DETERMINANTSOF HOUSEHOLD WATER SUPPLY SUSTAINABILITY IN RURAL AREAS OF SOUTHWESTERN ETHIOPIA: A STUDY IN GOMMA DISTRICT IN OROMIA REGION

A Thesis Submitted to the School of Graduate Studies Of Jimma University in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Science in Economics (Economic Policy Analysis)

BY:

AWOL BIKA GEDA

JIMMA UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

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CERTIFICATE

This is to certify that the thesis entitles "Determinants of Household Water Supply Sustainability in Rural Ethiopia": The case of Gomma Woreda, Oromia Regional State, Ethiopia", submitted to Jimma University for the award of the Degree of Master Science In Economics (Economic Policy Analysis) and is a record of confide research work carried out by Mr Awol Bika Geda, under our guidance and supervision.

Therefore, we hereby declare that no part of this thesis has been submitted to any other university or institutions for the award of any degree or diploma.

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DECLARATION

I hereby declare that this thesis entitled "Determinants of Household Water Supply Sustainability in Rural Areas of Southwestern Ethiopia: A study in Gomma district in Oromia Regional state has been carried out by me under the guidance and supervision of Mr Tesfaye Melaku and Mrs. Nejat Kedir. The thesis is original and has not been submitted for the award of any degree or diploma to any university or institutions.

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ABSTRACT

The main objective of this study was thus to assess the determinants of household water supply sustainability in Gomma district by examining the main factors and identifying the limitation and key challenges. Using Systematic random sampling techniques total of 352 households were selected and using structured questionnaire interview the information was captured and analyzed using descriptive statistics and the binary logistic regression model. I found that from the variables house ownership, monthly household income, water tariff, monthly Water service cost, management capacity, high population growth, family size and financial issue) are statistically significant in predicting the sustainability of households' water supply sustainability. Therefore, conclude that the average daily consumptions were very less, when compared with the international or national standard benchmark for water utilization different domestic purposes. It is recommended that effort should be made the water and Energy office of gomma district should actively give training in order to overcome the water management gaps, the rules related to water tarif and the water service payments system could be revised in order to cover the running cost of the projects.

***Keyword**: Domestic water determinants, Logistic model, Rural Households, Gomma District*

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ACRONYMS/ABRIVATIONS

ADF	Africa Development Fund
BRIICS	Brazil, Russia, India, Indonesia, China, South-Africa
CBPs	Community Based Projects
HH	household
MoWE	Ministry of Water, Irrigation and Electricity of Ethiopia
MDG	Millennium Development Goal
NGO	Non-Government Organization
O&M	Operation and Maintenance
OECD	Organization for Economic Co-operation and Development
RWSP	Rural water supply projects
RWSS	Rural water supply service
RWSN	Rural Water Supply and Sanitation
SDG	Sustainable Development Goal
WSS	Water Supply service
UNICEF	United Nations Children's Fund
UAP	Universal Access Program
WaSH	Water and sanitation hygiene
WCED	world commission on environment development
WHO	World Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

A large range of economic and social benefits can result from improved WSS services. Reductions in cases and deaths associated with diarrhea disease and in indirect adverse health impacts (e.g. through malnutrition), as well as time benefits resulting from the proximity of improved WSS services are expected to account for a large share of total benefits. Economic benefits related to savings from the health improvements of upgraded WSS services relate to seeking less health care, to reduced losses of productive time due to disease and to a reduction in premature mortality(Hutton, 2012).

Investments in the water sector has focused on economic value of time and cost savings through improved water systems which would enable people to use the saved time and costs in other productive activities which in turn boosts the chances of sustainably managing the systems. An improved water supply is defined as a system which provides water reliably, of potable quality, and of sufficient quantity to meet basic household needs like drinking, bathing, cooking, and washing around the house(Cook, Kimuyu and Whittington, 2015)

The links between water scarcity and economic growth are complex and are only gradually becoming apparent. There is relatively little literature that convincingly links water scarcity to economic growth; the seminal work in this respect is Sadoff et al. (2015). They find a strong relationship between water insecurity and growth, using a 113 country panel data analysis. The OECD Environmental Outlook Baseline projects future demand for global freshwater (or more precisely “blue water” excluding rain fed agriculture) to increase by 55% between 2000 and 2050 and this is expected to make water one of the most fiercely contested resources on the face of the planet . However, the projected pattern of growth in demand for water is quite varied, with water use in the OECD countries declining over this period, while growth in the BRIICS region is expected to nearly double. The same report also identifies the complex channels through which water affects economic growth. Sorting these out requires a more complete model of the global economy (Hertel and Liu, 2016).

According to World Bank (2016) report from the world community signed the 2030 Sustainable Development Agenda in September 2015 (‘Agenda 2030’), the countries agreed a specific commitment to “Ensure availability and sustainable management of water and sanitation for all”. SDG 6 targets that to a global effort to provide universal access to equitable, safe and affordable drinking water and sanitation by 2030 and particularly Target 6.1 addresses drinking water and measures the percentage of the population having access to a safely managed drinking water service. ‘Safely managed’ is defined as an improved water source, which is on premises, is free of contamination and is available when needed.

Availability when needed can be considered as a proxy for a reliable service. However, various studies estimate that between 30% and 50% of water points are not working as planned after two to five years. Such a non-functionality rate is, in part, an expression of a weak and fragmented rural water service chain; from the construction of the water point, and the management of the system to the point when water is consumed. Importantly, studies show that significant sustainability challenges are seen even during the first year after construction, often as a result of poor planning, siting, and quality of the construction process(UNICEF, 2017)

However, supplying water projects alone would not contribute for communities especially in rural areas to have reduced the problem. The issue of functionality, utilization by intended beneficiaries and continuity of water projects to serve for longer period are very important issues to be considered and integrated to scale up intended impacts. Hence, integration between beneficiaries and project suppliers in decisions and contributions as well as management in all phases need to be addressed. The main aim of this study was to assess the determinants of household water supply sustainability in rural areas in Jimma Zone Gomma District of Southwestern Ethiopia.

1.2 Statement of the Problem and Research Questions

1.2.1 Statement of the Problem

The recently issued baseline for the Sustainable Development Goals (SDGs) states that 844 million people in 2015 remain without access to basic water services, and an estimated 2.1 billion without access to safely managed drinking water services, the large majority of those living in rural areas (UNICEF, 2017). Although first time access in rural areas has seen remarkable improvements, including access to piped water supply in some regions, sustaining this access is under threat. This is manifested by high rates of hardware failure, poor performance of service providers and low levels of services.

Africa has the lowest total water supply coverage of any region in the world (ADB, 2013). Currently about 300 million people in Africa do not have access to safe water and about 313 million have no access to sanitation; a situation which exerts a heavy toll on the health and economic progress of African countries (da Costa Silva and Dubé, 2013).Statistics shows that, the progress towards target 7C of the Millennium Development Goals of halving by 2015 the proportion of people without sustainable access to safe drinking water and improved sanitation facilities remains slow (Smieja, 2011).The rate of access to improved water sources increased from 49% in 1990 to 60% in 2008, a marginal increase of less than 1% a year 27% to 31%.(Chacha, 2015)

There are many research studies which indicate that the sustainability of household water supply system is dependent on several factors. To some cite some, the study by Fikadu and Mehretie(2019) explored the determinants of household water supply sustainability in rural town of Agew-Gimbjabet, northwest part of Ethiopia. In their result they found that over 68% of households they do not get sufficient and sustainable water because of limited supplies at the sources; frequent power interruptions; and weak management systems. Freshwater supply sustainability in the town was discovered significantly influenced by age of the household heads, house types, rate of urbanization, micro-relief of the area and water management capacity.

Similarly, Habtamu (2012) studied titled factors affecting the sustainability of rural water supply systems in Mecha Wereda, Amhara region, Ethiopia. In his result he found that the greater involvement of women in the decision making process of the functioning wells than initially for the abandoned water source, the institutional support of the water supply systems after construction was very weak mainly due to understaffing of the woreda office.

Additionally, Dlamini(2015) studied researches on household water demand and willingness to pay for improved water services in the Lowveld and Lubombo regions of Swaziland. In his result indicates that household income, education, gender, distance and owning a backyard garden positively and significantly affect WTP.

Furthermore, age, water quality and the initial bid offered negatively and significantly affected WTP for improved water. On the other hand, results from the double-log regression model showed that education, household income and ownership of a water tank were positive factors influencing household water consumption. Different researchers tried to study the household water consumption determinants. More of the researchers they tried to indicate some determinants variables of sustainability. As I tried to cite above some the variable to be studied are missing that is water service structure and monthly water service revenue are the main significant variables to be studied specifically in the study area as well as the rural areas of Jimma zone.

In addition, aims to address the above problems by developing a tool to assess determinants of household water supply sustainability in rural areas of specifically in Gomma wereda., which are characterized by limited community participation, financial, and managerial capabilities. This is important because many studies have been found to focus on community participation in general without specifically targeting on how community project management capacity, financial capability may related to the project sustainability The study was tried to answer three questions: whether or not community members influence the sustainability of rural water supply projects, how the financial system influence the project sustainability and to what extent the project management capacity influence the project sustainability in the study area.

1.2.1 Research Questions

i. What the determinants of household water supply sustainability in the study area.
ii. To what degree do community members influence the sustainability of rural water supply projects?
iii. To identify the effect of water tarrif structures , monthly water service revenue and the level of budget source on the household's water sustainability
iv. How and to what degree the project management capacity influences the sustainability of rural water supply projects in the study area?

1.3 The General and Specific Objectives of the Study

The General Objective of the Study

The main aim of this study was to assess the determinants of household water supply sustainability in rural areas in Jimma Zone Gomma District of Southwestern Ethiopia.

While the specific objectives:

1) To identify and estimate the determinants of household water supply sustainability in the study area.
2) To examine the effect of community participation on sustainability of water supply
3) To assess the effect of cost recovery and cost-sharing on household water supplies sustainability.
4) To examine influence of Scheme Management Capacity on sustainability of households water supply sustainability in the study area

1.4 Study Hypothesis and Variables

1.5.1 Null Hypothesis (H_0):

The null hypothesizes (H_0) for this study assume that "there is no statistically significant relationship between Community participation, financial factors, project management capacity (X-independent variables) and the sustainability of rural water supply projects (Y-dependent variable)".

1.5.2 Alternative Hypothesis (H1):

The alternative hypothesis (H1) was an inverse or opposite of the null hypothesis, which assumed that indeed "there is a statistically significant relationship between Community participation, financial factors, project management capacity (X-independent variables) and the sustainability of rural water supply projects (Y-dependent variable)". The alternative hypothesis assume that at least one or more of the independent variables (Xs') "is useful" for explaining or predicting the depending variable (Y).

1.5 Significances of the Study

The significance of this study was to provide 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 Gomma Woreda and the remaining the same areas of the regional wereda. It was significant since different development actors in charge of rural water supply can use the findings & recommendations for planning and

implementation of community managed sustainable rural water supply projects. Needless to say, the presence of sustainable, accessible and adequate water supply service has got great contribution for socio-economic development of the community.

1.6 The Scope the Study

The scope of this study is restricted to households residential water supply and does exclude other demands of water, because of time and financial limitations. This investigation is constrained on rural areas of Gomma districts. Particularly the research was focused to identify the problems of sustainability of water supply in four kebeles namely chedero-suse, Yachi-Ureche, Dedo-ureche and Kilole-kirkir. The study covers only three The study covers major factors influencing the sustainability of rural water supply projects namely; community participation, project management capacity and financial factors. This gives a researcher a confined area of study which is easy to control and easy to understanding the effect of those factors. Geographically, the study covers only the district in Gomma Wereda of Oromia Regional State.

1.7 Limitation of the Study

The study was based largely on households who were encountered with the water supply sustainability problems and those who obtained drinking water from public taps an self-supply communities. The study was limited inadequate access water the detailed information of Gomma Districts as well as sample selected rural kebeles. The other issue looked by the examination procedure is the absence of enough measures of fund and duration. It is difficult to direct these types of research without an adequate quantity of cash, time and source. The other problems related to transparency and willingness of interviewees to participate in the study, and the readiness of government officials to share official documents that would be relevant to this study.

1.8 Structure of the Thesis

The thesis comprise into five chapters. He first chapter deals with introduction that consist of significance of the study, problem of the study, objectives of the study, the second chapter discusses with the review of literatures which comprises empirical and theoretical literatures, the third topic concerns with research design and methodology that used in for analysis, the fourth chapter comprises of the result and discussion of the study , the last chapter, chapter five the conclusion and recommendation that summarizes the main finding and some future suggestions recommended for researchers.

CHAPTER TWO

LITERATURE REVIEW

This chapter was narrated concepts as well as it provide the related review of theoretical literatures and empirical findings. While providing those literatures the research questions were taken in to account and addressed. Finally, the conceptual framework was developed based on statement of the problem, research questions, and literatures.

