



Assessment of Factors Affecting Sustainability of Rural Water Supply in Amhara Sayint Woredas, South Wollo Zone, Amhara National Regional State, Ethiopia

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ABSTRACT

Safe, adequate water supply is the basic needs and essential for the socioeconomic development of a given society. However, majority of the people in the Amhara Sayint Woredas rural settings still don't have access to potable, sufficient and sustainable water supply. The objectives of this study is to assess and evaluate the challenges of rural water supply schemes by assessing and evaluating the main factors related to community, financial, technical, institutional and environmental in the rural water supply scheme. A combination of purposive and simple random sampling techniques was used to identify sample kebeles, water supply schemes (villages) and household respondents in Amhara Sayint Woredas. 55 water supply schemes and 195 HHs were selected purposively and randomly. Cross-sectional design with descriptive analysis was applied using different data collection methods. Data were collected through household survey, focus group discussion, key informant interview and personal observation. Both quantitative and qualitative data were collected and analyzed using SPSS 16.0 version software. The results from the study indicated that poor community participation in the stage of planning, implementation and management, low level of women participation, weak performance of water committee and weak sense of ownership from the community, inadequate financial contribution for O and M, poor construction quality, lack of trained technician and weak institutional support are the main factors for the sustainability of rural water supply schemes. Water supply schemes failed due to depth, pump failure, inadequate spring tap, reservoir and water point construction, water quality and user's operation and management problems.

Keywords: Community participation; Community managed water supply; Sustainability; Water committee and water supply schemes; Indicators of sustainability

INTRODUCTION

Background

In developing countries national and regional governments, local and international NGOs and other concerned organizations invest large sums of money every year for the implementation of rural water supply projects. However, construction of water projects does not help if they fail after a short time. In order to make the investment in water supplies more effective, failure rates of these HDWs, SWS and Spring development systems should be reduced. According to Gebrehiwot, this can be

accomplished by better integration of people who receive the water and water project suppliers in decisions concerning planning construction and management of water supply systems.

About 33% of rural water supply projects in Ethiopia are non-functional due to lack of funds for operation and maintenance, inadequate community mobilization and commitment, less community participation in decision making as well as lack of spare parts. As Harvey and Reed reported that community issues like lack of ownership, lack of education on water supply and sanitation, poor management system and limited demand are

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related to low sustainability rates of water supply systems. This is a summary of rural water supply sustainability challenges by WELL [1].

Statement of the problem

Currently rural communities in Amhara Sayint Woredas don't have access to safe drinking water in most kebeles, due to the problem of sustainability of the water project after construction. A number of rural water supply projects are implemented in rural communities of Amhara Sayint Woreda by Governmental and Non-Governmental Organizations (NGO's) but they have no capacity to give service in their full performance.

Despite increasing attempt to tackle the limiting factors and many still fail to maintain the flow of expected benefits over their intended lifetimes of 10-15 years.

The non-functionality and sustainability of water supply project is one of the crucial problems in the Ethiopian water supply and sanitation sector development. For example, about 33% of the water supply schemes in the country are non-functional due to different reasons. The RWSN identify several reasons for the high failure rate, including inappropriate technology; poor construction; lack of community involvement and subsequent sense of ownership; poor community organization or cohesion; lack of follow-up support and/or training; the unavailability or high cost of spare parts, energy and professional support services. This study was designed to evaluate rural water supply sustainability to measures and act accordingly for improving access to drinking water.

Significance of the study

This study evaluates and identifies important information and lessons learned from the past and present water supply systems as per community participation in planning, implementation and management of water supply projects. It intends to provide stakeholders with possible indicators of sustainable safe drinking water scheme and input to intervene and take effective measure to sustain the rural water supply schemes in general and in the study area in particular and associated factors that need to be given due emphasis in future planning. The finding of the study as per the consideration of social factors, it makes aware sector partners to consider the importance of social dimension associated with community participation, management and attitude towards the essence and value of safe drinking water. It also provides inputs to the regional and woreda water supply sector and regional government to consider or take into account the results of the study for the future water projects implementation in Amhara Sayint Woredas rural settings. The results of the research will also contribute an input towards future planning, implementation and management of sustainable rural safe drinking water supply projects and enriches the knowledge base to be used by other researchers who intend to conduct broad based research pertaining to water system sustainability and community participation and management [2].

