Age _____ Sex_____

Occupation _____ Educational status _____

1. What are the main challenges in sustaining rural water supply schemes in Menz Mama Wereda, Emegwa Kebele?
2. How is user participation ensured in decision-making processes for water supply schemes?
3. Have training programs effectively enhanced the capacity of water supply scheme committees?
4. How are appropriate technologies selected for water supply schemes?
5. What are the major challenges in terms of providing financial resources for sustaining the schemes?
6. How affordable are water services for the local population?
7. Have there been positive economic impacts resulting from improved access to water services?
8. Is there an equitable distribution of water services and benefits among different social groups?
9. How are marginalized groups, such as women, included in water supply scheme management?
10. What improvements have been observed in public health and hygiene practices due to improved water supply?

Appendix C: focus group discussion (FGD) guiding questions

Rural water supply scheme in Menz Mama, Emegwa *Kebele*

The following are the series of questions used in the focus group discussions.

Table in the Appendix 8: Focus group discussion (FGD) guiding questions

No	Discussion topics	Guiding questions
1	Contribution of the rural water supply scheme	What are the main challenges in sustaining rural water supply schemes?
		How can a demand-driven approach be implemented effectively?
		What strategies can be used to ensure sufficient user participation?
2	Community participation	How can committee training be improved to enhance their capacity?
		What factors should be considered when selecting appropriate technologies?
		How can financial resources be better allocated to address sustainability challenges?
3	Challenges in rural water supply scheme management	What measures can be taken to improve cost recovery and affordability?
		How have improved water services impacted the local economy?
		What steps can be taken to ensure equitable distribution of water services and benefits?
		How can marginalized groups, such as women, be included in water supply scheme management?
		What improvements have been observed in public health and hygiene practices?
		How can environmental sustainability be ensured in rural water supply schemes?
		What actions can be taken to enhance community participation and ownership?
		How can the impacts of climate change on water supply schemes be addressed?
		What monitoring and evaluation mechanisms should be implemented for sustainability?

በናሙና ለተመረጡ ኣባዎራዎች የቀረበ የናሙና መጠይቅ

ውድ ለዚህ መጠይቅ ምላሽ ለመስጠት የተመረጣችሁ ምላሽ ሰጭዎች፤

በዚህ የዳሰሳ ጥናት ላይ ለመሳተፍ ፈቃደኛ ስለሆናችሁ ምስጋናዬን መግለጽ እፈልጋለሁ። ጥናቱን የሚያካሄደው በደብረ ብርሃን ዩኒቨርሲቲ የድህረ ምረቃ ተማሪ የሆነው ***ተክለሲኖዳ አሰበፃዲቅ*** ነው። ***ተክለሲኖዳ*** በአሁኑ ወቅት "በመንዝ ማማ ወረዳ እመጓ ቀበሌ የገጠር ንፁህ መጠጥ ውሀ ተቋማት ዘላቂነት ግምገማ" በሚል ርዕስ ባቀረበው የመመረቂያ ጽሑፍ ጥናት በማካሄድ ላይ ይገኛል። የዚህ መጠይቅ ዓላማ በገጠር የንፁህ መጠጥ ውሃ ተቋማት አያያዝ እና ዘላቂነት ላይ መረጃን መሰብሰብ ነው። የእርስዎም ምላሽም ለዚህ ጥናት ከፍተኛ ጠቀሜታ አለው።

የዚህ ቃለ መጠይቅ ውጤትም ለተጠቀሰው ዓላማ ብቻ እንደሚውል ለማረጋገጥ እወዳለሁ። እባኮትን ያለምንም ማመንታት እና ጭንቀት በገጠር የንፁህ መጠጥ ውሃ ተቋማት አስተዳደር ውስጥ ያለዎትን ሃሳብ፣ እውቀት እና ልምድ ለመግለጽ እና ለማብራራት ነፃነት ይሰማዎ። ቃለ መጠይቁ በግምት 30 ደቂቃ ይወስዳል ተብሎ ይጠበቃል ስለዚህ መጠይቁን እስክትጨርሱ ድረስ ትዕግስትዎን በአክብሮት እጠይቃለሁ።

	የምላሽ ሰጪዎች ኮድ	ወረዳ	ቀበሌ	መንደር /ጎጥ/
		መንዝ ማማ	እመጓ	----------
መጠይቁን የሞላው/ችው/ ሰው ስም				
መጠይቁ የተሞላበት ቀን፣ ወርና ዓ/ም				
መጠይቁን ያስሞላው/ችው/ ሰው ስም				