2.1The Conceptual Definitions of Sustainability

According to Abrahams (1998) definition Sustainability is about whether or not water and sanitation services and good hygiene practices continue to work over time. No time limit is set on those continued services and accompanying behavior changes. In other words, sustainability is about lasting beneficial change in WASH services and hygiene practices. According to this definition, the achievement of sustainability engrosses the realization of enduring 'beneficial' changes in rural water services. In this case, the issue of sustainability is considered further than limiting itself on technical functionality debate; the expression 'beneficial' highlights the outcome on the lives of people and it indicates to services other than technology(Lencha, 2012).

2.5 Theoretical Literature Review

Rural water supply projects are one of the community based project where the target beneficiaries are able to take responsibility for ensuring people in the current and future generation are able to benefits from the projects by sustaining its outcome, processes, resources and human capacity. Currently there are numerous theories that explain or can be related to community project management capacity, financial capability and participation in relation to rural water supply projects sustainability, however in this study, a review of three bodies of theories namely; sustainability theory, financial distress theory and contingency theory have been selected to form basis for the this study.

2.5.1 Sustainability Theory

The concept sustainability can be traced back to 1970 and later popularized by world commission on environment development (WCED) a branch of United Nations. The concept is founded on economic theory known as theory of environmental limit whose brain child was

Thomas Malthus and David Ricardo. The argument in their theory is that resource in the environment that we live are finite (White, 1996 and WCED, 1997).

In the WCED report namely our common future, the concept sustainable development and sustainability began to take shape and later became popular with environmental conservation. According to WCED, sustainable development is a development that meets the needs of current generation without compromising the ability of future generation to meet their own needs (WCED, 1987). In the context of this study therefore, the concept sustainability is about people being able to maintain and sustain the project or program outcome by their own assets or resources while not compromising the needs of future generation.

Sustainable development is a development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs and expectations (CEC, 2013; ILO, 2012; World Bank, 2005 and Bossel, 1999). The need for sustainable development has become an issue in any part of the world. However in order for one to know what is a sustainable development, knowledge of what is important for the viability of the systems and how that contributes to sustainable development is necessary. When assessing the community capacity in managing projects understanding sustainability issues is important. The capacity of a community to manage a project in itself is an indicator of sustainability. When considering the protagonist of sustainability theory, any capacity building strategies need to examine the interconnected nature of both the local and larger networks which is also a systematic factor as discussed above.

The theory of sustainable development indicates that the concern of Sustainable development is management of the process of change, not on setting an end goal with fixed outcomes. It recognizes that uncertainties exist, necessitating flexible and ongoing processes. It also supports diversity and differences within the local setting. Inherent in this concept is consideration of the social, political, economic, and cultural relationships fundamental to development agenda. In this theory, sustainable development requires a broad picture view global thinking and local action of communities, while constantly thinking critically about and fine-tuning the small intricacies of the relationships that ultimately shape these communities. Management of projects requires three key competencies namely; contextual, behavioral and technical skills. In regard to sustainability approach to community development project leaders and team require contextual competence to a larger extent and not excluding behavioral and technical competence (Beata , 2014).

Looking at the focus of this study, sustainable development theorist informs us that in order to identify community needs and set priorities, there is a need to determine community preferences and balance competing interests. In this argument, people and their social institutions must be included in the community planning process to increase the probability of achieving a successful and sustainable outcome because lasting change generally comes from local involvement (Nyaguthii and Oyugi, 2001, Chaskin, 2001; Robert, 2001, DFID, 1995).

Many good programs fail because the proponents have never stopped to assess community capacity or asset before rolling out the programs. Long-term goals of the sustainable development should seek to empower people, increase community participation, foster social cohesion, enhance cultural identity, strengthen institutional development, and promote equity and fairness.

Sustainable development theory suggests that human and social capital should be treated much like natural resources. Efficient and effective use of these resources provides long-term, sustainable benefit to local communities (CEC, 2013). The investigation in this study borrows from sustainable development theorist emphasis that capacity assessment is crucial foundation for community participation in development projects. Following this argument, sustainability of project outcome, maintenance of project deliverables processes, resource mobilization capacity and human capacity establishment have been selected as key indicators for community development sustainability

2.5.2 Financial Distress Theory

This theory is characterized by decline in the firm‘s performance, value and failure (Opler and Titman, 1994). Organizations with projects that are supposed to yield profits have to ensure their projects perform as per expectations. Projects for profits should first recoup the initial capital invested then yield profits. This theory is important when addressing financial challenges affecting the sustainability of CBPs. The CBPs financial management practices have a gap as they do not operate within budget shave weak internal controls. The major challenge of this theory is it cannot recognize symptoms of failure early enough in order to make corrections. The performance of CBPs has been declining and there is need to track and ensure they improve. This theory therefore guided in the understanding of the important role that financial factor plays in the survival and persistence of projects.

2.5.3 The Contingency Theory

Contingency is a leadership model which states that there is no one best way to manage, projects and that projects are more successful when the management style fits the nature of the work and tasks, and success relates to the fit a project has with its environment.

Contingency theory suggests organizational effectiveness depends on how well an organizational structure matches its environment. This theory proposes, "Effective organizational performance depends on a complex relationship among environmental characteristics, i.e. production, technology, internal differentiation, and integration". Hence it has become one of the most consistent theoretical perspectives used in Project Management Research, where project success is contingent upon a combination of organizational, project, and people-based factors(Rutto, 2017).

The Contingency Theory suggests that different environments require different organizational relationships for optimum effectiveness, taking into consideration various social, legal, political, technical and economic factors. In addition, Contingency theory views conflict when project team members are undertaking their activities as inescapable but also manageable. Therefore, contingency theory explains that projects performance and sustainability is a function of a managers' ability to adapt to environmental changes(Rutto, 2017).

2.2. Domestic Water supply and its Sustainability

Various studies conducted research relating to sustainability of water supply services which have been produced different definitions concerning sustainability. Most of the definitions in the context of the study capitalize on financing of continuous operation and maintenance cost by beneficiaries, minimal external assistance in long term and continued of benefits over a long period(Tadesse, Bosona and Gebresenbet, 2013).

According to (Hickey, 2008) cited the books about water supply systems and evaluation methods water supply system cannot service its beneficiaries unless there is a continuous supply of water to meet domestic consumption. Water sources need to be selected carefully to make sure that this fundamental requirement is met. The two main factors that affect water supply selections are quality of water and quantity of water

According to a study published by (Hickey, 2008), the main issue should be answered by water committee or the water office is " how much water will our system be required to deliver and to where, both today and in the future?" The answer to this question will require

the acquisition of basic information about the community, including historical water usage, population trends, planned growth, topography, and existing system capabilities, to name just a few. This information can then be used to plan for the logical extension of the existing system and to determine needed improvement to provide sufficient water supply at demand pressures throughout the community. The first consideration of a water distribution system is the determination of the quantity of water that will be required, with provision for the estimated requirements for the future. In terms of total quantity for domestic consumption, the water demand in a community usually is estimated on the basis of per capita demand.(Hickey, 2008).

According to (Mekonnen, 2019), a study in in Injibara town about the assessments of urban domestic water supply challenges in Ethiopia, the domestic water supply is characterized as water utilized for all resident purpose including demands of drinking, cooking or food preparation, washing, showering, cleaning and sanitation (Arturo et al., 2017). For every one of this residential use, a specific amount of water must be accessible. In any case, there is a problem to distinguish an obvious least measure of water for every residential action. For the manageability of life, a base amount of water is required of water by a human body.

The prerequisites as to the roundness of water supply over every one of these utilizations and not exclusively in connection to the utilization of water. Even though this expansive definition gives a general structure to resident water use in the setting of value necessities, it is less helpful while considering amount require a water supply. Similarly, the daily necessity of drinkable water supply per individual for their fundamental needs is 20 to 50 liters for each day, yet more than one out of six individuals do not approach such measures of potable water. Generally household water supply in Africa where only 62% of the number of populations in urban approaches to gate improved water supply. The rural zone has more difficulties in condition as it covers only 47% of the total country populations(Mekonin, 2019).

2.3. Sustainability of Rural Household Water Supply

According to (Fekadu and Mehretie, 2019) cited sustainabable water supply refers to clean and affordable freshwater avaialable to all persons with no discriminiation on contninuous basis in order to satisfy basic domestic needs. Similarly, Sustainability of water supply schemes is whether benefits from the service continue satisfactorily until the end of the design life. Benefits include health benefits through providing improved quality of water from protected source, water delivery to reduce time spent and convenience.

According to Carter *et al* (2010), sustainability is about the inter-relationship of natural resources, physical assets and the services they provide; the people and organizations which use and manage them; and the rules and financial systems which facilitate effective management. Functionality on the other hand is about whether (and where degrees of service are possible, to what extent) a service is operating at a particular point in time. The partial functionality or non-functionality of a service may provide a trigger for more detailed investigations of sustainability(Bitew, 2013)

2.3 Sustainability of Water Supply in Ethiopia

The water supply and sanitation sector in Ethiopia is one of the least developed and is mostly characterized by service deficiency of physical infrastructure as well as by inadequate management capacity to handle policy and regulatory issue and to plan, operate, and maintain the service. The Ethiopian government (subsequently the regional governments) adopted the National Water Resources Management Policy. Therefore, to increase and sustain water supply services in both rural and urban areas. The overall goal of the policy is to enhance and promote efficient, equitable and optimum utilization of water resources for sustainable socioeconomic development. The policy follows the principle that the water supply sector has to ensure that every Ethiopian citizen has access to water of acceptable quality to satisfy their basic human needs.(Alebachew, 2019)

The government later adopted the Universal Access Program (UAP) to scale up the water supply and sanitation coverage of the country and achieve 100% water supply coverage in most of the rural regions. To attain this target, the UAP assumes that, to make water supply schemes sustainable, hand pumps have to be made locally and repaired by local technicians and, generally, pumps and generators have to be standardized in relation to village-level operation and maintenance for sustainable service.

It has been estimated that 25% of rural water supply schemes in Ethiopia are non-functional at any time, owing to lack of funds for operation and maintenance, inadequate community mobilization and commitment and a lack of spare parts. With regard to this issue, the UAP aims to rehabilitate and maintain existing water supply schemes in the first two years of its seven-year plan, so as to develop a maintenance culture and increase the sustainability of both the newly constructed and the existing water supply schemes(Alebachew, 2019).

2.4. Empirical Literatures on Determinants of Household Water Supply Sustainability

(Kassa, 2014) conducted a research in Seharti-Samre Woreda inTigray Region, on the sustainability of community managed rural potable water supply systems, he found that he ineffectiveness and inability of the water committee to ensure regular payment for O&M of facilities, lack of spare part chain and a set of toolkits, seasonal fluctuation of many water sources, and limited external support were identified in this study as major challenges adversely affecting the sustainability of facilities.

(Chacha, 2015), studied research in Kiwimba District, Tanzania on the assessment of factors that affecting sustainability of water project services , determinants which affecting the sustainability of water supply project are the lack of community involvement and participation, destruction of water points and lack of social safeguards mechanism in protecting the water projects in Kwimba District. He recommended that in order to get the well-established water supply project the community participation must be given the first priorities in order to help the to maintain the sense of ownership and at the same time contribute for the development of projects in terms of labour power and skills. Moreover; technical skills manpower should be increased in the study area so as to provide sufficient technical skills for non-function water point hence reduce the water problem in the study area.

Mustafa (2016), conducted a study in Laikipia county, kenya on factors affecting Water supply project sustainability he concluded that any project to be successful, it must rely on the ability of the project manager to lead different teams successfully and to help them buy-in into a common goal of completing the objectives of the project; by ensuring that the there is sufficient technical expertise to manage the project, sufficient human resource, satisfactory risk management and advise about technical architecture is made available.

Rutto (2017) conducts research in Kipkelion East Constituency, Kenya on the performance and sustainability of community based water supply projects concluded that he effect of financial resources on sustainability of the water projects was of great extent. There was availability of enough adequate finances to fund the water projects from the C.D.F for the installation of the Community water projects. After the Study with it was found out that the effect of financial resources was a determining factor influencing the performance and Sustainability of water supply projects

Alebachew (2020) studied a research in Fogera District of Amhara Region on evaluation of rural Water supply schemes sustainability analyzed that Beneficiaries contribute money, labor, and raw material and available information. In this case, contribution of labor takes the largest percentage followed by local materials, but weak community participation during the planning stage and site selection which is the most important phase, low level of women involvement, limited water committees 'capacity, and less sense of ownership, is problems that aggravate on the sustainability issue of rural water supply schemes. He recommended that Water Supply scheme design should recognize the need for community involvement in planning, design and construction for sustainability. O&M, including cost recovery, will take place only when the community accepts full ownership of the facility.