MATERIALS AND METHODS

Description of the study area

This study was carried out in Amhara Sayint Woredas. It is located in the west, south Wollo zone, Ethiopia, lying 1219902N latitude and 0473716E longitude. The woredas has an altitude that ranges from 1500 m-3890 m above sea level. The woredas capital town, Adjibar, is about 590 km away from Addis Ababa and 189 km away from Dessie. Amhara Sayint Woreda has total population of 170047 of which 85104 (50.05%) were male and 84943 (49.95%) were female. From the total population, 10238 (6.02%) are urban dwellers and 159809 (93.98) are rural dweller.

According to woredas government communication affair report released in 2017, the agro climatic feature of the woreda is tropical as 4.2%, 38.7%, 22.5% and 34.6% are Wurch, Dega, Weyina dega and Kola respectively. As described by the woreda government communication affair report, 70% is Gorges while the rest 13% and 17% are mountainous and plain respectively and Amhara Sayint Woreda is characterized by low and erratic rainfall with mean annual rainfall of 219.75 mm that ranges from 437 mm-2.5 mm. The temperature varies from a minimum of 5°C to a maximum of 32°C annually and it has mean annual temperature of 22°C (Figure 1) [3].

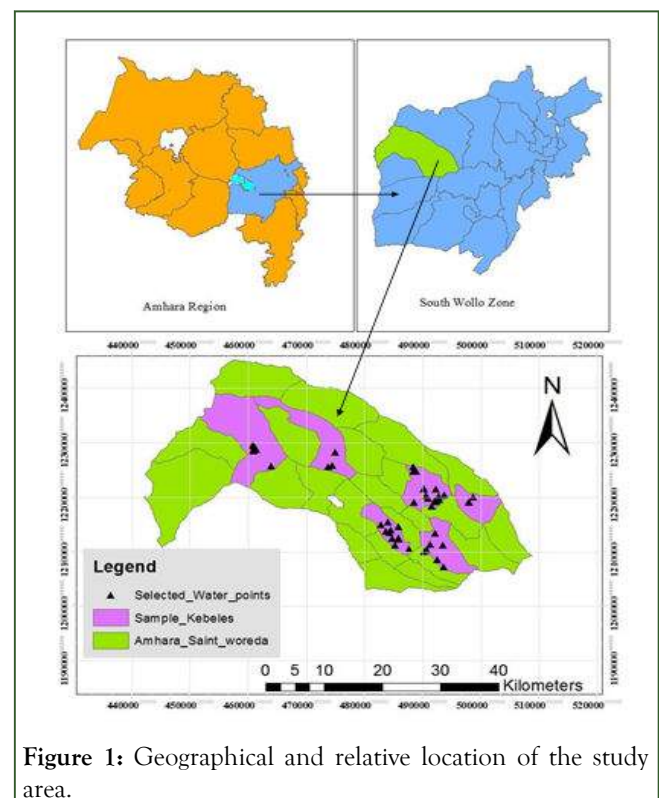


Figure 1: Geographical and relative location of the study area.

Research design

The research design used in this study was cross-sectional study, whereby different data were collected at a time and observed overall water supply schemes situation. In order to obtain the required information those are relevant to meet the objective of

the study. Both primary and secondary, qualitative and quantitative data collection instruments were used simple random sampling. Respondents should be including the age of 10 and above but not very old in order to data management and quality. Selected schemes in study area may be functional, non-functional and rehabilitation schemes but not includes ongoing process water supply schemes [4].

Sampling techniques and procedure

The necessary data were collected by interviews, Focus Group Discussion (FGD), Key Informant Interviews (KII) and field observations.