ክፍል 1፡- የምላሽ ሰጪው/ዋ/ የስነ ሕዝብ አወቃቀር ባህሪያት

1. ቅፁን የሞላው ሰው ጾታ፡ 1) ወንድ _____ 2) ሴት _____
2. የቤተሰብ አስተዳዳሪው/ዋ/ ዕድሜ (በዓመት): _____
3. የቤተሰብ አስተዳዳሪው/ዋ/ የጋብቻ ሁኔታ፡- 1) ያላገባ/ች/ 2) ያገባ/ች/ 3) የተፋታ/ች/ 4) ባሏን በሞት ያጣች ወይ ሚስቱን በሞት ያጣ
4. የቤተሰብ አስተዳዳሪው/ዋ/ የትምህርት ደረጃ፡ 1) ማንበብና መጻፍ የማይችል/የማትችል/ 2) ማንበብና መፃፍ የሚችል/የምትችል/፣ 3) የመጀመሪያ

ደረጃ (1-8ኛ ክፍል) 4) ሁለተኛ ደረጃ (ከ9-12ኛ ክፍል) 5) ዲፕሎማ ያላት/ያለው/ ወይም ከዚያ በላይ

5. የቤተሰብ ብዛት (ራስን ጨምሮ): በእርስዎ ቤተሰብ ውስጥ ምን ያህል ሰዎች ይኖራሉ? 1) ወንድ፡ _____ 2) ሴት፡ _____ 3) ድምር፡ _____

ክፍል 2፡- በቤተሰብ ኃላፊው/ዋ/ የማህበራዊ ኢኮኖሚያዊ ባህሪያት ላይ ያሉ ጥያቄዎች

1. በአሁኑ ጊዜ ምን አይነት የግብርና ስራዎች ላይ ተሰማርተሃል/ሻል/? 1) የሰብል ምርት ብቻ 2) የእንስሳት እርባታ ብቻ 3) ቅይጥ እርሻ (የሰብልና የእንስሳት እርባታ)
2. ከእርሻ ውጭ የገቢ ማስገኛ ምንጮች አሉዎት? 1) አዎ አለኝ 2) የለኝም
3. ለጥያቄ ቁጥር 2 "አዎ አለኝ" ብለው ከመለሱ፣ እባክዎን ስለ እንቅስቃሴዎቹ አይነት ዝርዝሮችን መስጠት ይችላሉ?

ተ.ቁ	የገቢ/መተዳደሪያ ምንጮች/	1) አዎ 2) አይደለም
3.1	አነስተኛ ንግደረ /ግብይት/	
3.2	የቀን ሰራተኛ	
3.3	የሰለጠነ ስራ (ግንበኝነት፣ አናጢነት)	
3.4	በአካባቢ የሚዘጋጁ (ለምሳሌ፣ አረቄ፣ ጠላ፣ ወዘተ.)	
3.5	ሴፍቲ ኔት	
3.6	በየቤተሰብ ወይም የሌሎች የገንዘብ ድጋፍ	
3.7	ሥራ (ደሞዝ ላይ የተመሠረተ)	
3.8	ሌላ (እባክዎ ይግለጹ)	

4. የመሬት ባለቤት ነዎት? 1) አዎ ነኝ 2) አይደለሁም
5. ለጥያቄ #4 የሰጡት መልስ "አዎ" ከሆነ ስንት ሄክታር የእርሻ መሬት አለዎት? እባኮትን በሄክታር ይግለጹ። _____
6. የከብቶች አሉዎት? 1) አዎ አለኝ 2) የለኝም
7. ለጥያቄ ቁጥር #6 መልስዎ "አዎ" ከሆነ እባክዎን እርስዎ የለዎትን የእንስሳት ዓይነቶች ከሚከተሉት ዝርዝር ውስጥ ይለዩ እና ለእንሰሳዎት የሚሆን የመጠጥ ውሃ አማራጮችን ይምረጡ።

