FACTORS INFLUENCING ADOPTION OF SANITATION SYSTEMS IN RURAL COMMUNITIES: CASE OF THARAKA-NORTH SUB COUNTY, THARAKA-NITHI COUNTY, KENYA

MUGENDI EDWIN MUTHONI

A Thesis Submitted in partial fulfilment of requirement for the conferment of the degree of Master of Science in Sanitation of Meru University of Science and Technology.

2025

DECLARATION

This thesis is my original work and has not been presented for a degree in any other institution.

EG407/201116/20

Signed_____ Date _____

Mugendi Edwin Muthoni

DECLARATION BY SUPERVISORS

This thesis has been submitted with our approval as University supervisors.

Signed_____ Date _____

Dr. Josphine Mutembei, Ph.D

Meru University of Science and Technology, Kenya

Signed_____ Date _____

Dr. Vitalis Too, Ph.D

Meru University of Science and Technology, Kenya

ACKNOWLEDGEMENT

Am grateful to the almighty God for the good health and progression during the research period. I would like to extend my gratitude and appreciation to my supervisors Dr. Josephine Mutembei and Dr. Vitalis Too. Their dedication and patience when helping me to accomplish this work. I remain challenged by the valuable guidance and support that I received from them and I acknowledge the effort of all lecturers for performing the basis for enlightenment within this research.

DEDICATION

This Thesis is dedicated to my mum Gladys Muthoni and family for their faith and unfaltering understanding, inspiration and moral support through the course period.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

CLTS	Community Led Total Sanitation
CHV	Community Health Volunteer
FAO	Food and Agriculture Organization
GLAAS	Global Analysis and Assessment of Sanitation
JMP	Joint Monitoring Programme
H/H	Household
KNBS	Kenya Bureau of Statistics
KESHP	Kenya Environmental Sanitation and Hygiene policy.
MAXQDA	A professional QDA software for mixed methods and qualitative data analysis.
KESSF	Kenya Environmental Sanitation Strategic Framework
MIRERC	Meru University Research Ethics Review Committee
MOH	Ministry Of Health
NSS	Non-Sewer Sanitation
OD	Open Defecation
ODF	Open Defecation Free
PHO	Public Health Officer
SD	Standard Deviation
SDG	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
STBM	Sanitasi Total Berbasis Masyarakat
STH	Soil Transmitted Helminths
TPB	Theory of Planned Behavior
UNEP	United Nations Environment Programme

UNICEF	United Nations Children's Fund
USD	United States Dollar
UN	United Nations
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WRC	Water Resilience Coalition

OPERATIONAL DEFINITION OF TERMS

Community Led Total Sanitation	A community driven behavior change approach of instilling fear, shame and digest to trigger communities to understand the negative implications of open defecation
Household	People living in the same dwelling unit with a common decision maker and may mostly share meals.
Improved Sanitation	Having access to facilities that completely prevent content with excreta.
Rural Areas	Regions that are geographically located away from cities or towns.
Sanitation Ladder	A sanitation monitoring tool used to determine sanitation progress towards the attainment of safe sanitation.
Sanitation systems	A set of technologist and services which together manage sanitation products along five functional groups of sanitation service.
Sanitation technologies	The specific infrastructure methods or services designed to contain and transform sanitation product.
Sanitation	Conditions relating to the health of the public especially, as used in this study, on safe disposal of human excreta.

Social Cultural Factors	Distinctive aspects in a society related to intellectual material, emotional and spiritual characteristics that facilitate adoption of particular behavior.
Unimproved Sanitation Facilities	Toilets or Latrines which do not completely prevent human feaces from human contacts.