Two data collectors were selected to assist me in the field and had training before the interventional survey was conducted. The selection of data collectors was based on worked load, work experience, profession and related fields to water supply profession (operation and maintenance technician=1, water resource and schemes management expert=1) from woreda water resource development office.

Criteria for kebeles and village selection

For the purpose of sampling kebeles were selected reasons the following criterias.

- Agro climate features (two kebeles Kola (011 and 016), two kebeles Woyina Dega (04 and 022), one kebele Dega (028) and one kebele Wurch (019))
- Very far to each other (assumed to be representative for the rest of the schemes from each sampled kebeles schemes)
- A mix of technology options (schemes type like HDWs, SW, spring developments)
- Water schemes under community management
- Duration of the water schemes had implemented
- Degree of community participation

Data quality management

Preserving and maintaining the data quality is very important in statistical analysis study. In order to achieve this training were given to data collectors and how to interview and carryout recording observations for completeness, accuracy and clarity carefully.

Data analysis and interpretation

Data collected using different instruments and techniques were analyzed and interpreted as per the stated study objectives and research questions. SPSS 16.0 data analysis software that involves descriptive statistics was used to manage, interpret and analyze quantitative data collected from the field.

Both quantitative and qualitative methods of data analysis were used. The questionnaires were assigned with unique numbers for identification purposes. Each question was identified by a variable name and within variables there were values and value labels for identification of responses from the respondents.

Sub-indicators of sustainability

Physical condition of system: This measures the overall physical condition of the water system. It is based on factors such as construction quality, pressure level in the schemes and leaks or defects in the masonry or pipe these factors measured with FGD participants, KII and Hs respondents and also personal observation.

Consumer satisfaction: This measures overall consumer satisfaction with the water system. It is based on expressed opinions on factors such as satisfaction with quantity and quality of water received, taste and color and continued use of alternative sources.

Operation and maintenance: This examines factors such as whether the community has a designated system operator, access to tools and spare parts and information about follow-up support.

Financial management: This assessment is based on a review of each community's financial records and interviews with the water committee and treasurer [5].

Willingness and ownership: This measures community support for sustaining the water system. It assesses the degree to which community members feel responsible for their maintenance of their system.

Scoring

Each sub-indicator score was based on a group of 10 related questions collected by the survey data collectors and researcher. Each question was scored on a scale of zero to two and the total score for the sub-indicator was calculated by combining these scores and converting to a ten point scale. A community which performs poorly on 50 percent of the parameters receives a score of five also a community performing perfectly on all parameters receives a score of ten. A community which performs poorly in all areas receives a zero.

Scoring methods

There were four types of questions in the survey. Most questions have maximum 2 points. Scores of the indicators were calculated to fit 10-scale that the sum of scores of the sub-indicators be divided by the number of sub-indicators and multiplied by five. Overall sustainability score was calculated by averaging the 5 sustainability indicators scores.

Measuring sustainability

Because water system sustainability depends on a number of factors which vary between communities and change over time, measuring sustainability is a difficult task. This study bases its analysis on indicators that measure the key social, technical, institutional, environmental and financial determinants of sustainability at the community level. The study employed different survey instruments to measure each of these factors. It collected information on the technical factors from technical assessments of the water systems like care taker and artesian, institutional factors from the technical assessment like water

sector from head and stakeholders, financial factors from water committee, community and kebele WaSHCOs and interviews, social factors from local governments, kebele WaSHCOs with the water committee and from households lastly environmental factors from stakeholders and field observation.

RESULTS AND DISCUSSION

Summary of data analysis sampling

Out of 34 kebele associations that makeup Amhara Sayint Woreda, the majority of community rural water supply schemes (HDWs, springs and SWs) are found in most of kebeles associations of the woreda. Six kebeles were selected used both simple random sampling and purposely to studied in this research work, namely 04 Shengo-Defar kebele, 011 Guameda kebele, 016 Tedibabe-Mariam kebele, 019 Gedeba kebele, 022 Tengobalel kebele and 028 Endotie kebele.