ተ.ቁ	የእንሳሳቱ ዓይነት	መለኪያ	ብዛት	ለእንሰሳቱ መጠጥ የሚውለው ውሃ መገኛው ይለዩ	
				1)ከመጠጥ ውሃ ተቋማት	2) ከሌሎች ከሆነ ይግለፁ
7.1	በሬ	ቁጥር			
7.2	ላም	ቁጥር			
7.3	ጥጃ	ቁጥር			
7.4	በግ	ቁጥር			
7.5	ፍየል	ቁጥር			
7.6	አህያ	ቁጥር			
7.7	ፈረስ	ቁጥር			

ክፍል 3፡- በጥናት አካባቢ የገጠር ውሃ አቅርቦት እቅድ አስተዳደር ዘላቂነት ሁኔታን በሚመለከት ተጨባጭ ጥያቄዎች

1. በዚህ አካባቢ ስንት አመት ኖረዋል? _____
2. ፕሮጀክቱን የመገንባት ሀሳብ የማን ነበር? 1. ማህበረሰቡ 2. የአካባቢ መሪዎች 3. መንግሥታዊ ያልሆኑ ድርጅቶችና የመንግሥት መሥሪያ ቤቶች 4. አያውቁም።
3. የፕሮጀክቱን ምንጭ ቦታ መምረጥ የማን ሀሳብ ነበር? 1. ማህበረሰቡ 2. የአካባቢ መሪዎች 3. መንግሥታዊ ያልሆኑ ድርጅቶችና የመንግሥት መሥሪያ ቤቶች 4. አያውቁም።
4. የፕሮጀክቱን አይነት/ቴክኖሎጅ መምረጥ የማን ሀሳብ ነበር? 1. ማህበረሰቡ 2. የአካባቢ መሪዎች 3. መንግሥታዊ ያልሆኑ ድርጅቶችና የመንግሥት መሥሪያ ቤቶች 4. አያውቁም።
5. የመንደርዎ የውሃ አቅርቦት እቅድ አሁን እየሰራ ነው? 1. አዎ 2. አይደለም

ክፍል 4፡- የገጠር ውሃ አቅርቦት እቅድ አስተዳደር የአካባቢን ዘላቂነት ሁኔታን የሚመለከቱ ጥያቄዎች

1. ከእርስዎ እይታ አንጻር የገጠር ንፁህ መጠጥ ውሃ ፕሮጀክት አስተዳደር ልምዶች በአካባቢዎ መተግበሩ የውሃ ሀብቶችን የረኸርም ጊዜ አቅርቦት አረጋግጧል? 1 = አዎ 2 = አይደለም
2. በእርስዎ አስተያየት፣ በእርስዎ አካባቢ የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ልምዶችን መተግበሩ ሥርዓተ-ምህዳራዊ ጥበቃን አረጋግጧል? 1 = አዎ 2 = አይደለም

3. በእርስዎ እይታ፣ በእርስዎ አካባቢ የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ልምዶችን መተግበሩ የአየር ንብረትን የመቋቋም አቅም ከፍ አድርጓል? 1 = አዎ 2 = አይደለም

ክፍል 5፡- የገጠር ውሃ አቅርቦት እቅድ አስተዳደር ኢኮኖሚያዊ ዘላቂነት ሁኔታን የሚመለከቱ ጥያቄዎች

1. በእርስዎ እይታ፣ በእርስዎ አካባቢ የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ልምዶችን መተግበሩ በተጠቃሚ ክፍያዎች ወይም በሌሎች የገቢ ምንጮች የወጪ ማገገምን አሻሽሏል? 1= አዎ 2 = አይ
2. በእርስዎ እይታ፣ የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ተጠቃሚ የገንዘብ ችግር ሳያጋጥመው ለውሃ አገልግሎት የመክፈል አቅም አለው? 1 = አዎ 2 = አይደለም
3. በእርስዎ እይታ፣ በአካባቢዎ ያሉት የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ልምዶች የግብርና ምርታማነትን ጨምረዋል፣ የጤና እንክብካቤ ወጪን ቀንሰዋል፣ እና የኑሮ እድሎችን አሻሽለዋል? 1 = አዎ 2 = አይደለም

