



JIMMA UNIVERSITY

INSTITUTE OF PUBLIC HEALTH

**SELECTION OF THE SUSTAINABILITY OF SANITATION
TECHNOLOGIES FOR URBAN SLUM: THE CASE OF JIMMA TOWN,
ETHIOPIA**

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Approval sheet

As thesis research advisors, we hereby certify that we have read and evaluated this thesis prepared under our guidance by Thanyang Koang Both entitled as “Selection of the Sustainability of Sanitation Technologies for Urban Slum: The Case of Jimma Town, Ethiopia”. We recommended that it could be submitted as fulfilling the thesis requirement.

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Acronyms and Abbreviations

FGD: Focal Group Discussion

FSMS: Fecal Sludge Management System

MCA: Multi- Criteria Analysis

OD: Open Defecation

Abstract

Background: *More than half of the world's population now lives in urban areas, and this is set to increase, mostly driven by urban growth in developing countries. This rapid urbanization increases the demand for services like water, sanitation, and hygiene in the last decades upto now. The demand of the urban poor is high on sanitation as in food and other commodities. Selection of sustainable sanitation technology and innovation that alleviate the problem is indicated for less invested development agenda in Ethiopia especially in urban settings. The basis for sanitation improvement in urban slums is a result of contaminated conditions and their negative effects on public health and the environment.*

Objectives: *The over all objectives of this study was to investigate the selection of sustainable sanitation technologies for urban slums in Jimma Town.*

Methods: *This project was conducted using a cross-sectional household survey in which households were selected using sampling of randomly selected kebeles. A total of 310 households were included; that the sample is calculated based on single proportion formula. Questionnaires were used to collect household sanitation conditions and systematic walks with key informants through the study area aimed at observing the slum condition of the kebeles carrying out informal and informative interviews using checklists. Data were analyzed using SPSS software for the survey; multi-criteria analysis (MCA) for focus group discussion (FGD) and descriptive statistics were used to summarize the results. Finally, alternative sanitation options were prioritized.*

Result: *Most of the households 234(77.5%) at least had one form of toilet facility. About 88(37.6%) has septic tanks, 53(22.6%) use traditional pit latrine, 50(21.4%) used to flushed pit latrine, 28(12%), discharge there feaces somewhere and 15(6.4%) used VIP. Only 31(10.2%) households safely manage fecal sludge, 44(14.6%) has access to basic service, 131(43.4%) has limited service, and 28(9.3%) unimproved sanitation and 68(22.5%) has access to any form of toilet facility. More than half 206(68.2%) has access to improved facilities. Where as, about 135(57.7%) were shared facilities at least between two or more households. Of the facilities observed 143(38.9%) were treated either in-suite or emptied safely as reported by respondents. The multi-criteria analysis was applied and the result shows; flush to septic tanks, compost*

toilets, and biogas toilets were the three alternatives ranked in the final analysis for this particular study area.

Conclusion and recommendation: Sanitation of urban slums in the town was low coverage. More of the technology options were traditional which are not sustainable, and unimproved. Only 10 % reported using safely managed sanitation service. Considering sustainability criteria and multi-criteria analysis septic tanks, compost toilets, and biogas toilet options were the three alternatives for the urban slum of Jimma town. The coverage of those sanitation technology options was very low that more than 70% of the households used other than the sustainable sanitation options. Only septic tanks were reported in use among some of the householders. Mobilize and demonstrating sustainable sanitation options like septic tanks, biogas toilets, and compost toilets are required to achieve sustainable sanitation goals for the study area.

Keywords: Selection, sanitation options, urban slum, Sustainable sanitation

CHAPTER ONE

1 INTRODUCTION

1.1 Background of the study

More than half of the world's population now lives in urban areas, and this is set to increase, mostly driven by growth in developing countries. This is one of the greatest transformations of the 21st century. During the next two decades, the urban population of the world's two poorest regions South Asia and sub-Saharan Africa is expected to double(1). Urbanization certainly brings opportunity. No country has achieved middle-income status without urbanizing. But to make the most of this phenomenon, new infrastructure, housing, transport, hospitals, schools, and public spaces need to be put in place. Without adequate services to match demand, the rapid increase of urban populations would posture new challenges, not least in terms of poor housing, insecure tenure, and inequalities in access to utilities. About 1 billion people currently live in slum settlements almost a third of the world's urban population and this could increase to 3 billion by 2050(2).

The major contributors of the pollution load in urban slums into the environments are excreta, gray water, and solid wastes. Slums in developing countries lack basic sanitation services due to poor accessibility, lack of legal status, and financial resources. The main sanitation challenges for slums are the ways of enhancing demand for sanitation, the sustainability question, and the institutional structures and arrangements for upscaling and replication by other practitioners. One of the ways to deal with pollution streams in urban slums is through the provision of well-functioning sanitation systems. Sanitation here refers to the management of human excreta, greywater, solid waste, and stormwater. The main polluting constituents are pathogens that endanger public health and nutrients that may cause eutrophication of surface waters and pollution of groundwater. Human excreta management is the key to public health in urban slums since most of the pathogens are of fecal origin(3).

Human excreta are predominantly disposed of in slum areas by use of unlined pit latrines which are usually elevated in areas with a high water table. Other excreta disposal facilities and options include traditional pit latrines, flying toilets (use of polythene bags for excreta disposal that are

dumped into the surrounding environment), open defecation, and to a small extent ventilated improved pit latrines (VIP), and pour-flush toilets by the few high-income earners(4). These excreta disposal systems in use are considered unimproved because they are shared by many households(5).

Providing sanitation solutions accepted by the population living in urban slums is very challenging. It is hampered by i) poor accessibility, which makes it difficult for cesspool emptier and solid waste collection trucks to reach the area; ii) the lack of legal status of the area; slums typically arise from encroachment on land owned by the government and house owners are not willing to invest in permanent structures that may be demolished at any given time, and iii) the lack of interest in investing in sanitation facilities by inhabitants who are typically renting rather than owning the houses. The growth dynamics of the urban slums over the last 15 years has indeed been unprecedented. Minor investments in improved sanitation have not been able to reduce the percentage of the urban unserved and this percentage is still expected to further rise. This is attributed to rural-urban migration and the low priority given to sanitation by urban authorities houses (6).

Open defecation is widely practiced in India, to improve sanitation and promote better health, the Government of India (GOI) has instituted large scale sanitation programmes supporting the construction of public and institutional toilets and extending financial subsidies for poor families in rural areas for building individual household latrines. Nevertheless, many household latrines in rural India, built with government subsidies and the facilitation and support of non-government organizations (NGO), remain unused. The literature on social, cultural, and behavioral aspects that constrain latrine adoption and use in rural India is limited. This paper examines defecation patterns of different groups of people in rural areas of Odisha state in India to identify causes and determinants of latrine non-use, with a special focus on government-subsidized latrine owners, and shortcomings in household sanitation infrastructure built with government subsidies(7).

Ethiopia is the second-most populous country in Africa next to Nigeria with a population estimated at 99.39 million out of which over 19.4% live in urban and peri-urban areas(8).

There is evidence of increased solid waste in Ethiopia as a result of the rapidly increasing human population, increased economic status and income, changing consumption patterns, urbanization, and industrialization. Pollution is a growing concern as industries and urban areas grow. Many rivers are polluted with urban and industrial waste. There is also a high level of air pollution in urban areas. Pollution has become a health threat for people and livestock(9).

In Ethiopia, access to safe sanitation services is still among the lowest in Sub-Saharan Africa (10). Also, the country suffers a variety of deprivation related to waste management. Although sanitation has been a long stand problem in urban slums of Ethiopia, there is still a gap in measuring the sanitation practice of slum residents, and identification of factors that affect sanitation practice and strategies to control them is yet to be established. To attain sustainable sanitation in slum areas and to prevent the dramatic problems linked with sanitation requires reliable data, since; sanitation does not exist in isolation, identifying and understanding the associated factor is equally crucial and their negative effects on public health and the environment. Thus, this study aimed to assess the sanitation practice and associated factors among slum dwellers residing in urban slums of Jimma, Ethiopia(11).

1.2 Statement of the problem

Collecting and managing solid and human waste is an important challenge for countries across the world. This problem is often magnified in cities where a dense concentration of people leads to a substantial amount of waste generation. In developing countries like Ethiopia, this problem is exacerbated by an influx of people moving to urban centers. Densely populated areas are more susceptible to health risks as the disease can be spread quickly. Globally, 2.6 billion people or 39 percent of the world population do not use improved sanitation. Some 1.1 billion people still defecate in the open air. Ten countries, including Ethiopia, are home to 81 percent of them. Open defecation is largely a rural phenomenon, most widely practiced in Southern Asia and Sub-Saharan Africa.

In many cities of Ethiopia, waste management is poor and solid wastes are dumped along roadsides and into open areas, endangering the health and attracting vermin. Access to sanitation is also among the lowest in the world. Sixty percent of the population still practice open field defecation. Only 12 percent (8% in the rural and 29% in the urban) of the population use

improved sanitation facilities. Waste management in Ethiopia is important because only a small percentage of the country's inhabitants have access to safe drinking water: 21% in rural areas, 84% in urban areas, and 30% country-wide. Additionally, only 7% of populations in rural areas, 68% in urban areas, and 15% of people country-wide have adequate access to latrines or other improved human waste disposal options improper waste management may have health, environmental and economic problems. Ecological phenomena such as water, soil, and air pollution have been attributed to improper management of solid wastes. Sanitation is fundamental to human development and security. The combined effects of inadequate sanitation, unsafe water supply, and poor personal hygiene are responsible for 88 percent of childhood deaths from diarrhea. Also, good hygiene practices improve overall health through reduced rates of pneumonia, scabies, skin and eye infections, and influenza (5). While the drinking water supply, sanitation, and hygiene (WASH) sector national policies and strategies exist, there are serious challenges in their implementation and enforcement. The capacity and governance issues in the sector implementing agencies are among the major challenges in performing relevant national programs(12).this research aims to explore the current policy and practice on the dry toilets characterization of pit contents of sustainable urban slums in Jimma town.

1.3 Significance of the study

This study will be used to identify the Selection of sustainable sanitation technologies for urban slums Ethiopia: in the case of Jimma town and how to intervene or management of sanitation hygiene and community should keep their mind in any sanitation problem and selection district that have lack of hygiene. And the community has been harm dirt hygiene that can need to be eliminated. Through the selection area, a community would be aware to take serious action on the part of the village where there will be harmful sanitation problems through technology selection. The gap of this research is for ranking the technology selection as to be scientific.

1.4 Research questions

In the investigation of the possibility to implement a sustainable sanitary system in the slum areas of Jimma, the research question at issue is:-

1. To select an appropriate technology for Jimma town?
2. To evaluate the selecting technology (optional)?
3. To determine the pollution slums areas in Jimma town?
4. What are the slum resident's requirements for a sanitary solution?

CHAPTER TWO

2 LITERATURE REVIEW AND FRAMEWORK

2.1 Overview of sanitation problems

The basic for sanitation improvement in urban slums is a result of contaminated conditions and their negative effects on public health and the environment. Unfortunate sanitation is part of the vicious circle of poverty and results in disease, illness, and low output(6). In slums, human excreta (urine and feces) are not properly managed. They are mainly disposed of by the use of unlined pit latrines which are regularly raised to overcome periodic floods, ventilated improved pit latrines, flying toilets (use of polythene gears for excreta disposal that are dumped into the surrounding environment), or open defecation. Besides, solid waste is characteristically disposed of on illegal refuse dumps and greywater is discharged into open stormwater drains or in the open space often resulting in pounding(4). Also, the disease burden as a result of inadequate and poor sanitation practice is escalating. Worldwide, poor sanitation practice is responsible for 4% of deaths and 5.7% of morbidity (5).The World Health Organization (WHO) estimates that 1.5 million preventable deaths per year result from unsafe water, inadequate sanitation, or hygiene and these deaths are mostly among children less than five years old(13).

During the 2012 conference of the United Nations Convention on Sustainable Development (Rio +20), the UN stressed that 2.5 billion people (roughly 37% of the world's population) still did not use an improved sanitation facility (toilets or latrines), and a little over 1 billion people were practicing open defecation which is one of the main causes of drinking water pollution and diarrhea incidences; resulting in the deaths of more than 750,000 children under 5 years of age per year. With 67% of the population having access to improved sanitation in 2015, the world is thereby far from meeting the agreed target of 75%. About 1.5 million children die each year (5,000 every day) from diseases that are largely preventable through proper sanitation and improved hygiene (UN 2012; Montgomery and Elimelech, 2007). With only 47% of the rural population using improved sanitation, rural areas lag far behind urban areas where the rate is about 80%. Seven out of ten people without improved sanitation live in rural areas. Countries that still have less than 50% coverage in the water supply are almost all in sub-Saharan Africa,

while several populous countries in Southern Asia also have low rates of improved sanitation(14). It can be argued that viewed side by side, the two frameworks (the urban environmental transitional model and comparative urban sanitation experience of developing and developed countries)provide a better perspective for understanding the sanitation challenges in developing world cities(15).