2.6 Determinants of Water supply Sustainability

This section of the literature will review the different critical determinant factors that influence sustainability of rural water supply schemes. Accordingly, Abrams categorized these critical factors into five categories namely Community factors, social factors, Technical, Financial and economic issue, Environmental aspects, institutional and legal factors. For the purpose of this research work the following factors are tried to be discussed in detail in relation to the role they played in promoting the sustainability of rural water supply projects.

2.6.1 Community and Social factors

Key components of the social category identified by Abrams (1998) and (Parry-Jones et al., 2001) are the principles of community participation and community management. Giné and Pérez-Foguet (2008), conclude that community participation has gained widespread acceptance as a prerequisite for sustainability but community management has not. Under community management, a committee of community members is given responsibility for managing the water supply (Harvey and Reed, 2006a). The community management model is the most widely adopted approach to managing rural water supplies in Africa(Harvey and Reed, 2004).Communities are not always motivated to manage water points effectively. Consequently, many communities experience a gradual decline of the service prior to a major breakdown, which is resolved only through an external rehabilitation program.(Alebachew, 2019)

Sara and Katz (2004), found the sustainability of water supplies was improved by the existence of a community management committee. However, Colin and Lockwood (2002) found that in many projects, the community management model was built on the premise that it would succeed, without necessarily investigating the risks and constraints associated with it. With an estimated 30% of hand pumps not working in Africa, Harvey and Reed (2004) argues there is evidence that only limited success has been achieved through the approach. When communities perceive a significant improvement in water services, they are usually more willing to pay for O&M willingness-to-pay is also affected by community perceptions of ownership or sense of entitlement to free services from the government(Alebachew, 2019).

2.6.2 Financial/Economic factors

According to Smet & van Wijk (2002:30), important financial factors that are likely to be considered for the sustainability of rural water supply schemes in general are: financial ability to meet the cost of maintenance i.e. presence of tariff structure covering O&M and replacement costs; willingness & ability to pay; and financial management system.

i) Financial ability to meet the cost of Operation &Maintenance

Failure to adequately cover costs of improved water supply services III developing countries has been identified as major constraints to achieving the goal of safe water supply for all on a sustainable basis. In recent years, increased community financing through user payment for services has been strongly promoted as a solution (Evans, 1992: I).

These are often costly and thought to be beyond the financial capacity of community, however, experience shows that communities are willing to shoulder portions of the investment costs and to pay for full O&M provided that they are in need of the service and appropriate community promotion exercise is being carried out. Although there are undoubtedly some areas in some countries where poverty is extreme, the review of global situation reveals that most rural communities can afford to pay for improved water supply services provided that appropriate technology is used. The reason for this argument is that people in rural areas are already spending large amount of time and energy in water collection(Gujo, 2009).

As far as payment for water supply service is concerned, Ethiopian Water Resources Management Policy (1999:23) promotes that for rural water supply schemes partial cost recovery principle to be applied i.e. user communities should cover O&M costs. Such kind of

payment is proposed to be effected through different tariff structures. The tariff structure that is adopted for rural water supply schemes that provide communal services and public stand posts is flat rate tariff, in which all beneficiaries are expected to contribute equal amount either in cash or kind in fixed time interval.

ii) Willingness and ability to pay for services.

Providing services which people can afford is a pre-condition for cost recovery [partial cost-recovery in rural water supply case in Ethiopia]. Being able to pay for something and being willing to do so, however, do not always go hand .in hand. From an economist's point of view demand is only real (or "effective") when it is accompanied by willingness to pay, in cash or kind, for goods or services offered. From this point of view, "willingness to pay" and "demand" essentially mean the same thing (Evans 1992:20). In order to the communities meet the cost of O&M, community members must be willing to pay for the service. However, not every community member is willing to pay for the services. Willingness to pay for the service is influenced by number of factors. For example, a community with a river near-by is prepared to pay much less for the constructed schemes than a community with similar income who has to walk kilometers to fetch water. This is why a survey should be done before the project is started to determine willingness to pay (Gujo, 2009).

iii) Financial management system

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

2.6.3 Technical Sustainability Factors

i). Technology selection

According to Musonda (2004), technology selection is crucial to sustainability of rural water supply schemes .because the type of technology chosen affects O&M. If a community is to manage a water supply system, the technology used needs to be the type that community care takers can maintain with little outside assistance. Also, technology must suit the existing locally available skills or skills that can be acquired by community members. Technology is considered suitable if it is socially acceptable, economically viable, technically effective, and environmentally sound. Communities should have a say in technology option. The

technology option should not be too technical and beyond the comprehension of community members.

In this regard, according to Geleta et al (2002), socio-economic viability, social acceptability and appropriateness of technology influence the ability and willingness to manage the improved water supply systems. The use of appropriate technologies, which are low cost, easy to maintain, simple to use, and readily available is one response to challenge of sustainability. Appropriate technologies are integral to the concept of village operation and maintenance (VLOM) which emerged in the water decade(Gujo, 2009)

Also, community participation in the selection of technology type in genera l and the mark of technology depending on their easiness for O&M in particular should be considered. In this regard, study inWest Abaya has shown that water committees have never been participated in technology selection activities(Israel and Habtamu, 2008).

ii) The availability, accessibility and costs of spare parts

Hand pump installation is the most widespread solution for supplying water to millions of people in Africa's rural areas. However, at any given moment, average 30 percent of all potentially functional hand pumps in Africa are not working. In some areas, 50% or more than nonfunctional, partly due to difficulties in obtaining spare parts (WSP, 2006). The problem of spare parts for rural water supply primarily attributed to lack of formal supply chain mechanism. Hence, Lack of spare parts has been a major constraint in sustainability of water supplies and has been a recurring problem. In some cases, it has led to the complete abandonment of the water supply system (Brikkke et al 1995:30). If sustainability is to be achieved, it should be ensured that after appropriate technology is chosen, spare parts for that type of technology are made readily available(Gujo, 2009).

iii). Construction quality

From experience, it is not uncommon for the failure of water supply hand-pumps because of construction quality problems. Common construction quality problems that result in scheme non-functionality are: improper site selection due to poor and/or lack of feasibility study, partial penetration of an aquifer, poor casing arrangements, poor gravel packing and poor estimation of well yield. Such kind of well completion problems eventually results in well dry up and as result hand-pumps will be abandoned(Gujo, 2009).

2.6.4 Institutional and legal factor

The institutional category of sustainability relates to external support being available to communities from NGOs, national and local government institutions, as well as the private sector Harvey and Reed (2004) and Carter et al. (1999), state that community enthusiasm for maintaining facilities wanes within two or three years after installation, hence the need for on-going support that enables; community institutions to overcome the challenges of managing water points Carteret, In recognizing that communities cannot autonomously manage services Giné and Pérez-Foguet (2008), call for appropriate institutional support where; governments don't neglect their responsibilities and trained technicians; encourage; and motivate communities, as well as monitor service performance. Whittington et al. (2008), included assistance with; maintenance and repairs, accounting and tariffs, technical training, free repairs, manuals and other materials, as well as access to spare parts. Found no evidence that free repairs or technical assistance were positively associated with sustainability the most promising support activities identified were those relating to administrative management and system operation.

2.6.5 Environmental Factors

Augustine (2009), the most important environmental factors that affect the sustainability of RWSS fitted with hand pumps are the quality of water source, the quantity of water source and continuity of water supply where each of the factors are discussed below. The quality of water source determines whether the water needs to be treated or not. It also influences the technology choice. Thus, domestic water should be available in acceptable quality to satisfy minimum requirements for drinking, cooking and food preparation as apriority in addition to water for washing clothes and utensils, bathing and personal hygiene and for watering small plots and/or small number of livestock or poultry. Therefore, water source to be developed should full fill a minimum set of water quality standards (WHO, 2004). Furthermore, water quality problem can be easily understood and mitigated by routine testing and understanding the nature of the geology and ground water resources (Hounslow, 2018). Otherwise, if minimum quality standard of drinking water is not fulfilled, sustainability of water supply scheme would be questioned.

In selecting site and appropriate method of developing and providing water for domestic uses, attention should be given to potential future demands on the system. The system should be designed with a view of possible future expansion in population or other condition on

requires it. In addition to this, knowing and calculating the differences uses of water is important. Single use/user approach is neither efficient nor sustainable. And ultimately it may generate wastage and conflict between uses & users. Therefore, understanding the hydrology is the key in the process of identifying how the water sites will behave under stress and also the long-term sustainability of water sources under the impact of drought and climate change. Well planned community water supplies, which take into account the nature of water resources, will be more sustainable. It is vital that for the sound development of water resources, the integrated strategies should be adopted(Alebachew, 2019).

2.6.6 Community participation and Water Supply Schemes Sustainability

Participation plays a great role as a foundation of community development projects including water services in developing world. Miruri and Wanjohi (2017), states that participation is a key instrument in creating self- reliant and empowered communities, stimulating village-level mechanisms for collective action and decision-making. Participation is also aimed at increasing the sense of ownership over the water supply within community members(Alebachew, 2019).

Tifow.et.al(2013), Community involvement and participation assumes that communities will be empowered to plan, manage, operate and maintain their water facilities in the long term if they are involved in decision making right from the project planning period through implementation and eventual hand over to the community. Many projects have achieved a certain level of involvement of communities in this process. However, even among these projects challenges still persist with respect to sustainability. It may therefore be necessary to look further at the dynamics in the community in order to understand who represents what, what are the different role differentiation aspects in a specific community. It might be necessary to ask who should be involved, who makes the decisions or how are water related roles defined. In many countries, community management Committees do not have proper legal status and are vulnerable to material, financial, contractual and legal problems contributing to their lack of capacity to sustain services(Tifow, 2013).

Full community participation promotes a proactive process in which the beneficiaries influence the development and management of development projects rather than merely receiving a share of project benefits. Community participation creates an enabling environment for sustainability by allowing users, as a group, to select the level of services for

which they are willing to pay, to guide key investment and management decisions, and also to make choices and commit resources in support of these choices(Lencha, 2012).

Shayo(2013) observed on community participation and sustainability on national water projects in Chalinze. The study was conducted in Chalinze whereby 130 respondents were selected to obtain both quantitative and qualitative data. Structured questionnaires, Focus group discussions, observation, interview of key informants and documentary reviews were used to obtain relevant information. Checklists and observation kits were used for interviews and focus group discussion and observation. The findings show that, the community participation in planning and implementation of Chalinze water supply project was very poor; as well as monitoring mechanism of operation and management and community participation on decision making was not satisfactory(Mrangu, 2018).

Boru (2012) conducted a study on determinants of community ownership of water projects in Kenya. The study revealed that community involvement influences community ownership of water projects. The study also concluded that there is a significant and inverse relationship between distance from the water source and ownership of water projects. Furthermore the established that technology use, ease of operation and maintenance cost, availability of spare parts influences community ownership of water projects. Therefore, this study examined the extent which community get involved in designing and implementation of projects.

2.6.7 Project Management Capacity and Water Supply Schemes Sustainability

The environment under which a community development projects operates may be a starting point in investigating community capacity to manage their own project for sustainability. Project management capacity factor is one of the independent variable in this study. It is the ability of the community members to actively participate in the management of the development projects that target them as beneficiaries. Community capacity can be categorized as functional, technical and behavioral. Community capacity to participate in project management is suspected to influence the level of community development projects sustainability.

According to ENDAN, 2011, the capacity factors for investigation when planning for community development project include; human resources which covers skills, experience,

talent, cooperation, knowledge, ability to work and good health; social factor which include relationships among individuals, organizations and groups within the community, political structures and informal networks as well as natural factors. Community resources which include finance, people, natural and manmade physical resources require effective leadership(Augustino, 2015).

Project management is common practice for village water scheme to be managed by a village committee of some sort: the creation of which is intended to enable communities to have a sense of ownership over the scheme and to ensure its ongoing operation and maintenance (Harvey & Reeds 2006). Empowerment of the communities involved in the management, leads to the positive participation in the sustainability. Coordination of stakeholders in formulation of sound sustainable mechanisms, leads to a lasting solution. Empowerment of the communities involved in the management, leads to positive participation by the community members in planning,implementation, development and maintenance of rural water supply systems(Mulwa, 2013)

2.6.8 Project Financing and Water supply Schemes Sustainability

Nyakundi (2014) conducted a study in Nairobi, Kenya that aimed at identifying on how stakeholder‘s involvement influences project monitoring and evaluation and to establish the influence of project technical skills on the implementation of community based projects. The study used interview and questionnaire to collect data. The study reveal that very low stakeholder participation in monitoring and evaluation of donor funded projects lead to mismanagement of fund which cause the unsuccessful of project implementation. The study recommended that, project managers should be in charge to provide resources for donor funded project to be sustainable.

Hayson (2006) conducted a research in Tanzania to assess the sustainability of water project in Singida and Dodoma areas. Both Qualitative and quantitative methods are used to collect information. a purposive survey was undertaken covering 38 villages in six different districts. The study revealed positive correlation between project sustainability and fund management. Moreover the water project in the said areas failed to sustain due to improper management of project fund(Mrangu, 2018).