ክፍል 6፡- የገጠር ውሃ አቅርቦት እቅድ አስተዳደር ማህበራዊ ዘላቂነት ሁኔታን የሚመለከቱ ጥያቄዎች

1. በእርስዎ እይታ፣ በአካባቢዎ ያለው የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር አሠራር በህብረተሰቡ ውስጥ ባሉ የተለያዩ ማህበራዊ ቡድኖች መካከል ፍትሃዊ የውሃ አገልግሎቶችን እና ጥቅሞችን በማሰራጨት ማንም ሰው ወደ ኋላ እንዳይቀር ያረጋግጣል ወይ? 1 = አዎ 2 = አይደለም
2. በእርስዎ አስተያየት፣ በአካባቢዎ ያለው የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር ልምምድ ከገጠር የውሃ አቅርቦት እቅድ እቅድ፣ ትግበራ እና አስተዳደር ጋር በተያያዙ የውሳኔ አሰጣጥ ሂደቶች ውስጥ የአካባቢውን ማህበረሰብ ተሳትፎ እና ተሳትፎ ያረጋግጣል ወይ? 1 = አዎ 2 = አይደለም
3. በእርስዎ አስተያየት፣ በአካባቢዎ ያሉት የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅችት እቅድ አስተዳደር አሰራሮች በተሻሻለ የውሃ አቅርቦት እና በህብረተሰቡ

ውስጥ ባሉ የህብረተሰብ ጤና እና ንፅህና አጠባበቅ ላይ አወንታዊ ተፅእኖ አላቸው? 1 = አዎ 2 = አይደለም

ክፍል 7፡- በገጠር ንፁህ መጠጥ ውሃ ተቋማት አስተዳደር ውስጥ የማህበረሰብ ተሳትፎን በተመለከቱ ጥያቄዎች

1. ቀጥሎ ከቀረቡት በየትኛው የገጠር ንፁህ መጠጥ ውሃ አቅርቦት ፕሮጅቸት እቅድ አስተዳደር ተግባራት ውስጥ እርስዎ ወይም ማንኛውም የቤተሰብዎ አባል በገጠር ንፁህ መጠጥ የውሃ ተቋማት አስተዳደር አቅርቦት ተግባራት ላይ ተሳትፈዋል? እባክዎ የሚከተሉትን አመልካቾች በመጠቀም የእርስዎን ወይም የቤተሰብዎ አባል በመነሻ እቅድ ደረጃ የነበረውን የተሳትፎ ደረጃን ይገምግሙ።

ተ.ቁ	በእቅድ ምዕራፍ ተግባራት	በጭራሽ (1)	አልፎ አልፎ (2)	አንዳንድ ጊዜ (3)	ብዙ ጊዜ (4)	ሁሌም (5)
1.1	የንፁህ መጠጥ ውሃ ፍላጎት ማሰባሰብ					
1.2	ለን/መ/ውሃ ተቋሙ አመቺ ቦታን መምረጥ					
1.3	የፕሮጀክት ግቦችን እና ዓላማዎቹን ማዘጋጀት					
1.4	የን/መ/ውሃ ተጠቃሚዎች መተዳደሪያ ደንብን ማዘጋጀት					
1.5	ለቦታው ተስማሚ የሆነ የመጠጥ ውሃ ተቋም ዓይነት መምረጥ					
1.6	ለግንባታው የሚሆን የሀብት አስተዋጽዖዎችን መለየት					
1.7	የአሠራር እና የጥገና እቅዶችን ማቋቋም /ማዘጋጀት/					

2. ቀጥሎ ከቀረቡት በየትኛው የገጠር ውሃ አቅርቦት እቅድ አስተዳደር ተግባራት ውስጥ እርስዎ ወይም ማንኛውም የቤተሰብዎ አባል በትግበራው ምዕራፍ ላይ ተሳትፈዋል? እባክዎ የሚከተሉትን አመልካቾች በመጠቀም የእርስዎ ወይም ማንኛውም የቤተሰብዎ አባል በትግበራው ሂደት ውስጥ ያለውን የተሳትፎ ደረጃ ይገምግሙ።

ተ.ቁ	የትግበራ ሂደት ተግባራት	በጭራሽ (1)	አልፎ አልፎ (2)	አንዳንድ ጊዜ (3)	ብዙ ጊዜ (4)	ሁሌም (5)
2.1	ሀብት ማሰባሰብ እና ቁሳቁስ አቅርቦት ስራ ላይ					
2.2	በን/መ/ው ተቋማት ግንባታ ስራ ላይ					
2.3	በስልጠና እና በአቅም ግንባታ ወቅት					
2.4	የግንባታ ቁሳቁስ አስተዋፅኦ ማድረግ					