The number of urban areas and people living in urban areas of Ethiopia has been steadily increasing over the last 4-5 decades, especially in the last decade up to now. Urbanization in Ethiopia created opportunities for improved energy availability, better road infrastructures, and improved housing conditions. However, it has also created growing challenges in sanitation and waste management systems, which pose serious health risks to the urban population. The three critical components of urban sanitation include excreta disposal, and liquid and solid waste management. Services to handle the waste are grouped into two related services: urban sanitation and urban waste management. Urban solid waste management (USWM) requires a system that ensures the maintenance of human health and the surrounding environment. Although the sources of waste generation are diverse, the proportion of household wastes (by volume and weight) makes a significant contribution to the overall improvement of urban health.

Onsite sanitation systems involve the waste generation and final disposal at the point of waste generation. Offsite systems are used in the generation and final disposal sites are distinctly different. Both systems are used in the cities of Ethiopia. The Ethiopian Demographic and Health Survey (EDHS) in 2014 showed that only 14% of the urban population has access to improved sanitation facilities (4), which are capable of breaking fecal-oral routes of infection transmission. The same data source indicated that access to shared sanitation will be 33%. These data were not different from that indicated by (EDHS 2011). According to the report, Ethiopia is on the list of countries that are not on track to meet MDG sanitation target, nevertheless, administrative reports claimed that the country is on the right track to meet the MDG(16).

2.2 Public health Concerns of lack of Sanitation

Public Health Proclamation the proclamation states that no person shall dispose of solid, liquid, or any other waste in a manner that contaminates the environment or affects the health of the society. Art. 12 No. 2(17).

2.3 Sanitation technologies

All sanitation technologies can be described as being either ‘wet’ or ‘dry’: Wet technologies require water to flush feces. Most urban sanitation in India is ‘wet’, involving some form of flush toilet connected to a leach pit, septic tank, or sewer. Dry technologies do not use water for flushing. They include a range of different types of traditional pit latrines, ventilated improved pits, as well as contemporary designs that promote the safe reuse of excreta. Pit latrines are rarely used in India, though in recent years some small-scale initiatives have promoted ecological sanitation (known as ecosan), a form of dry sanitation that involves the separation of feces and urine at source and the reuse of treated excreta. In principle, ecosan has some important advantages including (a) reduced water demand for flushing; (b) reduced wastewater management problems (no black water production); and (c) improved nutrient recycling, particularly the nutrients in urine. However, the traditional practice of using water for anal cleansing, and the availability of water to the majority of households in Indian cities, mean that flush toilets are likely to remain the preferred option for most households(13).

2.4 Sanitation and hygiene

Environmental health and sanitation to encourage consensus around the key parts. The Ethiopian definition draws on these definitions while emphasizing the key principle of 100% improvement. Our Definition 100% adoption of improved sanitation and hygiene is the process where people demand, develop and sustain a hygienic and healthy environment for themselves by erecting barriers to prevent the transmission of diseases, primarily from faecal contamination. Barriers to Improve Sanitation and Hygiene Improved sanitation and hygiene are about erecting physical and behavioral barriers to stop contamination. The primary barriers have the biggest preventive impact and concentrate on the safe management of feces to prevent contact with fields, fluids, fingers, feet, flies, and food.

Poor sanitation and hygiene conditions are among the major causes of public health problems in Ethiopia in general nearly 40% of Ethiopians lack access to sanitation facilities in 2014. Even where toilets do exist, many are not used, meaning that open defecation is common for almost all the rural population. In Ethiopia 82% of the population uses unimproved sanitation facilities, 38.1 million populations still practice open field defecation. The findings revealed that the rate of communal latrine use in Addis Ababa was about 79.8%. Unhygienic conditions, latrine emptying challenges, extreme smell, number of family units sharing the same squats, and latrine designs for the aged and children were identified as barriers to latrine utilization(18).

2.5 Latrines utilization

Poor sanitation and hygiene conditions are among the major causes of public health problems in Ethiopia in general nearly 40% of Ethiopians lack access to sanitation facilities in 2014. Even where toilets do exist, many are not used, meaning that open defecation is common for almost all the rural population. In Ethiopia 82% of the population uses unimproved sanitation facilities, 38.1 million populations still practice open field defecation.(IDF Diabetes Atlas, Belgium: IDF; 2013).the findings revealed that the rate of communal latrine use in Addis Ababa will be about 79.8%. Unhygienic conditions, latrine emptying challenges, extreme smell, number of family units sharing the same squats, and latrine designs for the aged and children were identified as barriers to latrine utilization, Although there are regional variations, it is thought that some kind of latrine access ranges between 9 percent in rural areas to 72 percent in the urban. This gives a national average of 18 percent which is mainly traditional latrines made from locally available materials(19)

2.6 Water sanitation management

In the face of more general urban growth, the populations in these two settlements are bound to increase. Without a corresponding increase in the provision of water supply and sanitation facilities, there will be intense pressure on existing facilities, which are already under great pressure leading to their further deterioration and also in environmental conditions, thus putting the residents at risk of various diseases and increased poverty. An important step towards resolving the crisis is to understand the magnitude of the problem The provision of up-to-date information on sanitation coverage and water supply in Jimma and communities will enable city

authorities to plan effectively towards interventions that require priority attention for the achievement of MDG 7 target 10 reducing by half the proportion of people without sustainable access to safe drinking water and sanitation. It will also provide baseline information that can be used to document change over time(20).

2.6 Waste Management

Although African cities generate only between 0.3 kg and 0.8 kg of solid waste per capita/day compared to the global average of 1.39 kg/capita/day,80 poor solid-waste management poses extreme hazards to health and water quality through pollution. In many African cities, waste management systems appear to be absent, with solid waste disposed of directly adjacent to informal settlements in mounds, trenches, and near watercourses. There is a relatively large proportion of organics in waste generated in African cities, typically well over 50 percent.81 The potential for “green economy” projects in waste separation and management is thus high and might reduce the waste disposed of through reuse of organics for animal feed, such as in Kampala, Uganda, or the generation of biogas from waste(21).

2.7 The improper waste disposal site

Waste generation rates are rising in the world. In 2016, the worlds’ cities generated 2.01 billion tons of solid waste, amounting to a footprint of 0.74 kilograms per person per day. With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tonnes. Compared to those in developed nations, residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste. In low-income countries, over 90% of waste is often disposed of in unregulated dumps or openly burned(22).

From a study conducted in Assela Ethiopia 82.8%, had improper solid waste management practice. Lack of adequate knowledge about solid waste management and not having door access to door solid waste collection could have contributed to the reported improper solid waste practice. Participants who didn’t have access to the door to door solid waste collection service were about three times more likely to practice improper solid waste management when compared to those who had access(23).

Conceptual framework

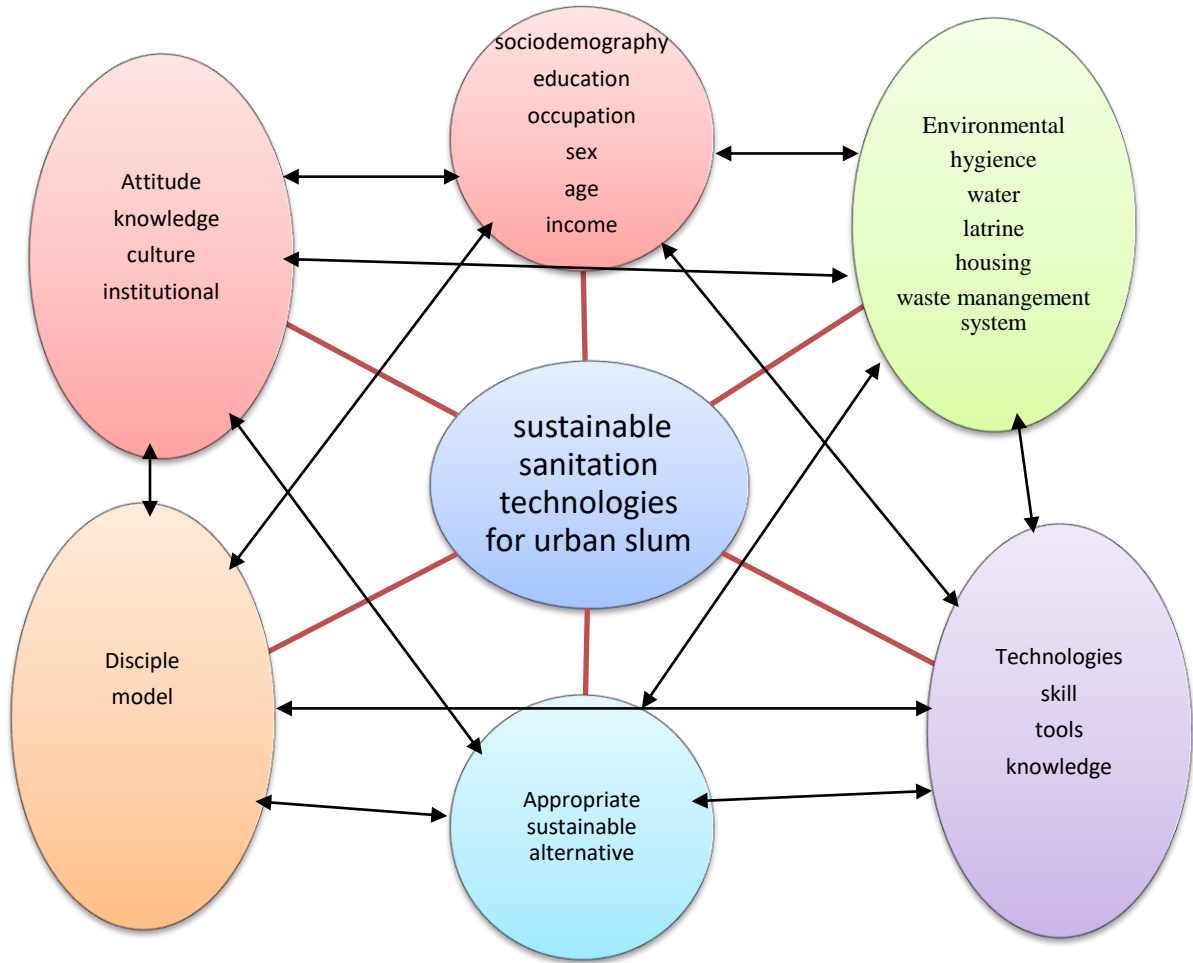


Figure 1 Conceptual framework

CHAPTER THREE

3 OBJECTIVE

3.1 General Objective

- The over all objective of this study was to assess sustainable sanitation technologies for urban slums: the case of Jimma town, Ethiopia,2020

3.2 Specific Objective

- To assess existing sanitation technologies in the study area
- To select an appropriate technology for urban slums
- To recommend alternative sanitation technologies for urban slums

CHAPTER FOUR

4 MATERIALS AND METHODS

4.1 STUDY AREA DESCRIPTION

The study was conducted in Jimma town. About 352 km from Addis Ababa. An estimated 155,436 (Source: WPE, 2018) population lives in the town. 17 kebele, mean minimum 11.9, mean maximum 25.5 °C, and average annual rainfall 141 mm. A community-based cross-sectional and multi-criteria study design was employed in five kebele Jimma town.