K.Rutto(2017) conducted a research to assess the performance and performance of community water supply projects which funded by Constituency Development Funds in Kenya, it was found out that the effect of Financial Resources was a determining Factor influencing the performance and Sustainability of water supply projects.

Shaw (2012) states that community members are usually reluctant to pay when everything appears to be working. Ideally, water tariffs should cater for future system upgrade, rehabilitation and expansion costs as well as ongoing O&M costs, and currently, this occurs very rarely. Nedjoh et al (2003) argue that a lack of knowledge regarding maintenance costs, inadequate tariffs and high rates of defaulting combined with ineffective collections and poor financial management undermines the ability of communities to establish such financing mechanisms. According to Harvey and reed (2004), one of the main constraints to this is the need for a transparent, secure and sustainable method of storing and investing money for future use. Community managed financing mechanisms are rarely able to fulfill these requirements,(Rutto, 2017)

2.7 Research Gap

Different studies conducted by different authors have pointed out a mixture of factors, that affect sustainability rural water supply projects. There are numerous case studies that make similar claims, but which are based or may be limited to a singled out for attention seems to miss the point. The literature review of the proposed variables and their related indicators points out that many authors accept community project management capacity and participation as a crucial requisite for the successful project sustainability. However, none of the authors has been able to provide empirical studies on how the community project management capacity may influence the rural water supply sustainability especially in the case of Oromiya regional state and particularly in Gomma wereda.

2.8 Conceptual framework of rural water supply sustainability

Sustainability is a complex and dynamic concept which is made up many interrelated components. As can be seen from the literature section of this paper, sustainability of rural water supply schemes depends on community, technical, financial, institutional and environmental factors. Furthermore, each factor comprises of important elements that have to be considered to ensure sustainability of rural water supply schemes.

As far as community factors are concerned, the community should participate in the project design, implementation as well as post-construction of the project for the sustainability of the schemes. More over for, Community participation creates an enabling environment for sustainability by allowing users, as a group, to select the level of services for which they are willing to pay, to guide key investment and management decisions, and also to make choices and commit resources in support of these choices.

Regarding technical factors, water supply projects should consider village level operated and maintained schemes for ease of community management, adequately trained and skilled technician under take minor maintenance of parts should be created within the user committee, spare parts supply system should be established in the way the community can access and afford them whenever maintenance needed.

Concerning financial factors, user committee should make regular contribution for O&M of rural water supply schemes. However, in order to sustain and maintain the existence of regular contribution for operation and maintenance the amount of contribution should be based on user ability and willingness to pay, taking into account the minimum requirement over all operation and maintenance cost of the scheme and practice of saving the money in local finance institutions(Chacha, 2015).

Regarding institutional and legal factors there should exist polices and legal framework under which water supply schemes are developed and managed and there should exist a room for private sector and capacitated local public institution responsive for monitoring and management. With regards to environmental factors, in order to avoid the scheme service unreliability due to water quality and inadequacy of yield problem Integrated feasibility study on scheme type selection to the study environment to be sustainability (Artyushevskaya, 2014).

Therefore, this study employs the following conceptual framework to assess the sustainability problem of rural water supply schemes by examining the existence or absence of factors those contribute for water supply schemes sustainability. (See fig. 2)

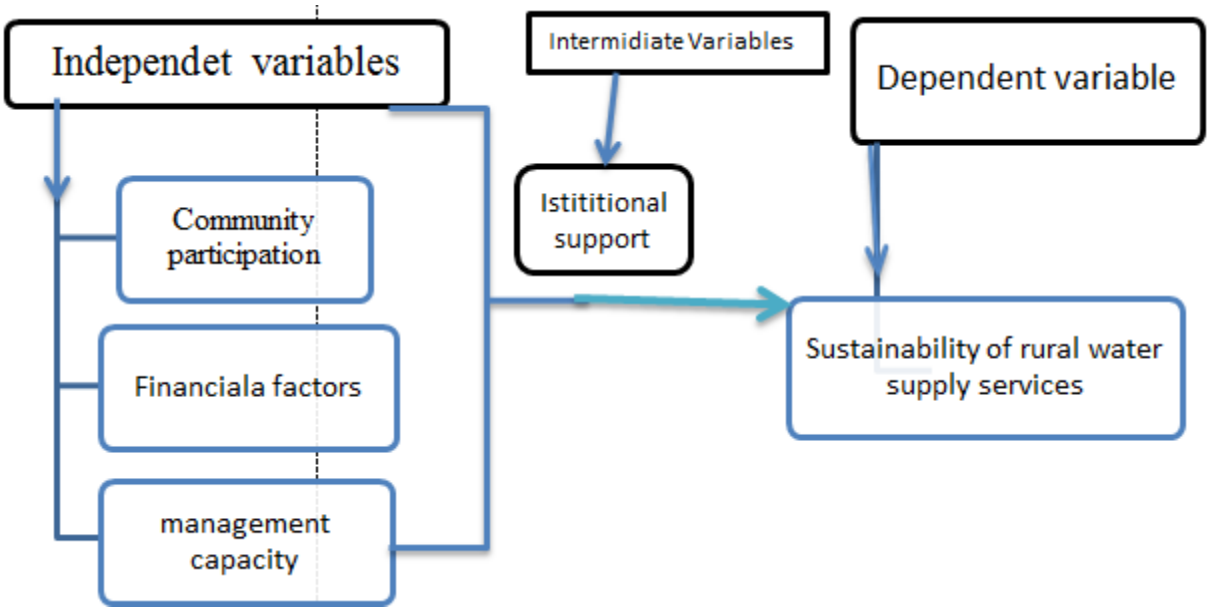

Figure 1:- Conceptual Framework for Rural households water supply Sustainability Determinants

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

3.1 Description Of The Study Area

Gomma wereda one of 20 weredas Jimma Zone and it is located 395 km south west of Addis Ababa and about 45 km west of Jimma town. The district is bordered with Gumay district in West,with Limmu- kossa district in North East, with Manna district in North-East with seka chokersa in south and Gera district in South-west.. The administrative center for this woreda is Agaro. Others city in the wereda include Limm-Shaye,Gembe and Choche. The district has an area of 93658 hectares comprises of 36 rural Kebeles and 3 urban towns. Based the wereda Administration office, the district has a total population of 297,699(with rural population 258927 and 38772 lives in urban) with density of 317.86, persons per square kilometer. The altitude of the district ranges from 1387 to 2870 meters above sea level (masl).

As far as agro-climatic condition is concerned, 8% of landmass of wereda constitutes highland /dega/ agro-climatic condition, 4% of landmass of wereda constitutes lowland while the remaining 88% is categorized under midland/woyena-dega agro-climatic zone. Annual temperature of the wereda varies between 15°c to 22°c while the annual rain fall ranges between 1700mm to 2600mm. The major rivers in the district are awetu , naso ,tamsa, malka-hida, dogaja , loga, Colombo and chiseche that drain to dedesa river. Agriculture is the main economic sources of the dwellers. Teff, wheat, barley , Millet, Horse, beans, neug , Linseeds , Rapeseed are the main crops produced in the district, and coffee production is the known cash crop in the area.

According to the district's Water and energy resource development office inventory report of 2012 E.C. in the district there are 1358 water schemes of which 1301 were constcturcted rural kebeles. Accordingly, the non-functionality rate of waters schemes were 10.22% , and the water supply coverage of the district was 83.5%.

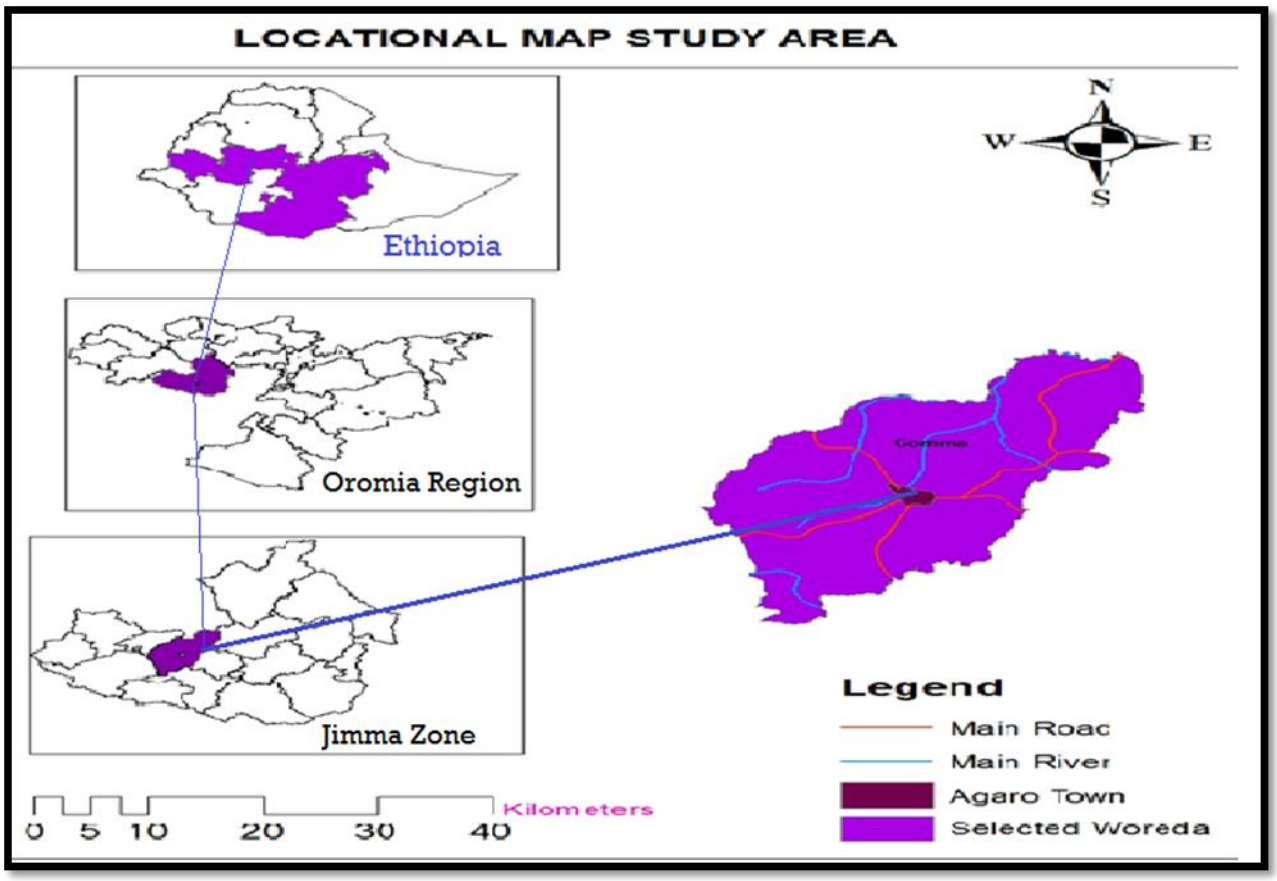

Figure 2: Location Map of the Study area

3.2 Research Design and Approaches Used

3.2.1 Research Design Used

According to John W. Creswell(2009) in his book of title 'Research design, cited that research designs are plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis. The overall decision involves which design should be used to study a topic. Informing this decision should be the worldview assumptions the researcher brings to the study; procedures of inquiry which called strategies; and specific methods of data collection, analysis, and interpretation. There are three types of research designs are advanced: qualitative, quantitative, and mixed methods. The distinction between qualitative and quantitative research is framed in terms of using words which known as qualitative rather than numbers that is named as quantitative, or using closed-ended questions

Quantitative research is a means for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures. The final written report has a set

structure consisting of introduction, literature and theory, methods, results, and discussion. Those who engage in this form of inquiry have assumptions about testing theories deductively, building in protections against bias, controlling for alternative explanations, and being able to generalize and replicate the findings(John, 2009).

The study employed descriptive survey design which is the one of the quantitative research design which provides numeric description of trends, attitudes, or opinions of a population by studying a sample of that population. It is a theory-based design method which is created by gathering, analyzing, and presenting collected data. This allows a researcher to provide insights into the why and how of research. Descriptive design helps others better understand the need for the research.

Therefore, researcher will use the descriptive research design because it tries to describe the effects of community participation, financial capability and project management capacity on the sustainability of rural water supply services in the study area. The quantitative research approach will be used for data collection and analysis. Quantitative research is an approach for testing objective theories by examining the relationship among variables. The researcher's aim was to investigate the causal relationships between independent variables namely community participation, financial factors and project management capacity; and the dependent variable which is Sustainability household water supply of water rural water supply projects by analyzing the numeric data and generalize results for the wider population of area.

3.2.2 Research Approaches Used.

Quantitative approach is Post positivist worldview, experimental strategy of inquiry, and pre and post-test measures of attitudes. In this scenario, the researcher tests a theory by specifying narrow hypotheses and the collection of data to support or refute the hypotheses. The data are collected on an instrument that measures attitudes, and the information is analyzed using statistical procedures and hypothesis testing.