3. ቀጥሎ ከቀረቡት በየትኛው የገጠር ውሃ አቅርቦት እቅድ አስተዳደር ተግባራት ውስጥ እርስዎ ወይም ማንኛውም የቤተሰብዎ አባል በክትትል እና ግምገማው

ውስጥ ተሳትፈዋል? እባክዎ የሚከተሉትን አመልካቾች በመጠቀም በክትትል እና ግምገማ ምዕራፎች ውስጥ የተሳትፎ ደረጃዎች ይገምግሙ።

ተ.ቁ	የክትትል እና ግምገማ ምዕራፍ ተግባራት	በጭራሽ (1)	አልፎ አልፎ (2)	አንዳንድ ጊዜ (3)	ብዙ ጊዜ (4)	ሁሌም (5)
3.1	በውሃ ጥራት፣ መጠን እና አጠቃቀም ላይ መረጃ መሰብሰብ					
3.2	ተግዳሮቶችን መለየት እና ማሻሻያዎችን መጠቆም					
3.3	በአፈጻጸም ግምገማዎች እና በግብረመልስ ወቅት በንቃት መሳተፍ					
3.4	ተቋማዊ ብልሽት ሲያጋጥመው ችግሩን በጥገና ለመፍታት ሃላፊነት መጋራት					

ክፍል 8፡- የገጠር ንፁህ መጠጥ ውሃ ተቋማት አስተዳደርን የማስቀጠል ተግዳሮቶችን የሚመለከቱ ጥያቄዎች

1 በእርስዎ አስተያየት በአካባቢዎ ያለውን የገጠር ንፁህ መጠጥ ውሃ ተቋማት አስተዳደርን ለማስቀጠል ዋና ዋና ተግዳሮቶች ምን ምን ናቸው?

ተ.ቁ	የገጠር ንፁህ መጠጥ ውሃ ተቋማት አስተዳደር ዘላቂነት ፈተና/ችግር/	የዘላቂነት ፈተናዎቹ/ችግሮች/ ደረጃ			
		አይደለም (1)	ዝቅተኛ (2)	መካከለኛ (3)	ከፍተኛ (4)
1.1	በፍላጎት ላይ የተመሰረተ አቀራረብ አለመኖር				
1.2	በበቂ ሁኔታ የተጠቃሚ ተሳትፎ አለመኖር				
1.3	በቂ ያልሆነ የኮሚቴ ስልጠና				
1.4	ተገቢ/ተስማማ/ ያልሆነ የቴክኖሎጂ ምርጫ				
1.5	በቂ ያልሆነ የፕሮጀክት ማዕቀፎች				
1.6	ውጤታማ ያልሆነ የተቋማት አስተዳደር ልምዶች				
1.7	በዲዛየን ወይም በተግባር ምዕራፍ ላይ ያሉ ቴክኒካዊ ጉዳዮች				

ለቁልፍ መረጃ ሰጪ የቀረበ የቃለ መጠይቅ ጥያቄ

አጠቃላይ መረጃ

(ማስታወሻ፡ የአካባቢ አስተዳዳሪዎች ፣ የሀገር ሽማግሌዎች ፣ ወጣቶች እና ባለሙያዎች በቃለ መጠይቁ ውስጥ ተካተዋል) የመረጃ ሰጪዎች ስም _____ ዕድሜ _____ጾታ____ሙያ _____

የትምህርት ደረጃ _____

1 **በመንዝ ማማ ወረዳ እመጓ ቀበሌ የገጠር ንፁህ መጠጥ ውኃ ተቋማትን ለማስቀጠል ዋና ዋና ተግዳሮቶች ምን ምን ናቸው?**
2 **ለንፁህ መጠጥ ውኃ አቅርቦት እቅዶች በውሳኔ አሰጣጥ ሂደቶች የተጠቃሚ ተሳትፎ እንዴት ይረጋገጣል?**
3 **የሥልጠና መርሃ ግብሮች የንፁህ መጠጥ ውኃ ተቋማት ኮሚቴዎችን አቅም በሚገባ አሳድገዋል?**
4 **የንፁህ መጠጥ ውሃ አቅርቦት መርሃግብሮች ተስማሚ ቴክኖሎጂዎች እንዴት ይመረጣሉ? /የሚመርጡት እንዴት ነው?/**
5 **ተቋማቱን ለማስቀጠል በፋይናንስ ምንጮች ረገድ ዋና ዋና ተግዳሮቶች ምን ምን ናቸው?**
6 **የንፁህ መጠጥ ውሃ አገልግሎቱ ለአካባቢው ህዝብ ምን ያህል ተመጣጣኝ ነው?**
7 **የንፁህ መጠጥ ውኃ አገልግሎት አቅርቦትን በማሻሻል አዎንታዊ ኢኮኖሚያዊ ተፅእኖዎች አሉን?**
8 **በተለያዩ ማህበራዊ ቡድኖች መካከል ፍትሃዊ የውሃ አገልግሎት እና ጥቅማጥቅሞች ስርጭት አለ?**
9 **እንደ ሴቶች ያሉ የተገለሉ ቡድኖች በንፁህ መጠጥ ውኃ ተቋማት አስተዳደር ውስጥ እንዴት ይካተታሉ?**
10 **በተሻሻለ የንፁህ መጠጥ ውሃ አቅርቦት ምክንያት በህብረተሰብ ጤና እና ንፅህና አጠባበቅ ላይ ምን መሻሻሎች ታይተዋል?**