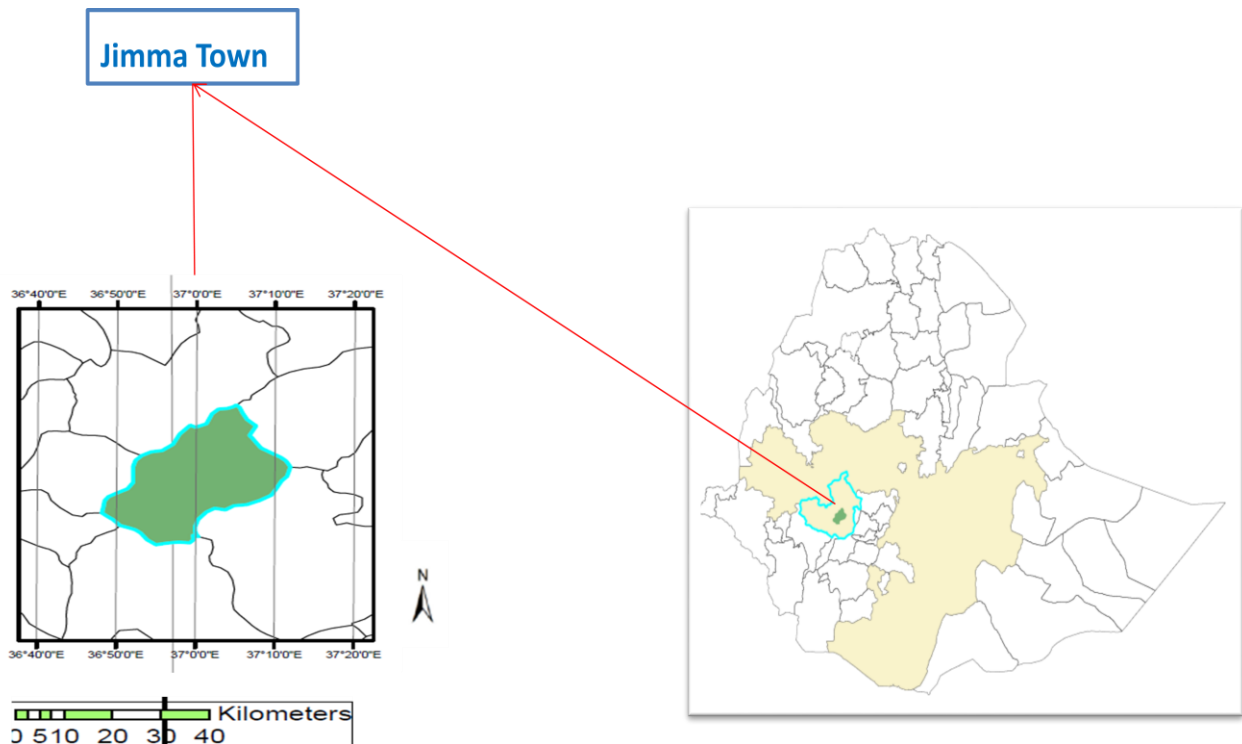


Figure 1 The map of the study area

Based on the 2007 CSA (2010), it has a total population of 120,960, of whom 60,824 are men and 60,136 women. With an area of 50.52 square kilometers, Jimma has a population density of 2,394.30 all are urban inhabitants. 32,191 households were counted in this Zone, which results in an average of 3.76 persons to a household, and 30,016 housing units. The three largest ethnic groups reported in Jimma were the Oromo (46.71%), the Amhara (17.14%), and the Dawro (10.05%); all other ethnic groups made up 26.1% of the population. Amharic was spoken as a

first language by 41.58% and 39.96% spoke Afan Oromo; the remaining 18.46% spoke all other primary languages reported. Orthodox 46.84%, 39.03% Muslim, and 13.06% Protestant (CSA, 2010).

4.2 Study Design

The descriptive cross-sectional survey design was used. In this study, both the Quantitative and qualitative approach was used. The qualitative approach was used for the measurement of attitudes, behaviors, and perceptions and quantitative was used to identify the sex, Age, Marital status, educational level, and economic level of the respondents towards improved sanitation utilization.

4.3 Population

Source population:All households in selected kebeles, Jimma town

Study population: Selected households

The Study unit: The study unit was family members aged 18 years and above living in Jimma town which was selected using SRS.

4.4 Eligibility criteria

Inclusion criteria: Adult (age \geq 18 years) family member who has been lived at least six months in the study area were included.

Exclusion criteria:Family members who have critically sick during the interview were excluded.

4.5 Sample size determination and sampling technique

4.5.1 Sample size determination

The sample size was determined using the single population proportion formula.

$$n = \frac{\left(\frac{Z_{\alpha}}{2}\right)^2 * p(1-p)}{d^2}$$
, where n=sample size, p=proportion of households using improved facilities from the previous study, α = margin of error at 95 C.I

$$n = \frac{(1.96)^2 * 0.886(1-0.886)}{(0.05)^2} = 155$$

Considering design effect of 2 (def)

Total sample size 155 * 2= 310 households

4.5.2 Sampling Technique

The kebeles were selected purposively considering the slum condition in the town. Households were selected using a systematic random sampling technique. Key informants were selected using purposive sampling for qualitative data collection.

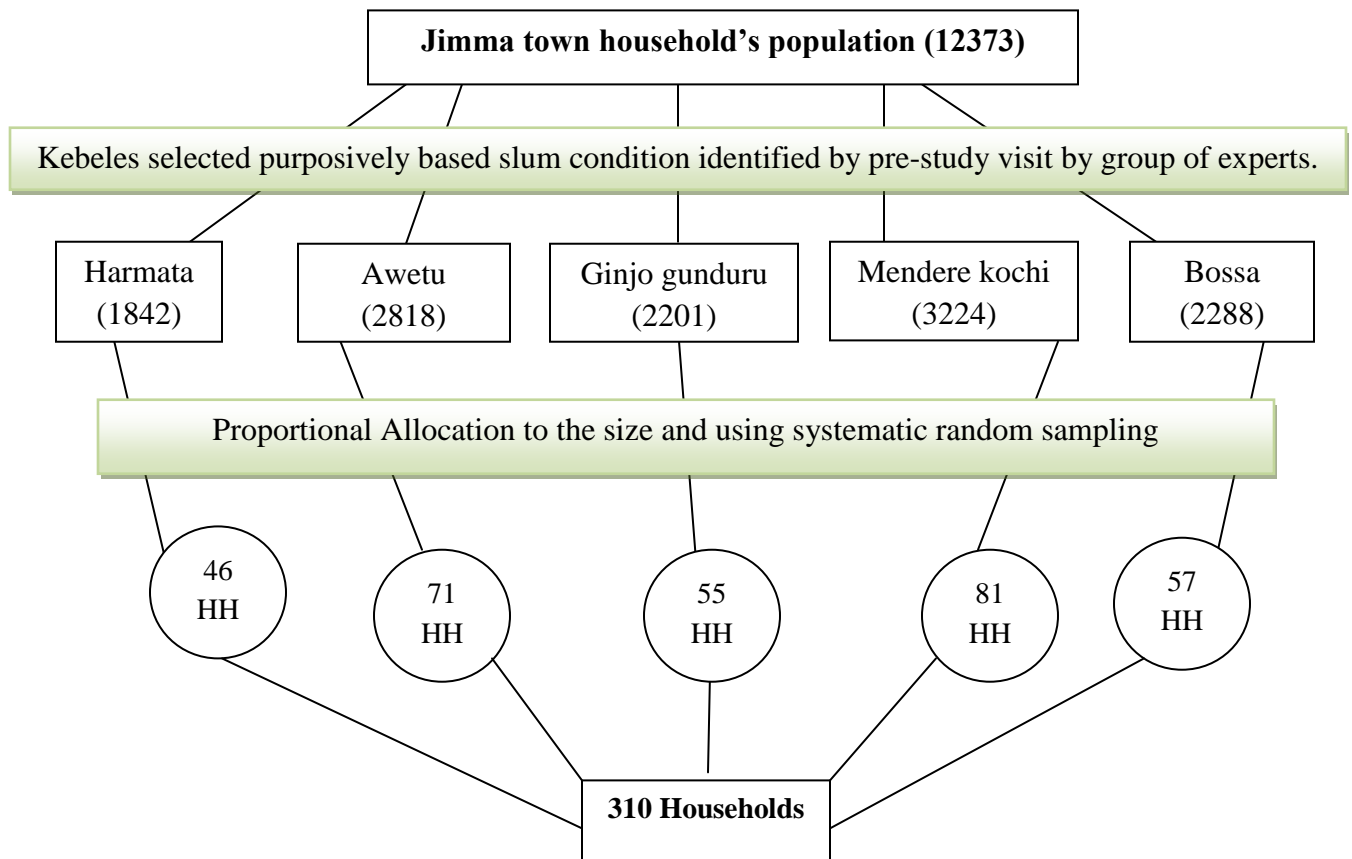


Figure 2: Schematic Presentation of sampling procedure

4.6 Data collection procedure

Standard questioner adopted from SDG sanitation indicator survey was used to collect household level. An observation checklist was used to collected toilet conditions. Data were collected by trained data collectors and supportive supervision was done to sure data quality from the fieldwork. FGD were recorded after consent from the participants, code was given for all decadents all informed to speak without naming themselves. The result was transcribed by experts and then thematically analyzed.

- **Primary source:**-Observation, FGDs, Interview with Questionnaires, KIIs.
- **Secondary sources:** - Report on any gray literature review

4.7 Operational definitions

Sustainable: -The definition of sustainable is something that can be continued or a practice that maintains a condition without harming the environment(24).

Sanitation: - is defined as access to and use of facilities and services for the safe disposal of human urine. Sanitation is the process of keeping places clean and healthy, especially by providing a Meaning, pronunciation, translations, and Definition of environmental sanitation: Activities aimed at improving or maintaining the standard of basic environmental conditions affecting the well- being(25).

Technologies:-the application of scientific knowledge to the practical aims of human life or, as it is sometimes phrased, to the change and manipulation(26).

Urban:-is of, relating to, characteristic of, or constituting a city. How to use urban in a sentence Once in the city and children who moved to help their families can find that participation in the urban economy weakens the bonds between them and their parents(27).

Slums:-A slum is an area of a city where living conditions are very bad and where the houses are in bad condition (28).

4.8 Technology selection

Technology selection was carried out using an excel-based tool that was developed under this study. It comprises of the input data that are area-specific, an assessment sheet where technology characteristics were.

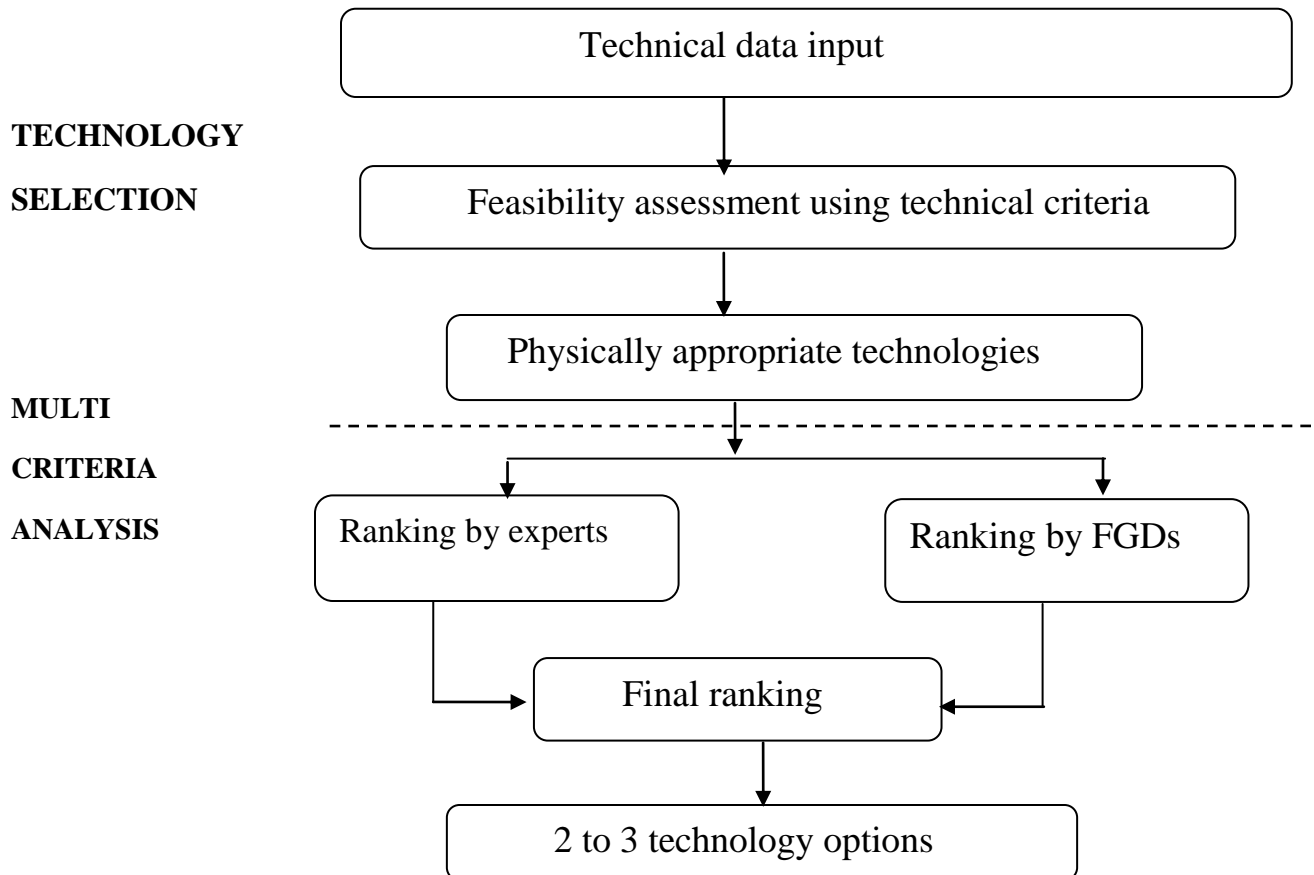


Figure 3: FGD AND MCA adopted from literature. (6)

The technical criteria and environmental compliance as well as the output sheet with technically feasible options. The aim was to eliminate non-feasible options for the next level of assessment.