According to John W. Creswell (2009), if the problem calls for the identification of factors that influence an outcome, the utility of an intervention or understanding the best predictors of outcomes, then a quantitative approach is best. It is also the best approach to use to test a theory or explanation. Therefore, in the context of the study objectives are an identification of factors that influence the sustainability of the households' water supply consumption, the quantitative research approach is appropriate. In addition the researcher uses quantitative

research approach because the objectives of the study testing the hypotheses by the collection and analyzing of the data.

3.3 The Data Sources and Type

There are two types of sources of data for the study. The primary and secondary data, which are collected from different sources mainly from the target rural households, from the sampled kebele administration office and the wereda water and energy resource development office.

3.3.1 Primary Data Sources

The primary data is collected from 352 sampled households of four sampled rural kebeles to capture adequate information on households water supply sustainability determinants. Four rural sampled kebeles which are Chedero-suse, Yachi-urache, Kilole- kirkir and Dedo-urache were taken as the sampled households for the study. The total numbers of 352 sampled households were selected and collected from others in order to meet the target objective of the study. Therefore, the community elders a, religious leaders, water committee members, kebele administration officers, local scheme technicians, institution and organization leaders were interviewed using structured questionnaires.

3.3.2 Secondary Data Sources

Secondary data: was collected from related sources of study, for example, books, published journals papers, yearly report and other specialist documents, socioeconomic profiles of wereda, and other related materials were gathered with applicable quality.

3.3.3 Data collection Methods

The methodology of data collection of this study is close questionnaires interviews and written document related to the objective of the study,

Questionnaires: Closed questionnaires were prepared to collect data depends on purposes of research and previous study which are related to this study. Questionnaires were distributed to sampled households and some water committee members to collect information about domestic water consumption determinants. First prepared by English language all questions and translated into the Amharic language because to make accessible and understandable for sampled households and chosen respondents of the town community. The questionnaires first prepared by English languages and translated into Afan Oromo languages to make accessible and understandable for sampled households of the study area. This was

done purposely for simplicity, acceptability, and decrease of duplication of ideas during data collection time. After completion of data collection translate into the English language to analysis and interpretation and also to solve the problems of study. These questions are shown under Annex 1.

Interview : structured interview were produced and used to create applicable information from sampled households them specifically eye to eye contact with these households and kebele administrative officers and water committee members these were chosen because of their position and the problem more concern in various means, the meeting is concerned about the factors relate to domestic water consumptions. The interview was commanded in the Oromo language to avoid language obstacle and supported by sound recorders due to reducing losses of sound data. The recorded information was divided dependent on similarities of reactions and converted into English language during the interpretation. This was helped to get significant and more solid data from sampled households and some selected offices during data collection from the study area. The questions of these interviews are shown under Annex 1.

3.4 Sampling Design and Sampling techniques Used

3.4.1 Sampling Design used

According to Polit and Hungler (2013), sampling involves a process of selecting a sub-section of a population that represents the entire population in order to obtain information regarding the phenomenon of interest. It's a procedure by which a few subjects are chosen from the target population to be studied in such a way that the sample can be used to estimate the same characteristic in the total target population. The advantages of using samples rather than surveying the population are that it is a much less costly, quicker and if selected properly gives results with known accuracy that can be calculated mathematically.

The focus of the study was on the determinants of household water of water supply Sustainability in the rural areas of Gomma Districts of Jimma Zone, in Oromia National Regional State of Ethiopia. The researcher selected the study woreda purposely having the information from officials of Jimma Zone Water and Energy Resource Development office. Which was one of the woredas where water supply sustainability is poor but no any study has yet been conducted that could identify the causes for failing of adequate and sustainable water supply system in the area. According to the Wereda Finance and Cooperative

development office the District 39 kebeles out of which 36 rural kebeles and 3 towns. The research focused on the rural kebeles of the woreda and employee a multi -stage sampling techniques. It was sampling technique where two or more probability techniques were combined. It was used when the elements of population were spread over a wide geographical region and it was not possible to obtain a representative sample with only one aforementioned technique.

First stage: Selection of Kebeles

The researcher selected four rural kebeles out 36 by using one of the simple random sampling called a table of random numbers generator. According to Cochran (1977), Simple random sampling is a method of selecting **n** units out of the N such that every one of the ${}_{N}\mathbf{C}_{n}$ distinct samples has an equal chance of being drawn. The units in the list of 36 kebeles are numbered from 1 to 36. A series of random numbers between 1 and 36 is then drawn, either by means of a computer program that produces such a table. At the first draw the probability that some one of the 4 specified units selected was 4/36.

Accordingly, the computer program generates the four random numbers are 19, 26, 6 and 11. Therefore, the sample kebeles that coded by numbers 19,26,6 and 11 are Chedero-suse, Yachi-Ureche, Kilole-kirkir and Dedo-ureche respectively.

Second Stage: Selection of Households

The researcher employed systematic random sampling techniques to select the sample households. According to Mohsen Hassan Alvi (2016), on title manual for selecting sampling techniques in research that have the following characteristics we use the systematic random sampling techniques:

- This type of sampling is also used for homogenous population.
- It is a bit different from simple random sampling.
- Unlike simple random sampling, there is not an equal probability of every element been included.
- In this type of sampling the elements are selected at a regular interval.
- The interval may be in terms of time, space or order. For instance, element appearing After every 30 minutes, or present at a distance of two meters, or every 5th element present on a list.
- Thus this regularity and uniformity in selection makes the sampling systematic.
- The list of elements may or may not be required before the conduction of research.

- Sometimes it is not even possible to create a list because of the nature of population.

As in the context of study the socio-economic characteristics of the target population sample kebeles are homogenous and each villages have the same demographical characteristics. The target population for this study was 2934 households identified as beneficiaries of 103 water supply schemes where the sampled households were drawn..

3.4.2 Sampling Units and Sample Size Determination

Sampling units are the elements in the sampling frame from which information about a study is collected (Lock *et al.*, 2012). In this study the sampling units were household heads representatives of the villages. Households heads was selected by using systematic random sampling techniques to give equal chance to all residence or beneficiaries to become a sampling unit and representative sample size of households from the consumers of water supply schemes; this is due to the similarity of socio-economic conditions of the area.

A systematic random selecting system was used to choose the representative sample from a total population of the study and total households of the rural kebeles. This assessment is better utilizing sample households because to consider all population and households of the study town would be impossible. Because the total numbers of people and households are huge(Workneh and Belay, 2019). Accordingly, a total of 352 sample representative households were identified from 2934 households using systematic random sampling technique for the questionnaire survey. Yamane (1967) sample size determination procedure was followed to reach at the 352 sample population. Because this method offers large number of samples compared to other models, it was used to determine the sample households in case of this paper.

The minimum sample size will determined by using the Yamane (1967) formula.

$$n = \frac{N}{1+N(e^2)}$$ ----------**Equation 3.4.2**

Where, n is the minimum sample size, *N* is the household water supply beneficiaries of the sampled kebeles. And *e* is the level of precision.

Therefore from the above N=2934 households and the precision, $\pm 5\%$Assuming the 95% confidence level.

$$n = \frac{2934}{1+2934(0.05^2)} = 352.0095 \approx 352$$

Therefore, from the above formula about 352 sample households will be used the sample for data collection. The total household head beneficiaries of the sample kebeles Chedero-suse, Yachi-urache,Kilole-kirkir and Dedo-urache were 589,675, 1089 and 581 respectively. Using the proportional-to-size allocation method through systematic selection procedure the sample household heads for Chedero-suse, Yachi-urache,Kilole-kirkir and Dedo-urache were found to be 70,81, 131 and 70 respectively.

3.4.3 The Target population of study

The target population for a survey is the entire set of units for which the survey data are to be used to make inferences. Thus, the target population defines those units for which the findings of the survey are meant to generalize. The target population in this study are water committee members, the household consumers and the wereda Water and energy resource development office experts. The target population for this study was 2934 households identified as beneficiaries of 103 water supply schemes where the sample will be drawn. This study involved a set of 103 water supply schemes that constructed in previous five years (between 2008 to 2012 EFY) in the four sample kebeles of Gomma Wereda.

Table 1: Proportion of Sampled HH Units For Each Sampled Kebeles

No.	Kebele	Total Population	Total Households of the kebele	Total population with potable water	Number HH of with potable water	Sample Size	%
1	Chedero-Suse	4175	835	2,937	589	70	19.9%
2	Yachi-Urache	4740	948	3,374	675	81	23.0%
3	Kilole-kirkir	8190	1638	5,459	1089	131	37.2%
4	Dedo-urache	4020	804	2,949	581	70	19.9%
	Total	21125	4225	14,719	2934	352	100.0%

Source:-The Kebeles Administration office and author's computational Report

3.5 Data Analysis Techniques

Data analysis is one of the important elements of research study help to covert the raw survey data into meaningful information. Accordingly, the data captured through different ways in this study were analyzed using quantitative and qualitative techniques. The quantitative data captured from the questionnaire survey were first edited, coded and encoded into the SPSS (SPSS Version-26) and then explored using descriptive statistics and the binary logistic regression model. The descriptive statistical measures were mainly employed to describe the

socioeconomic characteristics of studied households as well as the domestic Water consumption per day by the households.

After the completion of the interview data, the information got from the members was broke down and isolated into important parts and which make up a critical segment of their significant, were named and coded. Next this information was coded, a code list was shaped and it was utilized as a key rundown for analyzing and altering this information. At that point, the coding key and meeting transcripts were perused independently by individual analysts, and "agreement" and "contrast of assessment" issues were talked about and fundamental plans were made.

The data analysis was undertaken using STATA 14.0 software and involved two types of analyses; descriptive and binary logistic analyses. Descriptive analysis was undertaken to examine the percentage distribution of the variables of interest. The binary logistic regression model was employed to assess the determinants of household domestic water supply sustainability in the wereda. The fitness of the model to the data was estimated using the Pearson‘s Chi-square, Hosmer-Lemeshow goodness-of-fit statistics (Hosmer and Lemeshow, 1989) and the classification table of the sample cases(Workneh and Belay, 2019).

Table 2: Measurements indicators of Variables used in the regression modeling

Objectives	Variables naming	Description of Variables	Variables Types	Measurement Indicators	Category	Measurement
				Independent Variables		
to examine the effect of community participation on sustainability of water supply	PART	Community Participation	Dummy	whether or not the Household participation on project development	1. Yes 2. No	the number of households participated in the project development
				Level of Households' participation	1. During planning and project idea 2. During construction 3. During post-construction 4. participation at all phases	percentage of households participated in phases of project
				types of contribution in the construction of the project	1. Money (in-cash) 2. Both Labor and local materials 3- labor only	Percentage of households contribute in projection by with types of contribution
to examine the effect of Financial Determinants (cost-sharing, cost recovery and financial management) on household water supply sustainability	TAR	Water Tarif	Dummy	whether or not the households' pay as water service as per tariff	1. Yes 2. No	percentage households paid as per tariff
	WSCost	Monthly Water Service cost	Categorical	Monthly household payment for water service	0=no payment for service 1=payment less than 15 Birr 2=payment between(16-30)Birr 3= payment between(31-45)Birr 4= payment between(46-60)Birr 5=payment above 60 Birr	number of households paid water service and ratio of households paid

	FADEQ	Financial Adequacy for operartion and maintanance	Dummy	The water fees collected from the beneficiaries is adequate to cover all operation and maintenance cost of schemes?	1. Adequate 2 .Not adequate
What factors affect the sustainability of household water supply in this community to examine influence of Scheme Management Capacity on sustaianability of households water supply sustainability	OrgMEMB	Organizational structure	Dummy	whether or not committee have full members with organizational structures	1. Yes 2. No
	MgtCap	Water Management Capacity	Dummy	Capability of water committee to manage the scheme	1. capable 2. not Capable
				household participation in decision-making	1. Yes 2. No
				personally engaged in scheme management that your communities	1. Yes 2. No
	Popngrowth	Rapid Population Growth	dummy	High population growth	1. Yes 2. No
	FSize	Family size of HHs	Discrete	Family size of Household	1. Yes 2. No
	PorIfrast	Poor water infrastructures	dummy	nsufficient and poor distribution of water infrastructure	1. Yes 2. No
	Instnalissue	Absence of institutional coordination	dummy	Institutional issues(existence and functioning of user committees, capacity of VPMs, coordination and linkage of institutions)	1. Yes 2. No

	Financialisue	Financial issues(regularity of fee collection)	dummy	Financial issues(adequacy and transparency of financial contributions, regularity of fee collection)	1. Yes 2. No
	LocalskilMaintance	Absence of Local skilled for O&M	dummy	Lack of availability of local skill for maintenance	1. Yes 2. No
	HOship	House ownership	Dummy	House ownership of households	1. owen house 2 Rental
	INCOM	Households' Income	Categorical	Monthly Income level of the respondent	1. below 1000 Birr 2. (1001-2000) Birr 3. (2001-3000)Birr 4. (3001-4000) Birr 5. (Above 4000) Birr
Dependent Variable					
to examine sustainability of households' Domestic Water consumption	Y	Sustainability of Households domestic water consumption	Dummy	whether or not households water supply is Sustainable or not	1. sustainable 0. Not Sustainable
				Do you get sufficient water on a continuous basis to satisfy your domestic consumptions	1. Adequate 2 .Not adequate

3.4 Model specification and Description of study variables

The researcher used logistic regression techniques to develop household domestic water consumptions sustainability from the fact that both dependent and independent variables are categorical (Fikadu,2019).