In accordance with the sampling procedure stated in the research methodology section, the sample population representing each kebele association was selected based on access and coverage of the data summary obtained from Amhara Sayint woreda water office. Accordingly 57, 31, 10, 26, 58 and

13 households from 04 Shengo-Defar, 011 Guameda, 016 TedibabeMariam, 019 Gedeba, 022 Tengobalel and 028 Endotie kebeles were selected respectively using simple random sampling techniques. A total of 195 households from total 7543 studied schemes water beneficiaries were covered as a primary data source in order to serve the purpose of this study.

Demographic and socio-economic characteristics of the sample

Knowing socioeconomic profile of the respondents was important to understand their characteristics and roles in socioeconomic development. Accordingly, in this study total of 195 Hs were surveyed in six kebeles that use water from 55 both simple random sampling and purposively selected community schemes. Based on the result of survey, demographic and socioeconomic backgrounds were discussed as follows: Majority, 51.8% of the respondents still going to unsafe water sources such as rivers, traditional wells and roof catchments. The health implication of unsafe water source is also considerable (Table 1).

Table 1: Current sources of drinking water supply in sampled kebeles.

Sources	No respondents	Percent
Roof catchments	3	1.5
HDW, spring dev.t and SW	94	48.2
River	64	32.8
Traditional well	34	17.4
Total	195	100

With regard to the main problems to the un-sustained of water supply schemes, the following result were obtained from the surveyed households in the Table 2, among the sample 195 HH respondents 15.9% were indicated pump failure 17.4% replied that the depth problem/seasonality, 9.2% reported as construction quality problem and operation and management problems 57.4% of the respondents reported that problem of how to operate and manage were high problem to the non-functionality (un-sustained) water supply schemes.

From the above finding it can be concluded that the main problems for the non-functionality and sustainability of water supply schemes are inability to operate and manage the scheme properly problem 57.4%, depth (seasonality) problem 17.4% and pump failure problem 15.9%.

Table 2: The main problems for un-sustained water supply schemes (HDWs, SWs and spring developments).

Scheme failures type	No respondents	Percent
Pump failure	31	15.9
Depth problem (seasonality)	34	17.4
Construction quality problem	18	9.2
Operation and maintenance problem	112	57.4
Total	195	100

As shown in the Figure 2, the largest percentage of the respondents 59.5% confirmed that females were responsible for water collection in the family. 15.4% respondent reported that water collection was mainly the duty of girls, 9.2% are both male and female, 8.2% are female and children and also 7.7% is children. This finding is supports the assessment result of WHO that indicated, children and women, who were the common water attendants; spent much time on water collection in the rural areas of Ethiopia. Based on the finding was safe to say that water collection was mainly the responsibility of women and girls in the rural settings of Amhara Sayint Woreda [6].

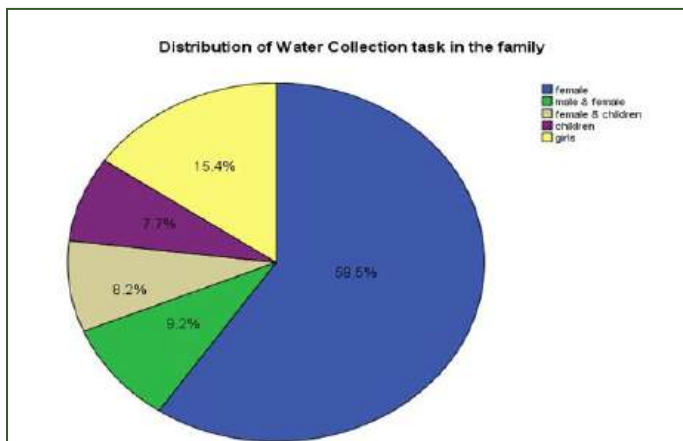


Figure 2: Percent distribution of water collection task in the family.