The technology and further screening by multi-criteria analysis for applicability in slum areas included. In our case: urine diversion dry toilet (UDDT), biogas toilet, compost pit latrine, traditional pit latrine, lined ventilated improved pit latrine, pit latrine with urine diversion, pour-flush toilet connected to twin pits and simplified sewerage possibly connected to the main sewer

of the nearby urban conventional system. The identified technology options were subjected to technical criteria to determine their appropriateness in the study area.

They included: water availability and consumption for waterborne systems, excavation depth, accessibility to vacuum trucks and pickups, and treatment requirements such as the recovery of nutrients and energy in the form of bugs and environment protection against pollution based on Nations and World Health Organization effluent discharge standards(3).

4.9 Multi-criteria analysis

The selected technologies were screened further by the use of multi-criteria analysis (MCA) to take into account the perception of the community members. The selected sanitation options for excreta disposal were presented to the group of experts for ranking. This was done using focus group discussions (FGDs) taking into account gender, age, and representation from the kebeles of the study area. There were a total of three FGDs; three for both females and males each composed of representatives from two neighboring Hermata Matina and Mandera Kochi. Also, various experts (n=14) participated in the ranking of the technically feasible sanitation options.

4.9.1 Ranking of technologies by FGDS

The pair-wise method was used for ranking the sanitation technologies by the FGDs on a pair by pair basis. Using this structured method, five sanitation technologies were compared each at a time for the five technology options. FGDs were held to establish perceptions and favorites from the communities about the technology options suitable for the study area.

The technologies were presented to the community (represented by FGDs) using IEC (Information, Education, and Communication) materials in the participatory discussion of the merits and demerits of these technologies concerning sustainability indicators before the ranking activity. For FGDs: Three FGD was being conducted. Individual expert under this

- ☞ Health workers,Community leaders,Religion leaders,Key informant interviews,Kebeles leader
- ☞ 1 FGDs for women of reproductive age(15-49) which contained 7 participants
- ☞ 1 FGDs male Adult community members age of ≥ 18 years contained 8 participants
- ☞ 1 FGD for kebeles staff workers excluding HEW and kebele leader which include 2 women & 4 males.

4.9.2 Ranking of technologies by experts

Experts composed of technical and non-technical professionals ranked the technically feasible sanitation options. They included social scientists, health and urban planning expertise.

4.9.3 Final ranking of the sanitation technologies

The Final ranking was achieved using the average FGDs scores for the parameters defining sustainability indicators and the weighted scores of the sustainability indicators by the experts.

The normalized score of a sustainability indicator will be obtained as follows:-

$$\mathbf{F} = \left[\sum_{i=1}^n \left(\frac{a_i}{c} \right) \right] \times \mathbf{G}$$

where \mathbf{F} is the normalized score of a sustainability indicator, \mathbf{n} is the number of parameters defining the criteria for a sustainability indicator, \mathbf{a} is the average FGD score of a parameter for sustainability criteria, \mathbf{c} is the total of the average FGD scores for criteria defining a sustainability indicator and \mathbf{G} is the expert's weighted score for sustainability. The sum of the normalized scores (\mathbf{F}) for all sustainability indicators was the total final score for a technology option and determined its final rank (3).

Technology gaps in the sanitation chain from the toilet to the final point of disposal and/or end-use of excreta-derived end-products can be found at all stages: sludge collection and transport, sludge treatment, and resource recovery. By filling these gaps, nutrients and other beneficial resources can be recovered, economic opportunities can be leveraged and environmental discharges can be minimized. Most importantly, effective barriers between humans and excreta can be ensured(29). The sustainability criteria were adopted from literature (Table 1).

Table 1: Sanitation technology sustainability criteria for urban slum

Sustainability indicator	Criteria
Socio-culture	Acceptance: Proportion of users unhappy with the proposed technology option. Perception/complexity: Ability of beneficiaries to participate in operation and maintenance
Technical	Use-ability: How easy it is to use the proposed facility as viewed by the intended beneficiary community. Local labor: Capacity of local contractors to undertake the associated technical works. Robustness: Sensitivity to improper use, durability, and sensitivity to the harsh environment. Materials: Availability of local materials for facility construction. Fit existing system: Upgradeability to suit the local infrastructural and physical conditions.
Health and environment	Environmental pollution: Risk of emission of pollutants to the environment such as nutrients and organic matter. Exposure to pathogens: Risk of negative health impact associated with pathogens and contact with excreta during system management.
Economics:	Capital cost: Investment's requirement for the system. Land: Space required for the system to be constructed. Operation and maintenance: Resources (time, money, and energy) for the system to serve its design life. Resource recovery: Possibility of nutrient recovery from proposed technology for agricultural use. Energy: biogas recovery.
Institutional	Adaptability: The ability of the beneficiary to use the technology. Management: System for over seeing that the facility serves its intended purpose. Policy: Strategic decisions by the government to increase sanitation coverage and service level to the urban poor.

Source: adapted from literature(3)

4.10 Data analysis and presentation

Survey data were entered into Epidata software and exported to SPSS version 20 for analyses. Descriptive statistics' was conducted to identify the socio-demographic status of the study participants, sanitation access condition, and sanitation options in the study area. The results were presented by table and graph.

4.11 Ethical Consideration

The study was reviewed for ethical consideration and a formal letter was obtained from Jimma University, Institute of Public Health and Medical Sciences, Department of Environmental Health Science and Technology to the Office of Health in Jimma regional western Ethiopia.

4.12 Plan for Dissemination of results

The result of this study will be submitted to JU as partial fulfillment of a Master's degree in Environmental Science and Technology. Finally, attempts will be made to present the results at scientific conferences and to publish the results of the study in national as well as international journals.

CHAPTER FIVE

5 RESULTS

5.1 Socio-demographic characteristics of the study participants

In this study, 302 households were approached which was a 97.4% response rate. The majority of the respondents were head of household 275(91.1%), 215(71.2%) of them were male respondents, with a mean age of 38(SD \pm 10.9), about (106)35% of participants were college and above educational status, 178(58.9%) were married and almost half 154(51%) respondents have family size of less than four-member (Table 2) (30,31,32).

Table 2: Socio-demographic characteristics of study participants

Variables		Frequency	Percent
Are you head of household	Yes	275	91.1
	No	27	8.9
	Total	302	100
Head of household	Male	215	71.2
	Female	87	28.8
	Total	302	100
Age categories of respondent (Mean = 37.79, SD= \pm10.89)	18-24	34	11.25
	25-29	42	13.9
	30-34	31	10.25
	35-39	60	19.9
	40-44	59	19.5
	45 & above	76	25.2
	Total	302	100
Educational status of study participants	Can read and write	18	6
	Primary (1-8)	56	18.5
	Secondary (9-12)	81	26.8
	Technical (10+)	41	13.6
	Collage and above	106	35.1
	Total	302	100
Educational status of mothers	Cannot read and write	16	5.3
	Can read and write	31	10.3
	Primary (1-8)	78	25.8
	Secondary (9-12)	99	32.8
	Technical (10+)	26	8.6
	Collage and above	52	17.2
Marital status of the respondent	Total	302	100
	Married	178	58.9
	Single	92	30.5

Occupation of the head of household	Widowed	14	4.6
	Separated	15	5.0
	Divorced	3	1.0
	Total	302	100
	Farmer	7	2.3
	Gov't	92	30.5
	Merchant	51	16.9
	Housewife	65	21.51
	Privet worker	65	21.54
	Day laborer	14	4.65
Wife occupation (n=196), (where 92 are single, 14 were widowed)	Other	8	2.6
	Total	302	100
	Famer	8	4.1
	Government employee	36	18.4
	Merchant	38	19.4
	House wise	78	39.8
	Privet work	27	13.8
	Day laborer	5	2.6
	Other	4	2.0
	Total	196	100.0
Family size (mean =5.55, SD=2.07) (n=302)	Less than five	154	51.0
	Above five	148	49.0
	Total	302	100.0
Family monthly income (n=302) (Mean =11, 896, SD±13,839)	Less than 7000 ETB	126	41.7
	7000 and above ETB	176	58.3
	Total	302	100.0

5.2 Housing condition of Households

Housing condition of households 238(78.8%) cemented floor, about 167(55.3%) were cemented, the majority 280(92.7%) iron sheet roofing, 280(92.7% access to drinking water by tap water and about 234(77.5%) have at least one form of toilet facility (

Table 3)(33).

Table 3: Housing condition of household in the study area

Variables		Frequency	Percent
House Floor Condition	Earth	40	13.2
	Cement	238	78.8
	Other	24	7.9
	Total	302	100.0
House Wall Condition /Type	Wood	15	5.0
	Wood and Earth	106	35.1
	Cement	167	55.3
	Other	14	4.6
	Total	302	100.0
House Roof Condition/ Type	Iron Sheet	280	92.7
	Other('Shara', Local Materials)	22	7.3
	Total	302	100
Do you have a toilet facility?	Yes	234	77.5
	No	68	22.5
	Total	302	100.0
Mothers access Phone	Yes	101	33.4
	No	201	66.6
	Total	302	100
Mobile	Yes	82	27.2
	No	220	72.8
	Total	302	100.0
Animal Cart	Yes	6	2.0
	No	296	98.0

	Total	302	100.0
Car	Yes	37	12.3
	No	265	87.7
	Total	302	100.0
Radio	Yes	215	71.2
	No	87	28.8
	Total	302	100.0
Head of Households Phone	Yes	202	66.9
	No	100	33.1
	Total	302	100.0
TV	Yes	288	95.4
	No	14	4.6
	Total	302	100.0
Source of water	Pipe tab	280	92.7
	Protected well	22	7.3
	Total	302	100.0
To access water during the dry season?	Yes	245	81.1
	No	57	18.9
	Total	302	100.0
Does your family have less than five years age child?	Yes	177	58.6
	No	125	41.4
	Total	302	100.0

5.3 Sanitation technology Options

In the study area, it was found that 234(77.5%) of the households reported at least they had one for of toilet facility and the rest 68(22.5%) did not have a toilet facility. About 50(21.4%) used to flush to a lined pit latrine, traditional pit latrine 53(22.6%), Septic tanks 88(37.6%), discharge somewhere 28(12%), and VIP 15(6.4%)(Table 4)(34).

Table 4: Toilet facility options and conditions among selected households in the urban slum of Jimma town, 2020.

Variables		Frequency	Percent
Do you have a toilet facility?	Yes	234	77.5
	No	68	22.5
	Total	302	100.0
Place of defecation of family members	Own toilet	232	76.8
	Other toilets	65	21.5
	Open Field/somewhere else	5	1.7
	Total	302	100.0
Where child feces disposed of?	Into toilet	60	33.9
	Dumped to open field	78	44.1
	With other wastes	37	20.9
	Buried	2	1.1
	Total	177	100.0
Type of toilet facility	Flush to a lined pit latrine	50	21.4
	Pit latrine	53	22.6
	Pipes to a septic tank	88	37.6
	Flush discharge somewhere	28	12.0
	VIP	15	6.4
	Total	234	100.0
Does it functional?	Yes	122	52.1
	No	112	47.9
	Total	234	100.0
Why not functional?	Unclean	23	7.6
	Full	29	9.6
	Not water	42	13.9
	No slab	11	3.6
	No superstructure	5	1.7
	Under construction	1	.3
	Prefer field	1	.3
	Total	112	37.1
	A distance of toilet from the main house(estimated)	Less than 6 meter	169
6 meter and above	65	27.8	
Total	234	100.0	
Does any household share your toilet?	Yes	135	57.7
	No	99	42.3
	Total	234	100.0

About 129 (42.7%) of participants very satisfied, 122(40.4) satisfied, and 51(16.6%) unsatisfied with the current sanitation technology options they are using. All most of the participants knew at least one sanitation option which improved sanitation technology currently working in Ethiopia (**Table 5**)(35).