Binary logistic regression was useful where the dependent variable is dichotomous (e.g., succeed/fail, live/die, graduate/dropout, vote for A or B). We may be interested in predicting the likelihood that a new case will be in one of the two outcome categories.(Workneh and Belay, 2019)).

As (Berger 2017) cited the Binary logistic regression model can be tested using three methods namely Chi-square test of statistics, the percent of cases correctly classified and using a measure of model fit is a pseudo R squared. The first is the Model Chi-square, which can be tested for statistical significance. This is an omnibus test of all of the variables in the model. Note that the chi-square statistic is not a measure of effect size, but rather a test of statistical significance. Larger data sets will generally give larger chi-square statistics and more highly statistically significant findings than smaller data sets from the same population. The second type of measure of model fit is a pseudo R squared. The goal here is to have a measure similar to R squared in ordinary linear multiple regressions. These range from 0 to 1, but they are not proportion of variance explained. Thereafter, logistic regression coefficients were estimated using the following likelihood ration(Berger, 2017).

Statistical Model :

$$Logit(Y) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots + \beta_i X_i + \varepsilon_i$$

$$= \beta_0 + \sum_{i=1}^{n} \beta_i X_i$$ **----------Equation 3.4**

Where Y= sustainability of domestic water consumption, Xi are the independent variables, ε_I the error terms and β_i are the coefficients of the independent variables and β_0 the intercepts.

CHAPTER FOUR

RESULT AND DISCUSSION

This section addresses on the data that has been collected through self-administered questionnaires and document analysis was analyzed and discussed depending on the planned methodology. Therefore, this chapter mainly clarifies socioeconomic characteristics of the target households, the descriptive and the econometric analysis of the variables of the study has been included. Finally, analysis results the findings were narrated accordingly.

4.1 Back ground information of the respondents

A total of 352 households were assessed to capture adequate information in this rural household water supply sustainability study. From the total surveyed household heads 69.60% were male respondents, while 30.40% were females.

We observe from our database that the number of family members varies from 1 to 15 Households with one family member are the most important group of the sample with average family size is 4.24. On the other side, many of households (55.7%) of them have passed through formal education and the remaining studied households (44.3%) were not formally educated.

The average amount of water consumed by family members per a day is 2.63 Liters which ranges from a minimum of 30 liters to maximum of 100liters. About 78.1% of the studied household heads were married (coupled) while 21.9% were non-married (single). In addition, 55.7% of respondents attend formal education and 44.3% were not attending formal education. Most of the age of studied households (76.1%) was lie between (18-50) years. About one third of the respondents (31.8%) were farmers and 23.6 % were public servants (Table 4.1).

The number of sampled households broadly categorized in different cash incomes per month is reported in table 4.1. in all the sampled rural kebeles. a majority of (63.6%) the sample households earned birr 1001to 4000 cash income per month. about 19.3% of households earned birr less than 1000 income per month and only 14(4%) out of 352 households, got above 4000 birr per month.

Table 3: Basic information on household characteristics (N=352)

S.N	Demographic Variables	Category	Number	%
1	Sex	Male	245	69.6
		Female	107	30.4
2	Age group	(18-29)yrs	58	16.5
		(30-40)yrs	93	26.4
		(41-50)yrs	117	33.2
		(51-60)yrs	70	19.9
		Above 60yrs	14	4
3	Marital Status	Coupled	275	78.1
		Single	77	21.9
4	Average Family Size	Minimum	1	
		Maximum	15	
		Mean	4.47	
5	Formal Education Attendance	Formal Education attendance(primary level to tertiary)	196	55.70%
		Non formal education attendance	156	44.30%
6	Major Occupation	Farming	112	31.8
		Self-employee	83	23.6
		Public servant	78	22.2
		Daily labor	5	1.4
		House wife	17	4.8
		Others	57	16.2
7	Home Ownership	Own	254	72.2
		Rented	98	27.8
8	Monthly Income	below 1000birr	68	19.3
		(1001-2000)birr	63	17.9
		(2001-3000)birr	69	19.6
		(3001-4000) birr	92	26.1
		above 4000birr	60	17
9	Domestic Water consumption per day	Less than 30Litr	30	8.5
		(30-70)Litr	137	38.9
		(70-100)Litr	113	32.1
		Above 100Litr	72	20.5

Source: Authors' computation based on SPSS-26

4.2 Households' Water Consumption and Their Perception Sustainability

Sustainability of household water supply in the context of this study refers to clean and affordably supply on continuous basis to all studied households in order to satisfy domestic family needs(drinking, food preparation, bathing, cloth washing and related household sanitations). With this understanding, the survey households were interviewed to tell whether they get sufficient water for their domestic uses(Workneh and Belay, 2019). Amazingly, over 63.1% of them replied that they have not satisfied for access to sustainable potable water on continues basis. Only 36.9% of the households confirm that they have the opportunity to get such adequate domestic water consumption per standard basis (Table 4.2).

As indicated in table 4 About 39.2% of the sampled HHs were mention the daily water demands between 30 to 70 liters, 31.8% of the sampled HHs were describe their daily demands between 71 to 100 liters and 20.5% of the sampled HHs were said above 100 liters. However, great parts of the sampled HHs daily water demands were between less 30liter and (30-70) liters per day but not always, sometimes they cannot get this amount water consumption. Generally, demands of water supply of the sampled HHs were varying from one beneficiary to other water beneficiaries or one place to other place because the distribution system does not distribute equally for all parts.

Table 4: Numbers of sampled HHs using different sources of water

S.N	Description	Category	Frequency	Percent	Valid Percent	Cumulative Percent
1	Domestic water consumption per day	less than 30Litr	30	8.5	8.5	8.5
		(30-70)Litr	138	39.2	39.2	47.7
		(70-100)litr	112	31.8	31.8	79.5
		Above 100Litr	72	20.5	20.5	100
2	Level of satisfaction Domestic water consumption	Satisfied	130	36.9	36.9	36.9
		Not satisfied	222	63.1	63.1	100.0
3	Extent of the water supply sustainability	To a very low extent	50	14.2	14.2	14.2
		to a low extent	179	50.9	50.9	65.1
		a great extent	107	30.4	30.4	95.5
		very great extent	16	4.5	4.5	100.0

Source: Authors' computation based on SPSS-26

4.3 The Binary Logistic Regression

Binary logistic regression was to assess the determinants of household water supply sustainability in rural areas of Southwestern Ethiopia.

The regression was run using the „natural log of odds" as the link function as follows:

$$\ln\left(\frac{p}{1-p}\right) = \beta o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots + \beta_p X_p + \varepsilon$$

Where, P is the probability for sustainability of domestic household water suppy coded as "1", 1-P is the probability of not sustainability of domestic household water suppy coded as "0".

Running the binary logistic regression using IBM SPSS version 26 provides the outputs presented as the following sections. The logistic regression estimated the marginal effects of each of the explanatory variables along with the respective statistical tests of significance.

4.3.1 Multi-collinearity tests

Even though logistic regression does not make many of the assumptions unlike linear regression, multi-collinearity if any can still be a problem. Gujarat (2004) noted that logistic regression result can be biased due to the effect of collinearity among the predictor variables. Hence it is essential to make sure that there is no strong collinearity among the predictor variables. The SPSS does not have option for testing multicollinearity for logistic regression. However, Field, (2009) suggested that it is possible to obtain statistics such as the tolerance and Variance inflation factor (VIF) by simply running a linear regression analysis using the same outcome and predictors. It is due to the fact that tests of multicollinearity examine only the explanatory variables; hence they are independent of the type of regression model employed. Multicollinearity was diagnosed through such procedure.

To diagnose the presence of multicollinearity in the logit model the tolerance test or variance inflecting factor (VIF) was performed it shows how much of the variability of the specified independent variable is not explained by the other independent variables in the model. Table 4 shows that the observed tolerance values are greater than 0.10, or the mean of VIF are less than 10 indicating that there is no problem of multicollinearity in the logistic regression model.

Table 5: The Variance Inflation Factors of Dependent Variables

estat vif

Variable	VIF	1/VIF
TAR	2.17	0.461183
WSCost	1.9	0.527379
INCOM	1.67	0.597972
MgtCap	1.47	0.679614
FADEQ	1.45	0.691588
Plevel	1.41	0.710106
FSize	1.4	0.714665
Instnalissue	1.37	0.732487
OrgMEMB	1.35	0.738974
Popngrowth	1.32	0.756884
Financiali~e	1.2	0.830494
HOship	1.15	0.865857
PorIfrast	1.15	0.867845
LocalskilM~e	1.12	0.895545
Mean VIF	**1.44**	

Source: Authors' computation based on STATA-14

4.3.2. Hosmer and Lemeshow Test

This test helps to assess the fit of a logistic model against actual outcome. The result shown in Table 4.1 supports the model being worthwhile. For the Hosmer and Lemeshow test, poor model fit is indicated by a significance value less than 0.05. To support the study model, the value must be greater than 0.05. In this test, the chi-square value of 15.196 and p-value of 0.055 implies that the model is a good fit. Higher p-values indicate that the null hypothesis stating the model best fits the data " shouldn't be rejected. Hence, it is possible to conclude that the model is fits the data well, since the p-value of the Hosmer and Lemeshow Test is much higher than 5% level of significance.

Table 6:**: Hosmer and Lemeshow Test**

Step	Chi-square	df	Sig.
1	15.196	8	.055

4.3. Discussion of Econometric Results of Findings

4.3.1 Households' Water Sustainability Determinants

Table 7:Binary logistic regression results of Explanatory Variables

Logistic regression	**Number of obs**	**= 352**
	LR chi2(14)	= 104.06
	Prob > chi2	= 0.0000
Log likelihood = -188.39708	Pseudo R2	= 0.2164

Y	Coef.	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
HOship	-.5984002	.5496903	.3008339	-1.99	0.047	-1.188024	-.0087766
INCOM	.3310933	1.39249	.1132579	2.92	0.003	.1091119	.5530747
PART	-.0201082	.9800926	.3350973	-0.06	0.952	-.6768868	.6366704
TAR	-.8652813	.4209331	.3933218	-2.20	0.028	-1.636178	-.0943847
WSCost	-.4820271	.6175304	.1658538	-2.91	0.004	-.8070945	-.1569596
FADEQ	-.0143312	.985771	.2794365	-0.05	0.959	-.5620167	.5333543
OrgMEMB	-.5400194	.582737	.299191	-1.80	0.071	-1.126423	.0463841
MgtCap	-.8126622	.4436753	.3037156	-2.68	0.007	-1.407934	-.2173905
Popngrowth	1.068789	2.911852	.2924746	3.65	0.000	.4955498	1.642029
FSize	.6027474	1.827132	.3015376	2.00	0.046	.0117445	1.19375
Porlfrast	.0634582	1.065515	.2584746	0.25	0.806	-.4431427	.5700592
Instnalissue	.0524533	1.053853	.2897589	0.18	0.856	-.5154638	.6203703
Financialisue	1.449155	4.259514	.2833705	5.11	0.000	.893759	2.004551
LocalskilMaintance	.2478465	1.281263	.4490441	0.55	0.581	-.6322638	1.127957
_cons	-1.10751	.3303805	1.694379	-0.65	0.513	-4.428431	2.213411

Source: Authors' computation based on Stata-14

Therefore, the final binary logistic model for households' water supply sustainability determinants in rural areas of Gomma District is given by:

$$Logit(Y) = -1.1075 - 0.598\text{HOship} + 0.331\text{Inc} - 0.865\text{Tar} - 0.482\text{WScost} - 0.812\text{MCap} + 1.069\text{Pop} + 0.602\text{Fsiz} + 1.45\text{Financial}$$

----------**Equation 4.3.1**

Where Y= sustainability of domestic water consumption, HOship=house ownerships, Inc=monthly income, WScost=monthly water service cost, MAcap=water amanagement capacity, Pop=population growth, Fsize=family size of hhs and fiancé= the Financial issues(regularity of fee collection)

To determine whether the association between the response and each term in the model is statistically significant, we should compare the p-value for the term to the significance level to assess the null hypothesis. The null hypothesis is that the term's coefficient is equal to zero, which indicates that there is no association between the term and the response. Usually, a

significance level (denoted as α or alpha) of 0.05 works well. A significance level of 0.05 indicates a 5% risk of concluding that an association exists when there is no actual association. P-value ≤ α: indicates that he association is statistically significant If the p-value is less than or equal to the significance level, you can conclude that there is a statistically significant association between the response variable and the term. on the contrary, if P-value > α: The association is not statistically significant If the p-value is greater than the significance level, you cannot conclude that there is a statistically significant association between the response variable and the term(*'https://stats.idre.ucla.edu/stata/dae/logistic-regression', 2021)*.