Demand for an improved water supply scheme planning

Based on respondent’s consideration the issue of water as a major challenge in their community Table 3 indicated, 102 (52.3%) out of the total respondent’s sufficiency and effective service delivery. Some of the solutions suggested by the respondents to the problems include developing new sources, improving storage, treating water, protecting and improving the existing sources.

This being the case, in 93 (47.7%) of cases it was revealed that water issue was not a major problem of the respective community. A response associated to water supply project initiators was shared among the different stakeholders involved in the project inception. Accordingly, results compiled in Table 3 have indicated how the target community members did not react to this issue.

Based on the survey 49.7%, (97) of respondents have confirmed community, NGOs and governmental offices as initiators of the project, 27.2% of respondents have confirmed community members and leaders as initiators of the project remain 15.9% and 7.2% followed by water committees and kebele WaSHCOs as initiators of the water project (Table 4).

Table 3: Responses regarding water as a major problem.

	No respondents	Percent
Yes	102	52.3
No	93	47.7
Total	195	100

Community participation in terms of initiating water project idea

Community members and leaders	53	27.2
Community, NGOs and Governmental office	97	49.7
Water committee	31	15.9
Kebele WaSHCOs	14	7.2
Total	195	100

Table 4: Phases and type of community participation in water supply project.

Phases of community participation in water supply project development

	No respondents	Percent
During construction	74	37.9
Post construction	36	18.5

Planning and during construction	18	9.2
During and post construction	67	34.4
Total	195	100
Types of Community participation in water supply project implementation		
Providing labor	49	25.1
Providing local materials, labor and cash	65	33.3
Providing local materials (wood and stone)	81	41.5
Total	195	100

Women participation

On average, rural villager's women often have to walked and spend considerable time average 24 hours in a day based on this study. The remaining of the respondents replied that spend time in a day 1-2 hours, 1-3 hours and 3-5 hours collecting water from unprotected sources that involve rivers, unprotected springs or polluted streams or ponds. For instance, in Ethiopia, rural women often have to walk five hours a day to fetch water and girls often miss school. They used to be exposed to these unsafe

water sources and this in turn increases the risk of being exposed to water borne diseases. Accordingly, increased access to safe drinking water would mean much for women and their children in terms of health, productivity and income. To this effect, the involvement of women has to be maximized in terms of water supply scheme planning, implementation and management (Table 5) [7].

Table 5: Women participation in water points.

	No respondents	Percent
Women participate in management of water points post construction		
Yes	70	35.9
No	125	64.1
Total	195	100
Women have participated in the development of water supply scheme		
Adult male	36	18.5
Adult female	26	13.3
Adult male and female	133	68.2
Total	195	100
Did the project given equal opportunities for male and female?		
Yes	81	41.5
No	114	58.5
Total	195	100

Community management

Community managing rural water supply schemes successfully means operating and maintaining a system on a day to day basis so that it continues to provide the service for its designed period

as planned. Therefore, water supply schemes will be better perform if they would be managed by users themselves and water supply agencies need to strengthen the capacities and willingness of the community to take the responsibility to manage their water supply systems. If water projects were to be managed

efficiently and are sustainable, it is important to promote beneficiary participation in the sense that the main

stakeholders should be actively involved in the management of water projects (Table 6).

Table 6: Responsible actors to make major decision regarding the water supply schemes.

Responsible factors	No respondents	Percent
Government bodies and beneficiary community	48	24.6
Water committee, government bodies and beneficiary community	63	32.2
Beneficiary community and water committee	32	16.4
Water committee	34	17.4
WaSHCOs	18	9.2
Total	195	100

Communities sense of ownership

The water supply schemes probably be poorly managed, misused rarely repaired by the community, if the beneficiaries do not feel sense of ownership, The degree of sense of ownership depends on the level of community participation in the development and management process. Conditions for conducting monitoring at household and community level has to be encouraged as it is found out to be one of the ingredient that greatly contribute towards the realization of sustainability, this is due to the fact that consideration remains purposeful on the required outcomes and service beneficiaries have got an opportunity of being empowered to manipulate their management and performance. These results of respondents on have got some kind of follow up and monitoring mechanism in Figure 3, in order to have updates regarding the management, operation and maintenance of the water supply scheme, the results should 39.5% of the sample respondents used to have indicated that they have some sort of monitoring system in place that they feel sense of ownership while 60.5% of them did not [8].