የትኩረት ቡድን ውይይት መሪ ጥያቄዎች

በመንዝ ማማ ወረዳ እመን ቀበሌ የገጠር ውሃ አቅርቦት ችግር

የሚከተሉት በትኩረት ቡድን ውይይቶች ውስጥ ጥቅም ላይ የዋሉ ተከታታይ ጥያቄዎች ናቸው።

ተ.ቁ	የመወያያ ርዕሶች	ለውይይት የተመረጡ ጥያቄዎች
1	የገጠር ንፁህ መጠጥ ውኃ ተቋማት አስተዋፅኦ/ሚና/	የገጠር ንፁህ መጠጥ ውሃ ተቋማት መርሃ ግብሮችን በጥሩ ሁኔታ ለማስቀጠል ዋና ዋና ተግዳሮቶች ምንድን ናቸው?
		በፍላጎት ላይ የተመሰረተ አካሄድን እንዴት በብቃት መተግበር ይቻላል?
		በቂና አስተማማኝ የተጠቃሚ ተሳትፎን ለማረጋገጥ ምን አይነት ስልቶችን መጠቀም ይቻላል?
2	የማህበረሰብ ተሳትፎ	አቅማቸውን ለማሳደግ የኮሚቴዎችን ስልጠና እንዴት ማሻሻል ይቻላል?
		ተስማሚ ቴክኖሎጂዎችን በሚመርጡበት ጊዜ የትኞቹ ነገሮች ግምት ውስጥ መግባት አለባቸው?
		የዘላቂነት ተግዳሮቶችን ለመፍታት የፋይናንስ ምንጮችን እንዴት በተሻለ ሁኔታ መመደብ ይቻላል?
3	በገጠር የንፁህ መጠጥ ውሃ ተቋማት አያያዝ ላይ ያሉ ችግሮች	ወጪን መልሶ ማግኘት እና ተመጣጣኝነትን ለማሻሻል ምን እርምጃዎች ሊወሰዱ ይችላሉ?
		የተሻሻለ የውሃ አገልግሎት በአካባቢው ኢኮኖሚ ላይ ምን ተጽዕኖ አሳድሯል?
		የውሃ አገልግሎት እና ጥቅማጥቅሞችን ፍትሃዊ ስርጭት ለማረጋገጥ ምን እርምጃዎች ሊወሰዱ ይችላሉ?
		እንደ ሴቶች ያሉ እና የተገለሉ ቡድኖች በንፁህ መጠጥ ውኃ ተቋማት አስተዳደር ውስጥ እንዴት ሊካተቱ ይችላሉ?
		በሕዝብ ጤና እና ንፅህና አጠባበቅ ላይ ምን መሻሻሎች ታይተዋል?
		በገጠር የውሃ አቅርቦት መርሃ ግብሮች ውስጥ የአካባቢን ዘላቂነት እንዴት ማረጋገጥ ይቻላል?
		የህብረተሰቡን ተሳትፎ እና ባለቤትነትን ለማሳደግ ምን አይነት እርምጃዎች ሊወሰዱ ይችላሉ?
		የአየር ንብረት ለውጥ በውሃ አቅርቦት መርሃ ግብሮች ላይ የሚያስከትለውን ተፅእኖ እንዴት መፍታት ይቻላል?
		ለዘላቂነት ምን ዓይነት የክትትልና የግምገማ ዘዴዎች መተግበር አለባቸው?