Table 5: Knowledge, attitude and perception on current sanitation option among urban slum households in Jimma town, 2021

Variables	Frequency	Percentage	
Satisfaction on current defecation place	Very satisfied	129	42.7
	Satisfied	122	40.4
	Unsatisfied	41	13.6
	Very unsatisfied	10	3.3
	Total	302	100.0
What type of toilet do you know?	Water flush	131	43.4
	Ventilated improved pit latrine	103	34.1
	Pit with slab	53	17.5
	Composting toilet	15	5
	Total	302	100.0
Which toilet did you choose for your family?	Water flush	138	45.7
	Ventilated improved pit latrine	94	31.1
	Pit with slab	64	21.2
	Composting toilet	6	4
	Total	302	100.0
Why you prefer it?	Comfort	92	30.5
	No bad order	150	49.7
	No flies	37	12.3
	Don't see feces	11	3.6
	Easy to clean	7	2.3
	Save water	2	.7
	Cheap	3	1.0
	Total	302	100.0
	Having toilets have a disadvantage?	Yes	189
No		113	37.4
Total		302	100.0
What are the disadvantages?	Bad odor	41	13.6
	Flies	49	16.2
	Cost	22	7.3
	Time-consuming	40	13.2

	Others use it	23	7.6
	Water contamination	11	3.6
	Over flow	2	.7
	No problem	1	.3
	Total	189	62.6
Advantages of having a toilet?	For safety	102	33.8
	Privacy	66	21.9
	Comfortable	48	15.9
	Time-saving	29	9.6
	For security	28	9.3
	Health protecting	20	6.6
	Shame reduction	9	3.0
	Total	302	100.0
How important to pay for toilet construction?	Very important	188	62.3
	Somewhat important	94	31.1
	Not important	16	5.3
	Not at all important	4	1.3
	Total	302	100.0
Dose adult your family members use a toilet?	Yes frequently	186	61.6
	Some times	109	36.1
	No	7	2.3
	Total	302	100.0

5.4 Fecal Sludge Management and Sanitation Ladder

From households who participated in this study, only 31(10.2%) safely manages fecal sludge, 44(14.6%) access to basic service, 131(43.4%) limited, and 28(9.3%) unimproved, and 68(22.5%) access to any form toilet facility. More than half 206(68.2%) accessed improved facilities. From while about 135(57.7%) were shared facilities at least between two or more households. Of the facilities observed 143(38.9%) were treated either in-suite or emptied safely as reported by respondents (Table 6)(36).

Table 6: Fecal Sludge management and sanitation ladder among households in the urban slum of Jimma town, 2020

Variables		Frequency	Percentage (%)
Improved toilet facilities	No(unimproved)	96	31.8
	Yes(Improved)	206	68.2
	Total	302	100
Sanitation ladder (n=302)	Safely managed	31	10.20
	Basic	44	14.60
	Limited	131	43.4
	Unimproved	28	9.3
	Open Field	68	22.5
	Total	302	100
	Treated (n=234)	Treated	143
Untreated		91	61.1
Total		234	100
Shared (n=234)	Shared	135	57.7
	Not Shared	99	42.3
	Total	234	100

5.5 Selection of appropriate technology

The selection of sanitation technology in this study was done from expert choice based on the scenario of sustainable sanitation options for urban slums. Many types of sanitation options were considered. Multi-criteria rank and sustainability perspective were assumed. The local context with the community participation was included. Important components of sustainability criteria were health benefit, social acceptance, economical feasibility, availability of skill for the technology, technical feasibility, and ease of expansion. Three FGDs were conducted to explore the sanitation technology options to prioritize for the study site. Thematic analysis was conducted to organize the challenges to sustainable sanitation options for the site

Many problems were raised by the participants. For instance, the environmental condition of the area is a challenge to select technology option, raised water table (more of wetland), poor urban planning, low attention from the community themselves, lack of technology options other than the conventional pit latrine, lack of sanitation technology incubation and development center, and lack of community involvement on sanitation technology options were problems many of the study participants raised(37,38).

A total of seven sanitation options were evaluated by expertise and FGDs. Five Criteria were considered; health risk, economical affordability, social acceptability, technical feasibility, and environmental. Different credit was given for each criterion by the group discussion to select feasibility sanitation option.(35)

Multi-criteria analysis was applied and the result shows Flush to septic tanks, compost toilet, and Biogas toilet were the three alternatives for this particular study area (**Error! Reference source not found.**)(3,39).

Table 7: Scoring of sustainability indicators by experts (n=8).

Sustainability indicator		Weight score by experts for each indicators (0-5)				Average scores (sum of Each score)	Weighted average scores (%)
		Public health specialists	Institutional specialists	Technical/regulatory	Social scientists / economists		
Socio-culture	Acceptance	4.5	4.8	4.25	4.9	18.45	13
	Perception/complexity	4.5	3.5	4.0	4.75	16.75	
Technical	Use-ability	4.85	4.5	4.5	4.25	18.1	29
	Local labor	3.5	4.2	3.5	4.25	15.45	
	Robustness	3.5	3.5	3.5	3.5	14	
	Materials	3.75	4.5	4.2	4.5	16.95	
	Fit existing system	4.8	3.8	4.1	4.25	16.95	
Health and environment	Environmental pollution	4.8	4.0	4.8	4.5	18.1	13
	Exposure to pathogens	4.5	3.8	4.5	4.5	17.3	
Economic	Capital cost	4.25	3.5	4.6	4.25	16.6	29
	Land	4.8	3.5	4.71	4.5	17.51	
	Operation and maintenance	4.85	3.5	4.2	4.25	16.8	
	Resource recovery	4.5	4.24	4.20	3.5	16.44	
	Energy	4.2	3.65	3.5	2.70	14.05	
Institutional	Adoptability	3.5	4.0	4.25	3.5	15.25	16
	Management	4.5	4.5	4.35	2.75	16.1	
	Policy	4.2	3.5	4.0	2.5	14.2	
Total						279	100

Table 8: Score given for each sanitation technology options by FGD participants

Sanitation options	Score Based on each Sustainability criteria for sanitation option given by FGD participants(n=14)				
	Socio-culture*	Technical *	Health and environment *	Economics\$	Institutional *
Ventilated improved latrine (VIP)	3	2	4	3	3
Compost toilet	2	3.5	4.5	4	3
Biogas	4	4.5	4	4.5	2.5
Flush to Septic tanks	3	3.5	5	3.5	2.5
Flush to Sewer line / networked	3.5	3.75	4	3	4
Pit latrine with slab	1.5	3.5	2	2	2.5
Urine diverted dry toilet (UDDT)	3.5	4	5	5	3.5
Max	4	4.5	5	5	4
Min	1.5	2	2	2	2.5
<p>*Beneficiary values (the more, the better): Health and Environment, Socio-cultural acceptance, technical, and institutional with high value. So that we divided the value of each by maximum to normalize.</p> <p>\$ No beneficiary values (the less the better): Cost is any beneficiary value that we need the smaller value; so that we divided the value for each by the smallest value to normalize</p>					

Table 9: Normalized Score for each sanitation technology options (Normalized)

Sanitation options	Score Based on each Sustainability criteria for sanitation option(Normalized)				
	Socio-culture	Technical	Health and environment	Economics	Institutional
Ventilated improved latrine (VIP)	0.75	0.44	0.80	1.50	0.75
Compost toilet	0.50	0.78	0.90	4.00	0.75
Biogas	1.00	1.00	0.80	2.00	2.50
Flush to Septic tanks	0.75	3.50	5.00	3.50	0.63
Flush to Sewer line / networked	0.88	0.83	0.80	1.50	1.00
Pit latrine with slab	0.38	0.78	0.40	1.00	0.63
Urine diverted dry toilet (UDDT)	0.88	0.89	1.00	2.50	0.88

Table 10: Score based on sustainability criteria for sanitation option and weighted and final rank for an urban slum in Jimma town (Weighted & final rank)

Sanitation options	Score Based on each Sustainability criteria for sanitation option(Normalized)					Total Score	Rank
	Socio-culture (13%)	Technical (29%)	Health and environment (13%)	Economics (29%)	Institutional (16%)		
Ventilated improved latrine (VIP)	0.10	0.13	0.10	0.44	0.12	0.89	6
Compost toilet	0.07	0.23	0.12	1.16	0.12	1.69	2*
Biogas	0.13	0.29	0.10	0.58	0.40	1.50	3*
Flush to Septic tanks	0.10	1.02	0.65	1.02	0.10	2.88	1*
Flush to Sewer line / networked	0.11	0.24	0.10	0.44	0.16	1.05	5
Pit latrine with slab	0.05	0.23	0.05	0.29	0.10	0.72	7
Urine diverted dry toilet (UDDT)	0.11	0.26	0.13	0.73	0.14	1.37	4

**Flush to septic tanks, compost toilet and Biogas toilet is three alternatives ranked first for the study area.*

CHAPTER SIX

6 DISCUSSION

This study aimed to investigate the sanitation situation in slum areas of Jimma town and select alternatives in the urban slum of Jimma town. A cross-sectional survey was conducted among urban slums of the town to identify the sanitation condition of the study area. The selection of alternative sanitation options was identified by a qualitative approach using FGD and expert participation. A multi-criteria analysis of alternative sanitation options was used(11,39).

This result revealed that most of the households 234(77.5%) reported at least they had one for of toilet facility and the rest 68(22.5%) did not have toilet facility.

About Septic tanks, 88(37.6%), traditional pit latrine 53(22.6%), 50(21.4%) used to flush to a lined pit latrine, discharge somewhere 28(12%), and VIP 15(6.4%).(40)

This study showed only 31(10.2%) households safely manage fecal sludge, 44(14.6%) access to basic service, 131(43.4%) limited, and 28(9.3%) unimproved and 68(22.5%) access to any form of toilet facility.

More than half 206(68.2%) accessed improved facilities. From while about 135(57.7%) were shared facilities at least between two or more households. Of the facilities observed 143(38.9%) were treated either in-suite or emptied safely as reported by respondents.(41)

A total of seven sanitation options were evaluated by expertise and FGDs. Five Criteria were considered; health and environmental benefits, economical affordability, social acceptability, Institutional capacity,and technical feasibility. Different credit was given for each criterion by the group discussion to select sustainable sanitation technology options. The multi-criteria analysis was applied and the result shows; flush to septic tanks, compost toilets, and biogas toilets were the three alternatives ranked in the final analysis for this particular study area.

Households indicate that status and standing considerations are only a peripheral motive for construction. Analysis further reveals that previous sanitation programs and marketing campaigns were not successful in increasing sanitation coverage in the kebele studied. Slogans focusing on standing do not stimulate households to construct a private latrine, because it appears that respect and status are not associated with private latrine ownership and can even cause an overestimation of sanitation market prices. We further assert that promoting latrine ownership by using health-based messages might be problematic given that (both positive and negative) health effects are delayed and difficult to connect to the sanitation involvement. In an environment with low sanitation coverage rates, pathogen contamination in general, irrespective of few individual households investing in private sanitation, still presents a significant risk to both latrine using and non-using households.(42)

These initiatives are a welcome addition to the sanitation landscape, but in order for these models to be successful, they will need capable champion within the municipalities. The municipalities, in turn, need to develop a clear understanding of how these innovations fit into the larger goal of comprehensive citywide sanitation(43). Shared sanitation facilities are often not considered “improved” sanitation facilities since they do not hygienically separate human waste from human contact(44).

CHAPTER SEVEN

7 CONCLUSION AND RECOMMENDATION

7.1 Conclusion

Sanitation of urban slums in the town was low coverage. More of the technology options were traditional which are not sustainable, and unimproved. Only 10 % reported using safely managed sanitation service. Considering sustainability criteria and multi-criteria analysis septic tanks, compost toilets, and biogas toilet options were the three alternatives for the urban slum of Jimma town. The coverage of those sanitation technology options was very low that more than 70% of the households used other than the sustainable sanitation options. Only septic tanks were reported in use among some of the householders. so building latrine it does not mean the full sanitation but is reduced some risk.

7.2 Recommendation

❖ Town Municipality, Urban health Workers and stakeholders

- Should mobilize Sustainable sanitation options like septic tanks, biogas toilet, and compost toilet.
- Technical support should be added to the community effort to shift to sustainable technology options.

❖ Research institutions

- Demonstrate alternative options for the urban slum community.
- Should test those alternatives.

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ANNEXES

Annex 1: Household Survey Questioner English version

JIMMA UNIVERSITY

ISTITUTE OF HEALTH SCIENCE

Department Environmental Health Science & Technology

Questionnaire prepared to identify Household _____, Ethiopia

Consent form

Hallo! Good morning/afternoon?

My name is -----I am here today to collect data on Household _____ of _____.