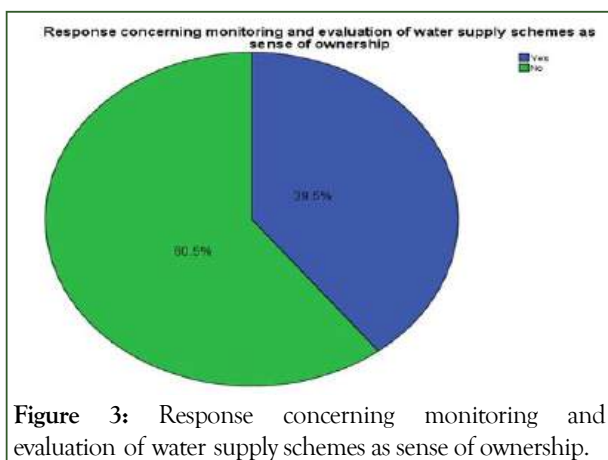


Figure 3: Response concerning monitoring and evaluation of water supply schemes as sense of ownership.

Financial related factors

It is a factor related to water supply scheme finance for its establishment, operation, maintenance and management costs money. In addition, existence of user’s contribution and its adequacy, ability and willingness to pay and proper management and utilization of the collected fee was important factor for the better performance of water points. Some of the financial factor related post management discussed as follows.

Existence of user payments and its adequacy for O and M

One of the many factors contributing for sustainable rural water supply system was attributed to the practice of cost sharing associated with user payments for water service delivered.

The results indicated that out of the total respondents in Table 7, 18.5% were to paying the water service fee as per the water supplied volume. In addition 16.4% of the total respondents have indicated a combination of users pay as per water supplied and monthly contribution as a way out in order to ensure the operation and maintenance of the water supply scheme.

Part of respondents nearly 48.7% of respondents deposits monthly contribution so as to ensure the water supply scheme operation and maintenance. The remaining 16.4% of the sample total have indicated quarterly contribution as a means of cost sharing in order to upkeep operation and maintenance of the water supply scheme. But, the data collected from FGD participants also confirmed that as it was establishment, majority of beneficiaries pay the water service fee at the time the scheme functional [9].

Table 7: Summary of why respondents pay water fee.

	No respondents	Percent
Response concerning the practice of cost sharing of the water supply scheme		
Users pay as per water supplied	36	18.5
Monthly contribution	95	48.7
Users pay as per water supplied and monthly contribution	32	16.4
Quarterly contribution	32	16.4
Total	195	100
Stated reasons why respondents pay water fee		
Salary of guard	132	67.7
It will cover operation and maintenance cost and salary of guard	31	15.9
It will cover operation and maintenance cost	12	6.2
Others	20	10.3
Total	195	100

Regarding to the amount of users payment was fair and adequate for the operation and maintenance under Table 8, 16.9% of sample household respondents reported that not fair and not adequate. As far as adequacy of payment of users' fee was concerned, the user community should contribute the money needed for operation and maintenance. The study indicated that majority of household respondents reported that the service fee rate set by the community through water committee.

In other words involvement of water supply agencies during service fee rate setting decision was limited to facilitation. Therefore, the amount of fee and mode of payment were not standardized and carried on depend on the capacity and interest of each community.

Table 8: Response payment pay status.

Response whether the payment you pay was	No respondents	Percent
Adequate	28	14.4
Fair	134	68.7
Unfair	33	16.9
Total	195	100

Ability and willingness to pay

In order the communities to meet the costs of operation and maintenance; beneficiaries must be willing and able to pay for the service. As the result Figure 4 shows, 42.1% of the respondents indicated that they were willing to pay 1-ETB per month per household, 23.1% households respondents reported 2-ETB, 17.4% were willing to pay 3-ETB and 17.4% were willing to pay 4ETB per month per household.