In the context of this study the researcher tries to assess the sustainability determinants of households' water consumption in Gomma district by the model of binary regression. While running the model data fitness was checked from the Pearson's Chi-square and the Hosmer-Lemeshow goodness-of-fit statistics. Likelihood ratio with $\chi 2$ = 104.06**,** p-value of 0.0000, at df=14 tells us that our model as a whole fits significantly better than an empty model (i.e., a model with no predictors).

In the output above Econometric test result, we see that eight variables house ownership, monthly household income, water tariff, monthly Water service cost, management capacity, high population growth, family size and financial issue are statistically significant in predicting the sustainability of households' water supply sustainability. Because their P-value is less than 0.05. On the other hand, The remaining six variables namely, the community Participation, adequacy of fund, organizational structure, Insufficient and poor distribution of water infrastructure, institutional issues and local skilled laborers are statistically non-significant response in predicting the supply and sustainability of households' water consumption.

Different analysts often prefer to interpret the results of logistic regression using the odds and odds-ratios rather than the log-odds. Accordingly, the odds ratios greater than one indicates there is positive effect relationship; this is because they increase the odds. On the other hand, the odds ratios between 0 and 1 Correspond to the negative effect relationships, because they decrease the odds. The odds ratios=1 means the is no association. The logistic regression coefficients give the change in the log odds of the outcome for a one unit increase in the predictor variable (*'https://stats.idre.ucla.edu/stata/dae/logistic-regression', 2021)*

Therefore, the interpretation result depending on the coefficients of the regression model was follows:

For every one unit change in households' income, the log odds of domestic water sustainability increases by 1.392 . For every one unit change in Water tariff structure, the log odds of domestic water sustainability decreased by 0.421 and for every one unit change Water service cost, the log odds of domestic water sustainability decrease by 0.6175. Similarly, for a one unit increase in water management capacity, the log odds of domestic water sustainability decrease by 0.4436. For every one unit change population growth, the log odds of domestic water sustainability increase by 2.9118 and for a unit change the household family size, the logs odds of domestic water sustainability of households increase by 1.827.

Generally, the above the coefficients of the regression results shows that four variables namely house ownership, Water Tariff, monthly Water service cost and management capacity of the committee had a positively effects on the sustainability of water supply. on the other hand the four significant independent variables such as monthly income of households, population growth rate, family size and financial constraints had negative effects with the sustainability of rural water supply.

Water management capacity: Nowadays community water management is seen as the best way to guarantee the sustainability of rural water services after the construction of the water system and after the implementing agency has left the community. Likewise Ethiopia has made community water management a key concept in its national water policies. Proclamation 122/1999 is one of its kinds that clearly set different categories of water supply services and gave rise to establishment of rural Water supply and management committees with clear mission. Water supply, sanitation and hygiene committee should be established based on the articles of proclamation for establishment of rural and urban water supply and sewerage services (Kassa, 2014b). Improved water management approaches can enhance the supply, use and sustainability of household's water consumption in the study area. Integration among decision making, financial management capacity and organizational structures of water committee contribute this event.

House ownership: House type where the respondents live can determine the amount and type of freshwater collected by people. This is because people living in their own homes have the potential to access their own piped water connections and can get pure water supply from their private standpipes. With this view house ownership was negatively influence household sustainable water access and supply for it initiates households to build their own pipeline

connections. The regression result indicate that of house ownership was a significant but negative influence of this variable on household freshwater sustainability. Under normal circumstances, living a given house appeared significantly decreasing households‘ capability of accessing sufficient and continuous domestic water consumption by about 40% (significant at P<0.05; Table 4.6).

Rapid Population Growth: The quick development of urban population has set massive weight on the administration limit of regions for administrations conveyance and neighborhood economic development. This exciting development has additionally concerned many districts with the problem of insufficient housing, poverty and joblessness, insufficient domestic water supply and power supply and poor hygienic and sanitation frameworks. the low dimension of improvement a critical extent of the total urban population of Ethiopia individually and add up to people of Ethiopia when all is said in done have no entrance to adequate and safe potable local water supply(Mekonnen, 2019). Therefore, as shown in above Stata Result (table 4.5) rapid population growth has enhancing effect on household water sustainability. In this study, the rate of population growth entailed positive significant effect on the households' domestic water sustainability. At P =0.000 level. It is observed that decreasing household freshwater sustainability by about 0.500704 times.

CHAPTER FIVE

CONCULSIONS AND RECOMMENDATIONS

5.1 CONCLUSION

This study evaluated the determinants of household water supply sustainability in a rural areas of Gomma District in Oromiya Region southwestern Ethiopia. Data for the purpose of the study was gathered based on questionnaire survey and other related secondary sources from March to May 2021. Over 63.1% of households have not satisfied for the access of sustainable potable water on continues basis. Because Population growth, increased food production, and industrial growth in conjunction with improved living standards lead to increased water demand, while climate change and environmental pollution affects the availability of water resources to meet this growing demand. Scarcity of traditional water sources, such as surface and groundwater, coupled with low water use efficiency are increasingly threatening the security of urban, and environmental water needs, therefore i conclude that from the above discussion the water supply and water demand of gomma district is not compatible. Furthermore, the cost they expense for running and operation and maintenance is not compatible. Finally, from design stage or from the scratch have a full of problems. The coefficients of the regression results shows that four variables namely house ownership, Water Tariff, monthly water service cost and management capacity of the committee had a positively effects on the sustainability of water supply. On the other hand, the four significant independent variables such as monthly income of households, population growth rate, family size and financial constraints had negative effects with the sustainability of rural water supply. The estimated annual water service payment of households indicate that the amounts currently average by households are not likely to be sufficient for adequate management of the rural water systems in the rural areas of the Gomma district

5.2 Recommendation

Based on the present study survey findings certain noteworthy suggestions were made, they include;

The average daily consumptions were very less, when compared with the international or national standard benchmark for water utilization different domestic purposes. There is a massive gap between demand and supply with regard to water consumption of the dwellers. These challenges identified are affecting the economic and social development of the residents. The effort should be made the water and Energy office of Gomma district should

actively give training in order to overcome the water management gaps, the rules related to water tariff and the water service payments system could be revised in order to cover the running cost of the projects. It is the improvement to household or community water supply through user investment in water treatment, supply, construction and upgrading and rain water harvesting. It is based on the incremental improvements with technologies affordable to users. This self-help approach is complementary to conventional communal supply which is generally government funded that forms the back bone of rural water supply (MoWIE, manual for accelerating self-supply program, February 2014)**.** This self-help approach is successful only if the local administration, community and Gomma woreda water and energy resource development office play their role in mobilizing the beneficiaries depending on the water source potential of the local. A water supply system must be operational for a longer time without many interruptions that would increase downtime, thus sustainability is achieved when the system is inspected, supervised, or closely attended by a technical staff / operator. The operator should be attentive, and troubleshooter of the system. Experiences indicate that failure to give sufficient consideration for operation and maintenance during planning, construction and operation stages resulted rapid deterioration of many water supply schemes. Sustainability of water can be measured explained by the effectiveness of on economy ,social, environmental, political and institutional development interms of quality and quantity wise. Finally, the water supply source of the target community of rural town specifically Yachi and Chedero town was outdated which cannot the satisfy the target communities of the town, Therefore, the Zone and regional Government should drill and construct the water systems for the community.

Policy recommendation on the study

On the basis of the results, this paper concludes that promoting participatory approaches Government must to use the self-supply implementation approach to satisfy the needs of the community, which fully involve beneficiaries according to their willingness and potential, supported by the right advocacy and promotional efforts, can significantly contribute to the sustainability of rural water supply systems in Ethiopia[1]. Furthermore, any water supply project should clearly illustrate the scope of a sustained and improved water service, along with its benefits to the beneficiaries, from the very beginning Indicators perform many functions. They can lead to better decisions and more effective actions by simplifying,

[1] This recommendation is strongly supported by Schouten & Moriarty (2003).

clarifying and making aggregated information available to policy makers. They can help incorporate physical and social science knowledge into decision-making, and they can help measure and calibrate progress toward sustainable development goals. They can provide an early warning to prevent economic, social and environmental setbacks. They are also useful tools to communicate ideas, thoughts and values and the experiences indicate that failure to give sufficient consideration for operation and maintenance during planning, construction and operation stages resulted rapid deterioration of many water supply schemes.

5.3 Suggestions for the Future Study

A comprehensive evaluation framework that can assess a wide range of water supply and demand management policy options in terms of economic, social, environmental, risk-based, and functional performance is crucial to ascertain their level of sustainability. However, such a detailed, generic, and holistic policy evaluation framework is not found in the literature. This paper reviews studies to evaluate water supply and/or demand management. Primarily, the paper reviews the evaluation criteria used by different studies for decision making given their significant difference and the importance of a comprehensive set of criteria to complete a rigorous evaluation. In addition, a comprehensive set of water supply and demand management options are not considered together for a comparative assessment to prioritise best options for a certain area and time. Further, performance of these options needs to be evaluated for a range of uncertainties arising from changes of spatial and temporal variables of the system. While this paper highlights the important aspects that need to be included in a comprehensive policy evaluation framework, available studies collectively present a rich set of information to support it.

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ANNEXES

Annex 1: Questionnaires

Dear Respondent,

The main objective of this questionnaire is to collect information about the determinants household water supply sustainability in rural areas. The other objectives are to gather information about the community factors, financial factors and project management capacity factors. Your information helps me to find the causes for the sustainability of rural water supply points. Therefore, you are kindly requested to fill the questions depending on the instructions given. The information you provide will be treated with utmost confidentiality and will be used for academic only.

Identifications:

1. Date of interview_____
2. Name of kebele _____Village/Got _____

3. Questionnaire identification number_____

Part I: Demographic and Socioeconomic Characteristics of the Studied Households (N=352)

1. **Sex** **(1) Male** **(2) Female**
2. **Age group of respondent(in years)**

(1) (18-29)yrs (2) (30-40yrs (3) (41-50)yrs (4) (51-60)yrs 5 Above 60yrs

3. **Level of Education of respondent**

(1) Cannot Read and Write (2) Able to Read and Write (3) Primary level
(4). Secondary level (4) tertiary level

4. **Marital status** (1) coupled (2) single
5. **Total Family Size of Household** _____
6. **Occupation** **(1).** Farming (2). Self-employee (3). public servant
(4) Daily labor (5). House-wife (6) other
7. H**ouse ownership**
(1) Owen house (2) Rent from Government or individual
8. **Monthly Income level of the respondent**

(1) below 1000 Birr (2) (1001-2000) Birr (3) (2001-3000)Birr (4) (Above 3001-4000) Birr (5) above4000

9. Monthly Expenditure level of the respondent

(1) below 1000 Birr (2) (1001-2000) Birr (3) (2001-3000)Birr (4) (Above 3001-4000) Birr (5) above4000

Part II: Regarding Community Participation Level

1. Have you participated in the development of the water supply schemes??

(1). Yes (2) No

2. If your response to Q2 is "yes", at which phase you participated?

(1) During planning and project idea
(2) During Construction
(3) During post-Construction
(4) I participate in all phase

3. What was your contribution in the construction of the project?

(1) Money (in-cash) contribution
(2)Labor only
(3)Local martials only (stone,sand)
(4) both labor and local materials
(5)I contribute in all types

4. If your answer for 'Q3' is 'No', what is your reason for not participating?

1 Not asked yet 2. Lack of awareness 3. everything done by implementing agency

4. Specify, if other _____

5. How do you rate the degree and level of your community participation during the project development, planning and implementation process?