The objective of _____ is _____ . Your correct and genuine answer to the questions can make the study achieve its goals. Therefore, you are kindly requested to respond voluntarily with patience. The interview may take 30-45 min. we assure you that this study is surely confidential, thus writing your name is not needed. Are you willing to participate in the interview? yes (go) No (stop)

Gender of the respondent male Female

Interviewer script:-To begin, we would like to get some basic information about you and your household

Q#	Question	Response	Skip
01.	Are you the head of this household?	<input type="checkbox"/> Yes.....1=====→ <input type="checkbox"/> No.....0	to 103
02.	Is this head of this household a male or female?	<input type="checkbox"/> Male.....1 <input type="checkbox"/> Female0	
03.	How old were you on your last birthday?	_____ Age in completed years	
04.	What is the highest level of school the head of the household attended?	<input type="checkbox"/> Cannot read & write...0 <input type="checkbox"/> Can read & write-----1 <input type="checkbox"/> Primary(1-8).....2 <input type="checkbox"/> Secondary9-12).....3 <input type="checkbox"/> Technical(10+)4 <input type="checkbox"/> collage (10+3).....5 <input type="checkbox"/> Above (>=12+).....6	
05.	What is your marital status now?	<input type="checkbox"/> Married or living in the union...1 <input type="checkbox"/> Single.....2 <input type="checkbox"/> Widowed.....3 <input type="checkbox"/> Separated.....4 <input type="checkbox"/> Divorced.....5	

06.	What is the highest level of school-level your wife/husband has attended?	<input type="checkbox"/> Cannot read & write...0 <input type="checkbox"/> Can read & write-----1 <input type="checkbox"/> Primary(1-8).....2 <input type="checkbox"/> Secondary9-12).....3 <input type="checkbox"/> Technical(10+)4 <input type="checkbox"/> collage (10+3).....5 <input type="checkbox"/> Above (>=12+).....6																
07.	What is the household head occupation?	<input type="checkbox"/> Farmer.....1 <input type="checkbox"/> Government employee2 <input type="checkbox"/> Merchant3 <input type="checkbox"/> Private work/NGO.....4 <input type="checkbox"/> Day laborer5 <input type="checkbox"/> Others (specify)																
08.	What is the wife/ spouse occupation?	<input type="checkbox"/> Farmer.....1 <input type="checkbox"/> Government employee2 <input type="checkbox"/> Merchant3 <input type="checkbox"/> Housewife.....4 <input type="checkbox"/> Privet work/NGOs.....5 <input type="checkbox"/> Day laborer6 <input type="checkbox"/> Other..... (specify)																
09.	How many people usually live in this house? [NOTE: If a person stays half of the week in the household and shares food from the same pot then s/he should be considered as a household member]	_____ People																
010.	What was the main material of the floor of the main house? [<i>Record observation.</i>]	<input type="checkbox"/> Earth0 <input type="checkbox"/> Cement/ceramic1 <input type="checkbox"/> Other.....(specify)																
011.	What was the main material of the walls of the main house? [<i>Record observation.</i>]	<input type="checkbox"/> Wood0 <input type="checkbox"/> Wood and Earth.....1 <input type="checkbox"/> Cement.....2 <input type="checkbox"/> Other.....96 (Specify)																
012.	What was the main material of the roof main house? [<i>Record observation.</i>]	<input type="checkbox"/> Grass.....1 <input type="checkbox"/> Iron sheet2 <input type="checkbox"/> other.....3																
013.	Does any member of this household own: (<i>Read each item and tick([✓] yes/no</i>) <ul style="list-style-type: none"> ○ A bicycle? ○ A motorcycle or motor scooter? ○ An animal-drawn cart? ○ A car or truck? 	<table border="1"> <thead> <tr> <th></th> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>Bicycle</td> <td><input type="checkbox"/> 1</td> <td><input type="checkbox"/> 0</td> </tr> <tr> <td>Motorcycle or scooter</td> <td><input type="checkbox"/> 1</td> <td><input type="checkbox"/> 0</td> </tr> <tr> <td>Animal-drawn cart</td> <td><input type="checkbox"/> 1</td> <td><input type="checkbox"/> 0</td> </tr> <tr> <td>Car/truck</td> <td><input type="checkbox"/> 1</td> <td><input type="checkbox"/> 0</td> </tr> </tbody> </table>		Yes	No	Bicycle	<input type="checkbox"/> 1	<input type="checkbox"/> 0	Motorcycle or scooter	<input type="checkbox"/> 1	<input type="checkbox"/> 0	Animal-drawn cart	<input type="checkbox"/> 1	<input type="checkbox"/> 0	Car/truck	<input type="checkbox"/> 1	<input type="checkbox"/> 0	
	Yes	No																
Bicycle	<input type="checkbox"/> 1	<input type="checkbox"/> 0																
Motorcycle or scooter	<input type="checkbox"/> 1	<input type="checkbox"/> 0																
Animal-drawn cart	<input type="checkbox"/> 1	<input type="checkbox"/> 0																
Car/truck	<input type="checkbox"/> 1	<input type="checkbox"/> 0																

01.	Does any member of your household have: (<i>Read each item and tick</i> ([✓] yes/no) ○ A radio? ○ A telephone/mobile phone? ○ Television?		Yes	No	
		Radio	[] 1	[] 0	
		Telephone/mobile	[] 1	[] 0	
		Television	[] 1	[] 0	
02.	What is the average monthly income of your family?	_____ ETB			
03.	Does the house visit by health workers in the last three months?	[] Yes.....1 [] No.....0 =====➔			to 129
04.	How many times did they visit?	[] One time.....1 [] Twice2 [] More than twice.....3			
05.	Do they discuss toilet or environmental sanitation issues with you/family member?	[] Yes.....1 [] No.....0			
06.	What is the main source of drinking water for members of your household?	[] Tap water(pipeline).....1 [] Protected Spring/well2 [] Rainwater.....3 [] Unprotected Spring/well/surface. [] Other..... 96 (Specify)			
Latrine knowledge and perception					
07.	Where do adults in your household usually go to defecate?	[] Household latrine ----1 [] Other latrine -----2 [] Open defecation –near house-----3 [] Open defecation –field/forest -----4 [] Other96 specify			
08.	How many meters is this place from your house?	_____meters			
09.	How satisfied are your current defecation place?	[] very satisfied -----1 [] satisfied -----2 []unsatisfied -----3 []very unsatisfied -----4 [] don't know-----5			
10.	Do you have children age less than five years?	[] Yes -----1 [] No-----0			
11.	In your household, how are babies' feces usually disposed of? [Check only which is very often]	[] put into a latrine -----1 [] put into drain/ditch-----2 [] thrown in the garbage -----3 [] buried -----4 [] left in open-----5 [] other96 specific			

<p>012.</p>	<p>What type of latrine do you know about? [Do not read options, check all that apply]</p>	<p>[] flush/pour-flush-----1 [] Ventilated improved pit latrine-----2 [] Pit latrine with slab-----3 [] Composting toilet -----4 [] Other96 specify</p>	
<p>013.</p>	<p>What kind of latrine would you most prefer for your household? [Read all options, check only one]</p>	<p>[] Flush/pour-flush -----1 [] Ventilated improved pit latrine-----2 [] Pit latrine with slab-----3 [] Composting toilet-----4 [] I don't know. -----5 [] other96 Specify</p>	
<p>014.</p>	<p>What particular features do you like the most about your preferred latrine? [Do not read options, check all that apply]</p>	<p>[] Looks good/comfortable1 [] No smell.....2 [] No flies3 [] Don't see feces.....4 [] Easy to clean.....5 [] Don't need water to flush6 [] Less expensive7 [] Others96 Specify</p>	
<p>015.</p>	<p>Do you know anyone who can build this type of latrine?</p>	<p>[] Yes1 [] No.....0</p>	
<p>016.</p>	<p>Does having a latrine have disadvantages?</p>	<p>[] Yes1 [] No.....0</p>	
<p>017.</p>	<p>What are the disadvantages of owning a latrine? [Do not read options, check all that apply]</p>	<p>[] Bad smell1 [] Attracts flies.....2 [] Cost to maintain it.....3 [] Work to maintain it4 [] Other people can use it.....5 [] Affect groundwater.....6 [] Overflows7 [] No disadvantages.....8</p>	
<p>018.</p>	<p>What are the advantages of owning a latrine? [Do not read options, check all apply]</p>	<p>[] Improved hygiene/health/cleanliness.....1 [] More privacy2 [] More comfortable3 [] Convenience/save time.....4 [] Improved safety5 [] Improved status /prestige.....6 [] Guests can use it7 [] No advantages.....8 [] Don't know.....9 [] others96 Specify</p>	

019.	How important is spending money for a good latrine to your family's health? [Read all options, check only one]	<input type="checkbox"/> Very important.....1 <input type="checkbox"/> Quite important2 <input type="checkbox"/> No so important.....3 <input type="checkbox"/> Not important at all.....4 <input type="checkbox"/> Don't know5	
020. Latrine ownership			
021.	Do you own a latrine?	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No -----0→.....skip	
022.	If yes, is the latrine functioning now? [Observe the functionality]	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No0	
023.	If no, why not? [Do not read options, check all that apply]	<input type="checkbox"/> Dirty1 <input type="checkbox"/> Full.....2 <input type="checkbox"/> No water to flush.....3 <input type="checkbox"/> Slab broken.....4 <input type="checkbox"/> Superstructure broken/missing.....5 <input type="checkbox"/> Not finished building.....6 <input type="checkbox"/> Using as storage7 <input type="checkbox"/> Smells bad.....8 <input type="checkbox"/> Prefer the field/forest.....9 <input type="checkbox"/> Other96 Specify	
024.	Do adults in your household use the latrine for defecation? [Read options, select one]	<input type="checkbox"/> always1 <input type="checkbox"/> sometimes.....2 <input type="checkbox"/> never.....3 <input type="checkbox"/> don't know...4	
025.	Do children in your household use the latrine for defecation? [Read options, select one]	<input type="checkbox"/> always1 <input type="checkbox"/> sometimes.....2 <input type="checkbox"/> never.....3 <input type="checkbox"/> don't know...4	
026.	Does anybody from neighboring households use/share your latrine?	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No.....0	
027.	If you didn't have this latrine to use, where would you go to defecate? [Don't read options check all that apply]	<input type="checkbox"/> Public latrine.....1 <input type="checkbox"/> Neighbor's latrine.....2 <input type="checkbox"/> Relatives latrine3 <input type="checkbox"/> Field /forest.....4 <input type="checkbox"/> Others.....96 Specify	

<p>028.</p> <p>What kind of latrine do you have? [Observe]</p>		<p>[] Pour flush latrine to sewer system ...1 [] Piped septic tank2 [] Pit latrine.....3 [] Flush Elsewhere/Open field.....4 [] Don't know.....5 [] VIP Latrine.....6 [] Pit latrine with slab.....7 [] Pit latrine without slab/open pit.....8 [] Composting toilet.....9 [] Other96 specify</p>	
<p>029.</p> <p>What kind of below-ground structure does your latrine have?</p>		<p>[] Unlined pit.....1 [] Lined pit-beneath latrine.....2 [] Lined pit-offset.....3 [] Piped sewerage.....4 [] Don't know.....5 [] Other 96 Specify</p>	
<p>030.</p> <p>What kind of slab does your latrine have? [observe and check one]</p>		<p>[] Wooden slab1 [] Concrete slab.....2 [] Pour flush3 [] Western toilet bowl.....4 [] Other96 specify</p>	
<p>031.</p> <p>What kind of shelter walls does your latrine have? [Observe if possible, check one. If more than one wall material is used, choose the material that covers the largest area]</p>		<p>[] concrete/brick.....1 [] fibrous cement.....2 [] galvanized steel3 [] wood.....4 [] thatch.....5 [] plastic sheet.....6 [] salvage materials.....7 [] no walls.....8 [] others.....96 Specify</p>	
<p>032.</p> <p>What kind of shelter roof does your latrine have? [Observe if possible, check one. If more than one wall material is used, choose the material that covers the largest area]</p>		<p>[] concrete.....1 [] fibrous cement2 [] galvanized steel3 [] tiles4 [] thatch5 [] plastic sheet6 [] salvage materials.....7 [] no roof8 [] others.....96 specify</p>	
<p>033.</p> <p>Do you use your latrine for bathing?</p>		<p>[] Yes.....1 [] No0 =====></p>	<p>To</p>

034.	How much water per day does your household usually need to flush the latrine?	<input type="checkbox"/> less than 5 liters.....1 <input type="checkbox"/> 6 to 15 liters.....2 <input type="checkbox"/> 16 to 25 liters.....3 <input type="checkbox"/> more than 26 liters.....4	
035.	Do you have enough water to flush the latrine in the dry season?	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No.....0	
036.	What is the level of your satisfaction with the type of toilet you own currently?	<input type="checkbox"/> Very dissatisfied1 <input type="checkbox"/> Dissatisfied2 <input type="checkbox"/> Neutral.....3 <input type="checkbox"/> Satisfied4 <input type="checkbox"/> Very much satisfied.....5	
037.	In what ways is your current latrine different from your old latrine? [check all that apply]	<input type="checkbox"/> pit now lined1 <input type="checkbox"/> walls are improved.....2 <input type="checkbox"/> roof is improved3 <input type="checkbox"/> slab is improved4 <input type="checkbox"/> has a pan.....5 <input type="checkbox"/> pan is now pour-flush.....6 <input type="checkbox"/> has ventilation.....7 <input type="checkbox"/> has hand washing area.....8 <input type="checkbox"/> has door.....9 <input type="checkbox"/> other96 Specify	
038.	What year was your first latrine built? [Best estimate]	_____year	
039.	Did you receive assistance from any organization to build your latrine? [e.g. free/subsidizing materials or labor, technical advice, etc.]	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No0 <input type="checkbox"/> Don't know.....96	
040.	How much did you pay for your latrine? [if possible , enter material and labor costs separately]	<input type="checkbox"/> Total cost_____ETB <input type="checkbox"/> Material cost_____ETB <input type="checkbox"/> Labor cost_____ETB <input type="checkbox"/> In kind contribution , value unknown	
041.	In the future, do you plan to make changes/improvements to your latrine?	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No.....0.....skip to <input type="checkbox"/> Don't Know.....96	