Thus, the surveyed households were able and willing to pay more than what they were paying now if the service would be continuous and performing better. In addition FGD confirmed that majority of users of water supply schemes were not capable and willing of paying for the service [10].

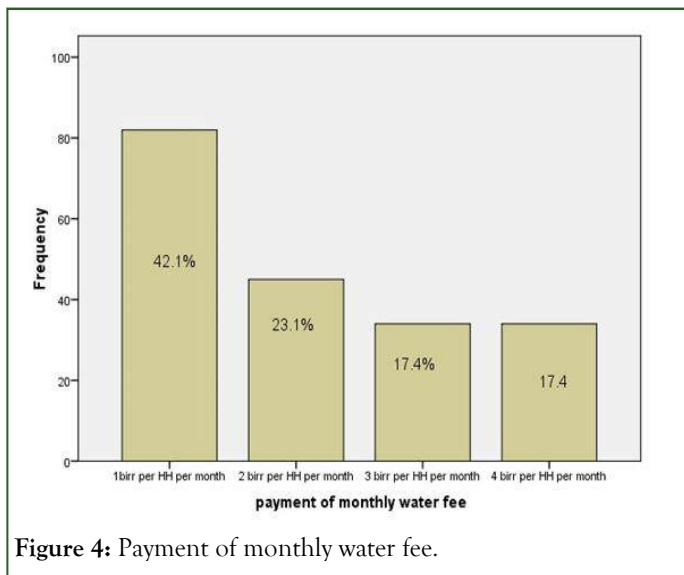


Figure 4: Payment of monthly water fee.

Operation and maintenance challenges

Sustainability of rural water supply schemes could not be fully realized if communities were not able to operate and maintain their own water supply facilities. This is due to operating and maintaining water supply schemes in day to day basis ensures the continuous work of the scheme for its design period. Hence, effective operation and maintenance of water supply schemes by the community was important to the sustainability of schemes and as the result the community utilized continuously the benefit of rural water supply schemes. The existence of local technician to operate and maintain their water supply schemes were assessed. As indicated in Table 9 shows the large percentage 91.8% of the respondents reported that there were no local technicians that maintain and repair when schemes got failed to provide the service while 8.2% of the respondents replied the existence local technician for operation and maintenance of water supply facilities [11].

Table 9: Existence of local technician and provided with training.

Respondent	No respondents	Percent
Existence of local technician and provided with training		
Exist	16	8.2
Not exist	179	91.8
Total	195	100

Construction quality of rural water supply schemes

Quality of construction is one of the technical elements which affect the sustainability of rural water supply schemes. This element comprises proper sitting of wells, proper well drilling and completion and proper construction of head/top part of the pump and proper construction of spring eye, reservoirs and water points. Even though, the issue is too technical and beyond the capacity of community to assess the complete construction quality whereas households were asked on the overall construction quality of water supply schemes for stakeholders (Figure 5) [12].

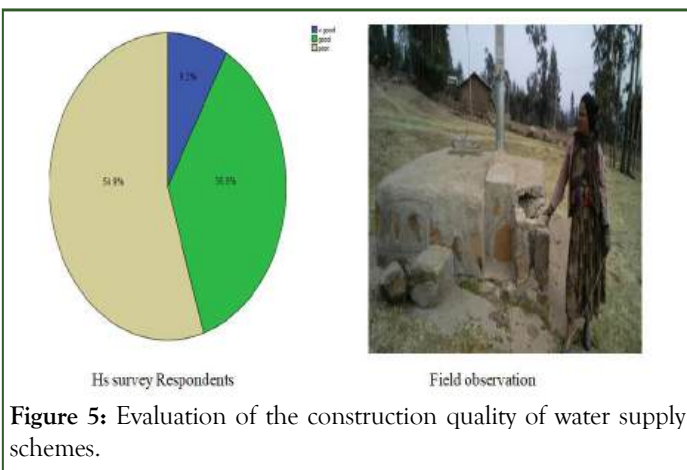


Figure 5: Evaluation of the construction quality of water supply schemes.