ABSTRACT

The purpose of the study was to evaluate the variables impacting the adoption of sanitation systems in rural communities of Tharaka -North Sub-County, Tharaka Nithi County, Kenya. The study's objectives were to assess how social-cultural factors, economic factors and sanitation technologies affect the adoption of sanitation systems. A convergent mixed methods design was used in the study, which collected both qualitative and quantitative data at the same time. 13 participants in a focus group who were purposely selected were used to provide qualitative data through the use of an interview guide. In order to determine the link between the variables, the quantitative data was analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0 which produced descriptive and inferential statistics. According to the findings, 86% of the inhabitants used pit latrines , some of which lacked slabs and roofs. Additionally, 15% of the households defecated in public, 17% had salaried jobs , and 10% had no jobs. The household income influenced adoption of sanitation systems with a mean of 4.9271 while employment status influenced adoption of sanitation systems with a mean of 4.1146. This economic disparity impacted sanitation access with only 9% of the respondents able to afford ventilated improved pit latrines. The target population of the study was 58,345 people. The sample size was 388 household heads. Cluster sampling, simple random and proportionate random sampling were the sampling techniques employed in the study. Appropriate confirmation of data collection instruments was conducted by characteristics qualified experts before data collection took place. A reliability test using Cronbach's alpha was carried to ascertain whether that data set was fit for analysis within the acceptable threshold. According to the findings, Public Health Officers should train masons to promote acceptable sanitation technology designs for usage in rural communities. Gender inequality should be taken into account while developing sanitation systems regulations. In public and health practices, the Community Led Total Sanitation (CLTS) strategy should focus on open defecation and encourage locals to embrace appropriately designed sanitation facilities, systems and technologies. The study also recommends the need to educate each other on the need to educate each other on the need for the adoption of improved sanitation technologies such septic tanks to increase awareness of safe sanitation systems and adaptability.

CHAPTER ONE: INTRODUCTION

This chapter entails, the background of the study, the statement of the problem, the general objective, the specific objectives, the research questions, the significance of the study, the justification of the study and the assumptions of the study.

1.1 Background of the study

Ensuring access to and use of sanitation facilities for all is the purpose of Sustainable Development Goal (SDG) 6 (United Nations, 2018). The achievement of Sustainable Development Goal (SDG) 6, which aims to guarantee universal access to water and sanitation by 2030, is contingent upon the active participation of multiple stakeholders. Recent projections show that quadrupling the current rate of progress would be needed to achieve SDG6 by 2030 (WHO & UNICEF, 2021).

Effective mutual accountability between stakeholders is critical for driving multi-stakeholder action on SDG 6 with its target on action on access to water, sanitation and hygiene (WASH). Mutual accountability refers to the way that partners work together to build transparent boost systems to hold each other to account (UNICEF, 2020) A recent review of accountability in a WASH context found the need to further develop and invest in accountability and advocacy interventions in the sector (Hepworth *et al.,* 2020)

Open defecation has continued to be a major global concern. The gravity of its negative effect on health and development has placed it in one of the most important global agenda in both political and development forums(Godfrey,2017) A 2018 world bank survey puts at 68% of the population with access to improved sanitation facilities globally with the high-income countries reporting between 99% to 100% access to improve sanitation facilities, while only 27% of the population in the low middle-income countries (LMI) had access to improved sanitation facilities (Cole, 2018).

Provision of adequate sanitation has been pointed out as one of the common strategies of preventing sanitation-related diseases such as diarrhea (Busienei, 2019). However according to Novetnjet *et al.* (2017) sanitation projects and solutions fail after 4 years of acceptability and sustainability issues in rural areas. For instance, sanitation in Asia is surrounded by social, cultural and economic factors which should be addressed before providing toilet facilities. Provision of latrines alone is not a sustainable sanitation solution unless the population behavior changes and positive perception embraced (Ogendi, 2019).

Reports by WHO / UNICEF in New Zealand indicated that 76% of the population had safely managed sanitation facilities, 23% had attained basic sanitation services and only 1% possessed an improved sanitation facility.(Braun, 2014)

In Uganda, a study by Ssemugabo *et al.,* (2021) that exploded latrine characteristics found that residents abandoned the latrines because they were soiled.

About 25% of people live in rural areas where open defecation is still common. 45% of the world's population, or 34 billion individuals, utilize safely managed services worldwide (World bank, 2018). It was discovered that 31% of the world's population, or 24 billion people, used private sanitation systems that were connected to sewers for the treatment of waste water (World Bank, 2019). Roughly 14% of the world's population, or roughly 1 billion people, were discovered to be utilizing latrines or toilets where excreta was disposed of on the spot (Alhassan, 2018). However, prioritization and investments in improved sanitation technologies by individuals and government in most developing countries are limited, creating imbalance between the population needs and available sanitation technologies, which leads to challenges in proper use and maintenance of existing sanitation facilities (Ssemugabo,2021)

Approximately 74% of the world's population, or over 5.5 billion people, were found to be using at least a basic sanitary facility. About 2 billion people still do not have access to basic sanitary facilities like toilets or latrines. Of the 2 billion people, 673 billion continued to urinate in public places, such as gutters, open water features, and places hidden from view (Bartram, 2017).