{1} Very low {2} Low {3} Fair 4. Good 5. Very Good 6. Excellent,

6 Are you personally engaged in scheme management that your communittee based organization(water committee)?

1. Yes 2. No

Part III. Regarding Financial Determinants (cost-sharing, cost recovery and financial management

1 Are Willingness to Pay (WTP) for Improved Water Service??

1. Yes 2. No

2. **Did you pay for the water as per the tariff?** (1) Yes (2). No

3. What is your perception on the tariff?

(1) Very cheap
(2) cheap
(3). Fair
(4). Expensive

4. Stated reasons why respondents pay water fee?

1. Salary of guard only 2. It will cover O & M cost only

3. Spare parts purchase only 4. Costs of technicians only

5. All running cost of the scheme

5. **How do rate willingness to pay water service based your perception of sustainability with the services offered?**

(1) Very willing (3)Neutral

(2)willing (4) Poorly willing (5) No willing

6. What is the practice payment system for the service given practice?

(1) Reactive(users pay as emergency failure of the scheme) (2)monthly payment

7. Does community had financial capacity to sustain the service?

(1) Yes (2). No

8. How much Amount paid per month? _____

9. How do you think funds should be obtained for water system repaired?

(1)Tariff and additional contribution by users (3). Water and Energy office

(2) Kebele administration

(4). other

10. What should be the source of fund for operation and maintenance cost of scheme?

(1) Tariff and additional contribution (3). From project owner/water office)

(2) From Local Government (4). I don't Know

11. Do you think the water fees collected from the beneficiaries is adequate to cover all operation and maintenance cost of schemes?

(1) Adequate (2) Not Adequate

12. How do you evaluate the financial contribution and management in the water scheme you are using? (1) Poor 2) fair 3. Good

Part IV: Regarding Scheme Management Capacity

1. Did your water committee have full members with organizational structures?

1. Yes 2. No 3. I don't know

2. Are you personally engaged in scheme management that your communities based organization (water committee)?

{1} Yes {2} No

3. Do you feel the government is supporting your water Committee in project management capacity?

{1} Yes {2} No

4. **If Q3 'Yes' How do rate the training given by government in terms of your capacity in project management?**

{1} Poor {2} Fair {3} Good 4. Very Good 5. Excellent,

5. **Capability of water committee to manage the scheme?**

{1} Capable {2} Not capable (3) I'm not sure

6. **Does the community have rules and regulations in the use of the water supply Services?**

{1} Yes {2} No

7. **Are you satisfied with the Management of the service given by the water committee?**

{1} Yes {2} No

8. **Did your community participate in decision-making in all aspects related to water project development, planning, implementation and post-constriction?**

{1} Yes {2} No

9. **How would you rate the leadership of this water and sanitation project by the management committee?**

{1} Poor {2} Fair {3} Good 4. Very Good 5. Excellent,

1. Do you think your water supply is Sustainable?

{1} Yes {2} No {3}Not sure

2. If Question 1 'yes' to what extent the water supply sustainable?

1 to a very low extent
2 to a low extent
3 A great extent
4 very great extent

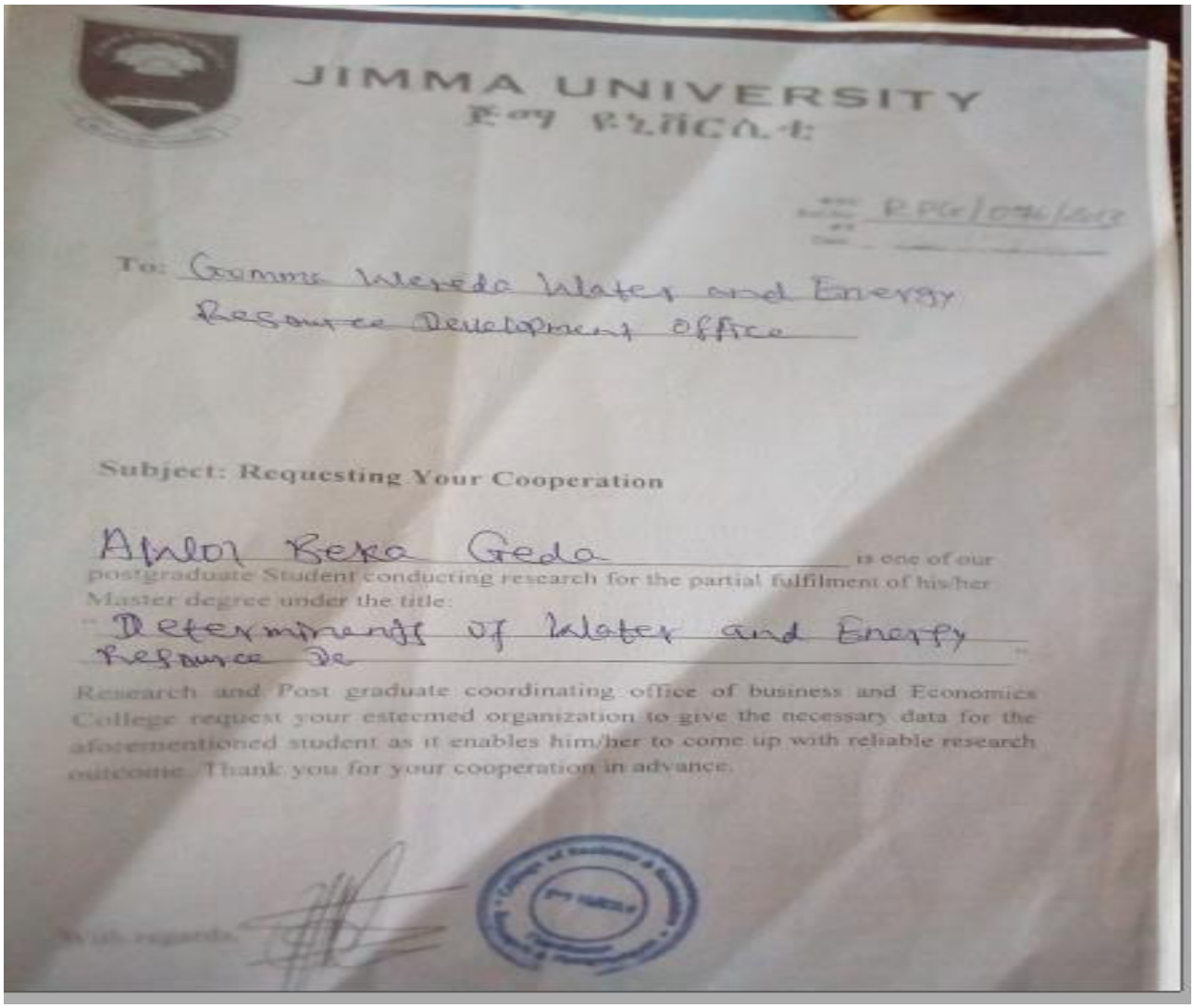
3. Do you get sufficient water on a continuous basis to satisfy your domestic consumptions(drinking,food preparation, bathing, cloth washing and related household sanitations).

{1} Yes {2} No

4. What factors affect the sustainability of household water supply in this community?(multipile response is possible)

(1) High population growth
(2) Family size of Household
(3) Insufficient and poor distribution of water infrastructure
(4) Weak Water committee management capacity
(5) Institutional issues(existence and functioning of user committees, capacity of VPMs, coordination and linkage of institutions)
(6) Financial issues(adequacy and transparency of financial contributions, regularity of fee collection)
(7) Lack of availability of local skill for maintenance
(8) Income of Household

Annex: 2 Letters of Cooperation



JIMMA UNIVERSITY

To: Gommo Woreda Water and Energy Resource Development Office

Subject: Requesting Your Cooperation

Ayalu Beka Geda is one of our postgraduate Student conducting research for the partial fulfilment of his/her Master degree under the title: "Determinants of Water and Energy Resource De

Research and Post graduate coordinating office of business and Economics College request your esteemed organization to give the necessary data for the aforementioned student as it enables him/her to come up with reliable research outcome. Thank you for your cooperation in advance.

Lakka BI/347/2013

Guyyaa 9/9/2013

Qaama Dhimmi Ilaalu Hundaaf

Bakka Jirtanutti

Dhimmi isaa;-<u>Deeggarsa akka gotanu gaafachuu ta'a.</u>

Akkuma armaan oliitti ibsuuf yaalameetti ***Obbo Awwal Beekaa*** qoronno maastarsiitiif ragaa waa'ee rakko tajaajila bishaan dhugaati irratti gaggeessa waan jiranuuf gama keessaniin deeggarsa barbaachisa akka gootanuuf kabajaan ni gaafanna.

Nagaa Wajjiin!

BIR Fadilaa Sammaan

Dursaa Garee Mis/Qabeenya Bishaanii A/Gemmaa

Annex-3: Test of Fitness of The Model

corr HOship INCOM Plevel TAR WSCost FADEQ OrgMEMB MgtCap Popngrowth FSize PorIfrast Instnalissue Financialisue LocalskilMaintance, (obs=352)

Table 8:The pairwise correlation test of the independent Variables

	HOship	INCOM	Plevel	TAR	WSCost	FADEQ	OrgMEMB	MgtCap	Popngr~h	FSize	PorIfr~t	Instna~e	Financ~e	Locals~e
HOship	1.000													
INCOM	0.186	1.000												
Plevel	0.005	0.438	1.000											
TAR	-0.089	-0.172	0.066	1.000										
WSCost	0.205	0.149	-0.022	-0.628	1.000									
FADEQ	-0.022	0.288	0.112	0.248	-0.116	1.000								
OrgMEMB	0.030	-0.127	-0.208	0.112	-0.100	0.045	1.000							
MgtCap	0.113	0.039	0.042	0.080	-0.005	0.167	0.403	1.000						
Popngr~h	-0.054	-0.224	-0.169	0.139	-0.219	0.033	0.183	0.111	1.000					
FSize	-0.149	-0.249	-0.299	-0.127	0.096	0.051	0.173	-0.009	0.311	1.000				
PorIfr~t	0.035	-0.143	-0.017	-0.070	0.036	-0.287	0.144	0.077	0.107	0.039	1.000			
Instna~e	-0.024	0.136	0.148	-0.193	-0.022	-0.126	-0.243	-0.330	-0.230	-0.242	-0.073	1.000		
Financ~e	0.110	-0.012	0.035	0.229	-0.038	0.072	-0.119	-0.195	-0.162	-0.127	-0.038	0.021	1.000	
Locals~e	-0.024	-0.071	0.009	0.045	-0.037	0.153	0.094	0.149	-0.131	-0.049	-0.044	0.038	0.041	1

Source: Authors' computation based on STATA-14

Annex 4: Descriptive Analysis Tables

Table 9: Socioeconomic characteristics of Sampled Households

Household related Variables	N-statistics	Mean	Std. Error	Std. Deviation	Variance
Sex of respondents	352	1.30	.025	.461	.212
Age of Respondents	352	2.68	.058	1.089	1.185
Educational level of respondents	352	1.56	.027	.497	.247
Marital status of respondent	352	1.22	.022	.414	.171
Family size of respondents	352	4.47	.163	3.060	9.366
Occupation	352	2.72	.094	1.762	3.106
House ownership	352	1.28	.024	.449	.201
monthly income	352	3.04	.073	1.378	1.899
Monthly Expenditure	352	2.29	.062	1.172	1.374
Valid N (listwise)	**352**				

Source: Authors' computation based on SPSS-26

Table 10: Monthly Water Service Paid for the Sampled Households

The amount of payment paid per month(ETB)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not pay for service	166	47.2	47.2	47.2
	less than 15 birr	101	28.7	28.7	75.9
	Between (16-30)birr	58	16.5	16.5	92.3
	between (31-45)birr	19	5.4	5.4	97.7
	Between (46-60) birra	5	1.4	1.4	99.1
	Above 60birr	3	.9	.9	100.0
	Total	**352**	**100.0**	**100.0**	

Source: Authors' computation based on SPSS-26

Table 11: Assess consumption of water supply services and its challenges for sampled HHS

Descriptive Statistics							
		Statistic	Std. Error	Bootstrap[a] Bias	Bootstrap[a] Std. Error	Bootstrap[a] 95% Confidence Interval Lower	Bootstrap[a] 95% Confidence Interval Upper
Sustainability of HH Water Consumption	N	352		0	0	352	352
	Mean	.43	.026	.00	.03	.38	.48
	Std. Deviation	.496		-.001	.004	.485	.500
	Skewness	.288	.130	.003	.108	.080	.519
	Kurtosis	-1.928	.259	.013	.066	-2.005	-1.741
2. to what extent the water supply sustainable?	N	352		0	0	352	352
	Mean	2.25	.040	.00	.04	2.18	2.33
	Std. Deviation	.752		-.002	.026	.700	.803
	Skewness	.194	.130	-.006	.090	.010	.361
	Kurtosis	-.250	.259	-.006	.144	-.503	.061
domestic water consumptions satisfaction	N	352		0	0	352	352
	Mean	1.63	.026	.00	.02	1.58	1.68
	Std. Deviation	.483		-.001	.007	.468	.494
	Skewness	-.544	.130	-.006	.110	-.770	-.336
	Kurtosis	-1.714	.259	.018	.123	-1.898	-1.415
Domestic water consumption per day	N	352		0	0	352	352
	Mean	2.64	.048	.00	.05	2.55	2.74
	Std. Deviation	.901		-.001	.026	.849	.951
	Skewness	.063	.130	-.003	.075	-.086	.211
	Kurtosis	-.878	.259	.007	.080	-1.027	-.701
Valid N (listwise)	N	352		0	0	352	352

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

Source: Authors' computation based on SPSS-26