CONCLUSION

The community played role in demanding for the improved water supply schemes. Findings of the study have indicated that capital costs for rural water supply were fully covered by water implementing agency. Institutional support to communities in rural water supply scheme was inadequate. Water committees and WaSHCOs not adequately managing water supply schemes. All stakeholders not satisfied with rural water supply schemes construction quality. Financial sustainability of the water supply schemes has been in significant. Rural water supply projects not give equal chances for rural women.

RECOMMENDATION

Sustainability is increased when community members involving rather than government and NGOs agencies in all phases. Woredas water office needs to work hard mobilizing partners with building community capacity to manage rural water supply schemes. Operation and maintenance costs of rural water supply schemes should be covered by user community. Institutional capacity of the governments and non-governmental organization of rural water supply schemes should be adequate. Water committee, WaSHCOs, caretakers and technicians should be training in order to improve rural water supply sustainability. Schemes implemented should be bottom up and demand response approach. There are more needs and attention should

be given to build these unsustainable schemes, instance rehabilitation. The necessary feasibility study should be conducted by the relevant professional with the community participation before the implemented water supply schemes. Water committee, caretakers and technicians should be training in order to improve rural water supply sustainability.

REFERENCES

1. Admassu M, Kumie A, Fantahun M. Sustainability of drinking water supply projects in rural of north Gondar, Ethiopia. *Ethiop J Health Dev.* 2003;17(3):221-229.
2. Legesse S, Hailemeleket M, Tamrat H, Alemu YF. Epidemiological and therapeutic studies on sheep lice in Sayint district, South Wollo zone, Northeast Ethiopia. *Front Vet Sci.* 2022;9:1008455.
3. Dessale M, Habteselase Y, Abi D. Households' willingness to pay for soil and water conservation practices on communal lands in South Wollo zone, Ethiopia. *Sustain Water Resour Manag.* 2022;8(4):111.
4. Ayana GF, Megento TL, Kussa FG. The extent of livelihood diversification on the determinants of livelihood diversification in Assosa Wereda, western Ethiopia. *GeoJournal.* 2021:1-25.
5. Tamene A, Tediso D, Gebretsadik A. Level of job satisfaction and associated factors among rural health extension workers in Hadiya zone, Southern Ethiopia. *BMC Health Serv Res.* 2023;23(1):258.
6. Haile A, Megerssa B, Negash R. Enset (*Ensete ventricosoum*) value chain in Dawuro zone, southern Ethiopia. *Int J Agricultural Sci Food Technol.* 2020;6(1):126-150.
7. Alamirew SK, Lemke S, Stadlmayr B, Freyer B. Dietary behaviour and sociocultural determinants of dietary diversity among rural women of reproductive age: A case of Amhara region, Ethiopia. *Nutrients.* 2023;15(15):3369.
8. Mera GA. Drought and its impacts in Ethiopia. *Weather Clim Extrem.* 2018;22:24-35.
9. Tesfaye B, Lengoiboni M, Zevenbergen J, Simane B. A holistic analysis of food security situation of households engaged in land certification and sustainable land management programs: South Wollo, Ethiopia. *Foods.* 2023;12(18):3341.
10. Kassahun A, Yimam SM, Muanenda YS, Ali BM, Yalew SG. Uncovering the priorities of scientific research on sustainable development goals: A case study in Ethiopia. *Sust Develop.* 2024.
11. Baye F, Adugna D, Mulugeta S. Administrative failures contributing to the proliferation and growth of informal settlements in ethiopia: The case of woldia township. *Heliyon.* 2023;9(3):e13758.
12. Minale AS, Alemayehu ZY, Adam AG. Climate-change-driven conflict: Insights from North Wollo, Northeast Ethiopia. *Sust Develop.* 2024;10(1):2361563.