<p>042.</p> <p>What changes /improvements do you plan to make?</p> <p>[Read options, check all that apply]</p>		<p>[] line the pit.....1</p> <p>[] Improve the wall.....2</p> <p>[] Improve the roof3</p> <p>[] Improve the slab.....4</p> <p>[] Get pan.....5</p> <p>[] Get pour-flush pan.....6</p> <p>[] Add ventilation pipe to pit.....7</p> <p>[] Build water storage tank.....8</p> <p>[] Build bathing area.....9</p> <p>[] Build hand washing area.....10</p> <p>[] Build door11</p> <p>[] Move to side the house12</p> <p>[] Other96 Specify</p>	
<p>043.</p> <p>Has your latrine pit ever been emptied?</p>		<p>[] Yes1</p> <p>[] no.....0.....skip</p> <p>[] don't know ...96.....skip</p>	
<p>044.</p> <p>If yes, what do you do with the content?</p> <p>[Read options, check all that apply]</p>		<p>[] Spread on the field as fertilizer1</p> <p>[] Dumped in the forest.....2</p> <p>[] Dumped in the river/pond/canal.....3</p> <p>[] Empty pit content into new hole.....4</p> <p>[] Other96 .specify</p>	
<p>045.</p> <p>When the pit fills up, how long do you wait before emptying it?</p> <p>[check only one option]</p>		<p>[] None(emptied right away)1</p> <p>[] Less than one month.....2</p> <p>[] 1-6 months.....3</p> <p>[] 7-12 months.....4</p> <p>[] More than 12 months5</p> <p>[] Don't Know.....96</p>	
<p>046.</p> <p>Have you ever hired someone to empty your pit? (Is there anyone who gives emptying service?)</p>		<p>[] Yes.....1</p> <p>[] No.....0</p> <p>[] Don't Know.....96</p>	
<p>047.</p> <p>How much you pay for one trip emptying the toilet?</p>		<p>_____ETB</p>	
<p>048.</p> <p>What is the level of satisfaction with the cost?</p>		<p>[] very dissatisfied1</p> <p>[] Dissatisfied2</p> <p>[] Neutral..... ..3</p> <p>[] satisfied4</p> <p>[] Very much satisfied.....5</p>	
<p>049. Non-latrine owners</p>			

050.	Where would you go to defecate? [Don't read options check all that apply]	<input type="checkbox"/> Public latrine.....1	1
		<input type="checkbox"/> Neighbor's latrine.....2	
		<input type="checkbox"/> Relatives latrine3	
		<input type="checkbox"/> Field /forest4	0
		<input type="checkbox"/> Others.....96 <i>Specify</i>	
051.	Has your household ever thought about or discussed building a latrine for your family?	<input type="checkbox"/> Yes.....1	
		<input type="checkbox"/> No0 =====> skip to	
052.	If yes, when was the last time discussed this?	<input type="checkbox"/> less than one month ago.....1	
		<input type="checkbox"/> 1-6 months ago.....2	
		<input type="checkbox"/> 7-12 months ago.....3	
		<input type="checkbox"/> more than 1 year ago.....4	
053.	Who in your household would make the final decision to build a latrine?	<input type="checkbox"/> Head1	
		<input type="checkbox"/> Spouse2	
		<input type="checkbox"/> Husband and wife jointly.....3	
		<input type="checkbox"/> All(joint decision)4	
		<input type="checkbox"/> Other96 <i>Specify</i>	
054.	Do you have enough places to build a latrine?	<input type="checkbox"/> Yes.....1	
		<input type="checkbox"/> No0.....skip to	

Latrine design assessment sheet for onsite sanitation

Code	Variables	Options	Data sources /methods
055.	Drop hole cover	<input type="checkbox"/> Covered /Yes.....1	Observation
		<input type="checkbox"/> Not covered/No2	
056.	Vent pipe	<input type="checkbox"/> Have vent pipe/Yes.....1	Observation
		<input type="checkbox"/> Not have vent pipe / no2	
057.	Availability of doors	<input type="checkbox"/> Yes.....1	Observation
		<input type="checkbox"/> No.....0	
058.	Door type	<input type="checkbox"/> Timber1	Observation
		<input type="checkbox"/> Metallic2	
		<input type="checkbox"/> Roofing sheets.....3	
		<input type="checkbox"/> Polyethylene.....4	
		<input type="checkbox"/> other5	
059.	Nature of pit	<input type="checkbox"/> Direct discharge1	Observation
		<input type="checkbox"/> Containment2	

060.	Latrine stance	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No0	Observational
061.	Stance length	-----meters	Measurements
062.	Stance width	_____meters	Measurements
063.	Stances number	------(count)	Count
064.	Manhole	<input type="checkbox"/> Yes.....1 <input type="checkbox"/> No.....0	Observation
065.	Sign of pit latrine collapse	<input type="checkbox"/> No cracks were seen.....0 <input type="checkbox"/> Cracks saw structure.....1	Observation
066.	Sign of rain or stormwater entry	<input type="checkbox"/> No rain or storm.....0 water entry	Observation
		<input type="checkbox"/> Rain/storm water entry.....1	
067.	How often the latrine is cleaned	<input type="checkbox"/> Before or after use.....1 <input type="checkbox"/> When dirty2 <input type="checkbox"/> Daily.....3	Interview
068.	Non-flooding area	<input type="checkbox"/> Non-flooding area ...0	Assessment and interviews
		<input type="checkbox"/> Flooding area.....1	
069.	Level of pit content	<input type="checkbox"/> Empty, half-full.....1 <input type="checkbox"/> Full, overflowing.....0	Measurement
070.	Latrine cleanliness	<input type="checkbox"/> clean, fairly clean.....1 <input type="checkbox"/> dirty, very dirty.....0	Observation
071.	Latrine smell	<input type="checkbox"/> no smell, slight smell.....1 <input type="checkbox"/> moderate, strong and very strong smell.....0	Observation
072.	Latrine flies	<input type="checkbox"/> No, few flies.....1 <input type="checkbox"/> Many flies0	Observation

Annex 2: Household Survey Questioner Afan Oromo version

Unka waliigalaa

Hello! Akkam bultan /ooltan/? Maqan koo ----- har'a kan ani asitti argameef "Itti fayyadaamaa fi filannoo mana fincanii ilaalchisaa" qorannoo geggeessaa jirruuf ragaa funannachuudha. Qorannoon kuni Barataa saayiniisif naannoo fi teknolojii kan digirii 2ffaa kan ta'ee **Keenyaan** kan geggeeffamuudha. Kaayyoo qorannoo kanaa galmaan ga'uuf, deebiin dhugaa fi qajeelaan isin gaaffii keenyaaf deebistan akeeki qorannoo kanaa akka bakka ga'u godha. Kanaafuu, obsaa fi heeyyama keessaniin deebii keessan akka nuuf arjoomtan isin gaafanna. Gaaffii fi deebiin kun daqiiqaa 30-45 fudhachuu danda'a.

Qorannoo kanaaf deebiin isin kenitan iccitiin akka qabaman isiniif mirkaneessina.

Maqaa keessan hin barreeffamu. G aaffiifi deebii kana gochuuf heeyyamammoodhaa?

[] eeyyee (itti fufi) miti [] (asumarratti dhaabi)

lak#	gaaffii	Deebii	Skip
014.	Isin abbaa manaa (maatii) kanaatii?	[] eeyyee.....1=====➔ [] miti.....0	to 03
015.	Kan mna kna hoogganu (bulchu) saalaan dhiira moo dhalaa dha?	[] dhiira.....1 [] dhalaa0	
016.	Umuriin keessan meeqaa?	Waggaa _____ xumureera	
017.	Abbaan manaa hanga kutaa meeqaatti barate?	_____	
018.	Amma haalli gaa'ela keessanii akkami (maal fakkaata)?	[] gaa'ela waliin jiru..1 [] kan qofaa (hin fuune).....2 [] kan jalaa du'e.....3 [] kan adda adda jiraatan.....4 [] kan walii hikan.....5	
019.	Haati manaa (abbaan manaa) keessan hanga meeqaatti baratan?	_____	
020.	Hojiin abbaa manaa maali?	_____	
021.	Hojiin haadha manaa maali?	_____	
022.	Baayinni maatii meeqa?	nama _____	
023.	Manni keessan lafti isaa maal irraa hojjetame? [ilaaluun kan galmaa'u.]	[] biyyoo0 [] simmintoo1 [] kan biraa.....(barreessi)	
024.	Keenyan (girgidnaan) mana keessanii maal irraa hojjetame? [ilaaluun kan galmaa'u.]	[] muka0 [] muka fi biyyoo1 [] simmintoo.....2 [] kan biraa.....96 (maqaan barreessi)	
025.	Gardafoon (xaariyaan) mana keessanii maal irraa hojjetame? [ilaaluun kan galmaa'u.]	[] citaa /caffee/.....1 [] qorqorroo2 [] kan biraa.....3	
026.	Maatii keessan keessaa namni:		
	Saayikilii	[] 1	[] 0

		Mootera saayikilii	[] 1	[] 0	
		geejjiba beeyladaa	[] 1	[] 0	
		Konkolaataa	[] 1	[] 0	
014	Maatii keessan keessaa namni: (hunda dubbisaatii fuulduratti mallattoo godhaa (<i>eeyyee/miti</i>) [✓]	eeyyee		miti	
		raadiyoo	[] 1	[] 0	
		Bilbila	[] 1	[] 0	
		Talaviziyoona	[] 1	[] 0	
015	Ji'aan galiin maatii giddu galeessaan qarshii meeqa ta'a?	Qarshii _____			
016	Maatiin kun bishaan dhuggatii eessaa argatu?	[] Bishaan boombaa.....1 [] Bishaan boollaa eegame2 [] Bishaan roobaa.....3 [] Bishaan boollaa kan hin eegamne--4. [] kan biraa..... 96 (haa ibsamu)			
Beekumsa fi ilaalcha waa'ee mana fincaanii (mana boolii)					
017	Miseensi maatii ga'eessi eessatti boolii ba'u?	[] mana fincaanii kan maatii ----1 [] mana fincaanii nama biraa -----2 [] Dirree (daggala) naannoo manaa jiru--3 [] kan biraa 96 (haa ibsamu)			
018	Mana irraa hangam fagaata?	meetira _____			
019	Iddoo itti boolii baatan kanatti hangam gammadoodha?	[] baay'een itti gammada -----1 [] ittan gammada -----2 [] itti hin gammadu -----3 [] baay'ee itti hin gammadu -----4 [] hin beeku -----5			
020	Daa'ima waggaa shanii gadii qabduu?	[] eeyyee -----1 [] hin qabu-----0			
021	Boolii daa'ima keessanii eessatti dhangalaastu? [kan yeroo baayee godhamu qofa barreessi]	[] mana fincaaniitti naqama -----1 [] bo'oo /daaqaatti) naqama-----2 [] balfa keessatti naqama -----3 [] ni awwaalama -----4 [] lafa duwaa irratti dhangalaafama-----5 [] kan biraa96 haa ibsamu			
022	Gosa mana fincaanii beektan natti himaa. [filannoo hin dubbisin waan isaan himan qofa barreessi]	[] bishaan itti naqamee akka deemmu godhamu---1 [] boolla fincaanii qilleensa akka argatu godhamu -2 [] boolla qadaada qabu-----3 [] Koompoostii oomishuuf kan oolu--4 [] kan biraa96 haa ibsamu			
023	Gosa mana fincaanii kam maatii keessaniif filattu?	[] bishaan itti naqamee akka eemu godhamu---1 [] boolla fincaanii qilleensa akka argatugodhamu -2 [] boolla qadaada qabu-----3 [] Kompoostii oomishuuf kan oolu --4 [] hin beeku. -----5 [] kan biraa96 haa ibsamu			

024	Manni fincaanii filatan maal akka ta'u barbaadu?	[] kan mijatu akka ta'u1 [] foolii kan hin qabne.....2 [] Tisiisa kan hin qabne3 [] Boolii argaa kan dhoksu.....4 [] qulqulleesuuf salpha kan ta'e.....5 [] bishaan itti naquu hin barbaadu6 [] kan gatiin isaa rakasa ta'e7 [] kan biraa96 haa ibsamu	
025	Mana fincaanii qabaachuun miidhaa qaba?	[] eeyyee1 [] hin qabu.....0	
026	Mana fincaanii qabaachuun miidhaa maalii qaba?	[] foolii gadhee qabaata1 [] Tisiisa harkisa.....2 [] ijaaruuf baasii guddaa gaafata.....3 [] akka turu hojjechuu gaafata4 [] nama biraatu itti fayyadama.....5 [] bishaan lafa jalaa miidha.....6 [] guutee dhaangala'a7 [] midhaa hin qabu.....8	
027	Faayidaa manni fincaanii qabu maali?	[] qulqullina eeggachuuf gaariidha.....1 [] dhuunfaan/kophaa/ itti fayyadamuuf2 [] ni mijata3 [] yeroo qusata.....4 [] Nageenya mirkanessa5 [] heera fayyaa qabaata.....6 [] keessummaan itti gargaarama7 [] faayidaa hin qabu.....8 [] hin beeku.....9 [] kan biraa96 haa ibsamu	
028	Qarshii baastee mana fincaanii gaarii ijaaruun hangam maatii keef barbaachisaa dha? [hunda dubbisii tokko qofa keessa filachiisi]	[] baay'ee barbaachisaadha.....1 [] xiqqoo ni barbaachisa2 [] hin barbaachisu3 [] gonkuma hin barbaachisu.....4 [] hin beeku5	
mana fincaanii qabaachuu			
029	Mana fincaanii qabduu?	[] eeyyee.....1 [] hin qabnu -----0→skip	
030	Yoo qabna jettan,amma ni hojjetaa(tajaajila ni kennaa)?	[] eeyyee.....1 [] hin kennu0 [hojjechuu isaa ilaaluu]	

031	Yoo hin hojjetu ta'e maaliifi?	[] kosaayee /xuraayee/1 [] guutee.....2 [] bishaan dhabee.....3 [] Qadaada waan hin qabneef.....4 [] ijaarsa isaatu caccabe.....5 [] ijaaramee hin dhumne6 [] akka mana kuusaatti fayyada7 [] foolii gadhee waan qabuuf.....8 [] bosona waanan filadhuuf.....9 [] kan biraa96 haa ibsamu	
032	Ga'eessotni mana fincaanii ni fayyamuu?	[] yeroo hundaa1 [] al tokko tokko.....2 [] hin fayyadamani.....3 [] hin beeku...4	
033	Maatii olla keessanii keessaa namni isin waliin mana fincaanii fayyadamu?	[] eeyyee.....1 [] hin jiru.....0	
034	Mana fincaanii akaakuu akkamii qabdu? [ilaali]	[] bishaan itti naquun akka deemu kan godhamu ...1 [] kan boollaa2 [] ujummoon bakka kuusaa isaa akka deemu kan ghamu-3 [] dirree.....4 [] hin beeku.....5 [] kan namni beekamaan itti gargaaramu.....6 [] kan boollaa, garuu kan qadaada hin qabne.....7 [] kan boollaa, garuu kan qadaada qabu.....8 [] kan xaa'oottii geedaramu.....9 [] kan biraa96 haa ibsamu	
035	Boolli mana fincaanii keessanii keessi isaa akaakuu akkamiiti?/pit	[] ijaarsa kan hin qabne/unlined1 [] ijaarsa lafa jalaa kan qabu/lined.....2 [] Ujummoon dirree irratti kan yaa'u.....- 3 [] Ujummo bakka balfi itti gatamu geessu kan qabu ...4 [] hin beeku.....5 [] kan biraa 96 haa ibsamu	
036	Akaakuun qadaada mana fincaanii keessanii kan akkamiiti? slab [ilaalii waan argite guti]	[] kan muka irraa hojjetame1 [] kan simmintoo irraa hojjetame.....2 [] bishaani kan itti dhagalaafamu3 [] saahanii kan ammayyoome.....4 [] kan biraa96 haa ibsamu	
037	Girgiddaan /Adeemuun) mana ficanii maali irraa hojjetame? [yoo danda'ame ilaalii, waan lamaaf isaa oli irraa yoo ijaarame isa caalimaa fayadaman galimeesi]	[] polokeetiin/xuubiin irraa kan hojjetame.....1 [] walitti makaa wantootaa irraa kan hojjetame.....2 [] Qorqorroo /sibiila/ irraa kan hojjetame3 [] muka irraa kan hojjetame.....4 [] citaa/caffee/ irraa kan hojjetame.....5 [] laastika/sharaa irraa kan hojjetame.....6 [] wantoota gataman irraa kan hojjetame.....7 [] girgidaa hin qabu.....8	

		[] kan biraa.....96 haa ibsamu	
038	Gardafoon isaa maal irraa hojjetame? [yoo danda'ame ilaalii, waan lamaaf isaa oli irraa yoo ijaarame isa caalimaa fayadaman galimeesi]	[] Qorqorroo /sibiila/ irraa kan hojjetame.....3 [] citaa/caffee / irraa kan hojjetame.....5 []] laastika/ irraa kan hojjetame.....6 [] wantoota gataman irraa kan hojjetame.....7 [] Gardafoo hin qabu.....8 [] kan biraa.....96 haa ibsamu	
039	Mana fincaaniitti naquuf guyyaatti bishaan hangamii fayyadamtu?	liitira _____	
040	Yeroo bonaa mana fincaaniif bishaan ga'aa ni argattu?	[] eeyyee.....1 [] hin argannu.....0	
041	Mana fincaanii amma qabdaniif hangam gammadoodha?	[] baay'een gammada1 [] gammachuu hin qabu2 [] nan gammachiisus nan jibbisiisus.....3 [] nan gammada4 [] baay'ee baay'een itti gammada.....5	
042	Manni fincaanii keessan kun waggaa meeqa ta'eera? [tilimaama gariin]	Waggaa _____	
043	Gara fuulduraatti mana fincaanii keessan fayyessuuf karoora qabdu?	[] eeyyee.....1 [] hin qabu0.....skip to [] hin beeku.....96	
044	Jijjiirama akkamii karoorfattan? [filannoo hunda dubbisi, filannoo hunda galmeessi]	[] toora boollaa.....1 [] girgiddaa fayyessuu.....2 [] garafoo fooyyeessuu3 [] qadaada fooyyeessuu.....4 [] Saanii gooliboo.....5 [] saanii goliboo bishaan irraatti naqama.....6 [] karaaa /ujummoo/hafuura ittiin baafatu hojjechu.....7 [] kuusaa bishaanii ijaruu.....8 [] bakka qaama dhiqannaa fooyyessuu.....9 [] bakka harka dhiqannaa fooyyessuu.....10 [] balbala fooyyessuuu11 [] bakka isaa jijjiiruu12 [] kan biraa96 haa ibsamu	
045	Boolli man fincaanii keessan keessaa xuuchiftanii beektuu?	[] eeyyee1 [] ta'ee hin beeku.....0.....skip [] hin beeku...96.....skip	

046	Mana fincaanii keessan bollii keessaa xuuchiftan yoo ta'e qabiyyeesaa eessatti gattan? [filanno hunda dubbisii kan filatame hunda guuti]	[] akka xaa'ootti dirree irratti naquun fayyadamne.....1 [] caakkaa keessatti dhangalaasne.....2 [] Qaama bishaanii irratti dhangalaasne.....3 [] bollaa biraatti dhangalaasne4 [] kan biraa96 haa ibsamu	
047	Boolla mana fincaanii kana duwwa gochuuf al-tokkotti qarshii hangamii baasitan?	Qarshii _____	
048	Baasii baastaniif hangam gammaddan?	[] baay'een gammade1 [] itti hin gammadne2 [] hin gammadnes hin jibbines.....3 [] itti gammadeera4 [] baayee baay'een itti gammade.....5	

Gaaffii namoota mana fincaanii hin qabneef

049	Boollii eessatti baatu? /filannoo hin dubbisin kan deebisan guuti/	[] mana fincaanii kan waliinii (kan ummataa)...1 [] mana fincaanii kan ollaa.....2 [] mana fincaanii kan firaa3	1
		[] dirree /bosona/4 [] kn biraa.....96 haa ibsamu	0
050	Maatii waliin waa'ee ijaarsa mana finaanii mari'attanii beektuu?	[] eeyyee.....1 [] mari'annee hin beeknu0 =====> skip to	
051	Yoo mari'attaniittu ta'e yeroon dhumaa itti mari'attan yoomi?	[] ji'a tokko asi.....1 [] ji'a tokko hanga jia'aa darban.....2 [] jia'a torbaa hanga kudha lamaa darban.....3 [] waggaa tokkoon dura.....4	
052	Maatii keessan keessaa murtee mana fincaanii ijaaru isa dhumaa kan godhu eenyu?	[] abbaa manaa1 [] haadha manaa2 [] haadha manaa fi abbaa manaa.....3 [] maatii hunda)4 [] kan biraa96 haa ibsamu	
053	Mana fincaanii ijaaruuf lafa ga'aa qabduu?	[] eeyyee.....1 [] hin qabnu0.....skip to	

Gaaffilee qajeelcha mana fincaanii waa'ee bakka qulqullinaa baruuf gaafataman

Lak addaa	hurka	filannoo	qalbeeffannaa
054	Boollii haguugaa qabaa/slab	[] haguugamaadha (eeyyee).....1 [] hin haguugamne2	ilaali ilaaluun
055	Ujummoo qileensaa qabaa/vent	[] qaba (eeyyee).....1 [] hin qabu2	Qalbeeffannaan ilaaluun
056	Cufaa qabaa?/door	[] eeyyee.....1 [] hin qabu.....0	Qalbeeffannaan ilaaluun

057	Gosa cufaa/type of door	[] muka1 [] sibiila2 [] qorqorroo.....3 [] laastika.....4 [] kan biraa ----96 haa ibsamu	Qalbeeffannaan ilaaluun
058	Haala uumama boollichaa/pit	[] ujummoon kan dabarfamu1 [] kan kuusamu....-2	Qalbeeffannaan ilaaluun
059	ijaarsa guutuu mana fincaanii	[] ijaarsa qaba1 [] ijaarsa hin qabu0	Qalbeeffannaan ilaaluun
060	Dheerina dhaabaa	Meetira -----	Safaruun
061	Balina dhaabaa	Meetira _____	Safaruun
062	Baayina dhaabaa	------(count)	Lakkaa'uun
063	Qadaada qabaachuu	[] qaba.....1 [] hin qabu.....0	Qalbeeffannaan ilaaluun
064	Boollii man fincaanii tajaajila kennuu dadhabaa jiraachuu isaa mallattoo gad jiguu qabaa?	[] caccabuun irraa hin mul'atu0 []caccabuun irraa mula'ata.....1	Qalbeeffannaan ilaaluun
065	Mallattoon biraan kan akka bishaan galchuu ni mul'ataa	[] hin mula'atu.....0 [] ni mula'ta.....1	Qalbeeffannaan ilaaluun
066	Yeroo akkamii qulqulleeffama	[] itti gargaaramuu duraafi booda...1 [] gaafa kosaa'uu2 [] guyyaa guyyaan.....3	Gaaffii fi deebii
067	Naannoo lolaatti argamaa?	[] naannoo lolaattii hin argamu...0 [] naannoo lolaattii argamu-1	Gaaffii fi deebii
068	Boollichi hangam qabatee jira?	[] duwwaa, walakkaa.....1 [] guutuu, guutee dhangala'aa jira..0	Lakka'uun
069	Qulqullina qabaachuu mana fincaanii	[] qulqulqulludha, xiqqoo qulquluudha...1 [] xuraa'eera, baayee xuraa'eera...0	Qalbeeffannaan ilaaluun
070	Foolii qabaachuu	[] foolii hin qabu, foolii xiqqoo qaba-1 [] foolii giddu galeessa, baayee akkasumas baayee baayee foolii qaba -0	Qalbeeffannaan ilaaluun
071	Tisiisa mana fincaanii	[] hin jiran, muraasa.....1 [] baayeetu jira0	Qalbeeffannaan ilaaluun

Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented for a degree in this or any other university and that all sources of materials used for the thesis have been fully acknowledged.

Name: _____

Signature: _____

Name of the institution: _____

Date of submission: _____

This thesis has been submitted for examination with my approval as University advisor

Name and Signature of the first advisor

Name: _____

Signature: _____

Name and Signature of the second advisor

Name: _____

Signature: _____