Kenya's sanitation coverage is estimated to be just 50%; nonetheless, 11% of the country's population, or roughly 6 million people, were found to be unable to access any kind of sanitation facility, leading them to practice open defecation along train tracks, in fields covered in plastic bags, in rivers, in gutters, and/or in buckets (UNICEF 2015 & WHO, 2019). According to WHO/UNEP/FAO (2016), the sanitation systems now in use have been shown to be expensive, labor-intensive to develop, and/or provide insufficient protection for ground water. However, the primary factor in assessing the likelihood of a rise in the use of a particular sanitation facility is the acceptance rate within the community, which may be ascertained by the degree of investment or adoption of the existing sanitation technology (Ali, 2012; Boutayab, 2016).

Rural sanitation is at times ignored and a lot of emphasis put on urban and informal settlements. Rural sanitation, where the majority of children reside, needs immediate attention in light of the rising number of children dying in developing countries from diseases like diarrhea that are easily preventable (Mwirigi, 2020). Existing studies for instance by Mwirigi *et al.* (2020) confirm that social cultural, economic factors and sanitation technologies could influence the adoption of sanitation systems in rural areas.

Since the establishment of the millennium development goals, little progress has been made in extending improved sanitation access to the poor in rural areas, while the issues relating to the long - term usage and functioning of sanitation systems require more consideration (Obeng, 2020). Tharaka North is one of the sub-counties in Tharaka Nithi

County that is facing a water shortage is Sub County. According to the County Water Supply and Urban Sewerage Strategic Plan 2015-2019, the County has significant problems in the areas of water resource protection, water infrastructure development, adoption of relevant technologies, and sustainable water and sanitation facility provision. This study examined factors influencing rural populations' adoption of sanitation systems.

1.2 Statement of the Problem

Improved hygiene and adequate sanitation are the most fundamental components of effective public health hygiene. An increasing awareness worldwide on the environmental problems associated with inappropriate sanitation systems implementation has led to the development of various sanitation facilities (Mwirigi et al., 2020). Sustainable use of sanitation technologies depends upon basic factors like cost, social acceptance, user friendly technology, ease of operation and maintenance as well as health and hygiene safety (Uwintwari, 2017).

10% of the world's diseases are caused by poor sanitation. The health of populations is greatly impacted by inadequate access to proper sanitation systems, which can result in illnesses associated to sanitation, such as upper respiratory tract infections and diarrheal worm infestations (Barchi, 2019).

The consequences of inadequate sanitation systems extend far beyond the population's health. A number of factors, including social, demographic, cultural, and economic ones, may have an impact on people's motivation and ability to engage in a behavior, which could explain some of the reasons why sanitation levels remain low (Stopnitzky, 2017).

Research is needed to fill in the knowledge gap about the reasons why people still do not prioritize having sanitary facilities in their homes and the factors that influence the adoption of sanitation systems in rural communities. In Kenya, for example, only 33% of

the population access improved their sanitation, and 9% still defecate outside (WHO/UNICEF, 2021).

Rural sanitation is at times ignored and a lot of empirical focus is put on urban, peri - urban and informal settlements (Ssemugabo *et al*., 2021; Busienei *et al.,* 2019, *Winter et al.,* .2019: Adugyamfi, 2018).

Approaches instituted by the government to promote improved sanitation such as Community Led Total Sanitation and creation of awareness have not shown complete effectiveness in triggering a sustainable sanitation behavior change. The impact of sanitation technology and social, cultural, and economic factors on the adoption of sanitation systems in rural areas is not well covered by the literature. In addition to major adjustments in financial and policy goals, closing the gaps in sanitation coverage would necessitate substantial behavioral adjustments at the individual, household, and community levels. WHO (2018) points out that some 5000 children die daily from preventable water sanitation - related diseases, 90% of whom die before age five. WHO believes the impact of unclean water and unsanitary systems is underestimated, because of weak data collection and insufficient research on several WASH issues. Therefore, this study aimed to assess into the factors contributing to lack of access to proper sanitation systems in Tharaka-North Sub County, Tharaka Nithi County, Kenya.

1.3 Objectives of the Study

1.3.1 General objective

The general objective of the study was to assess the factors influencing adoption of sanitation systems in rural communities. A case of Tharaka- North Sub - County, Kenya.

1.3.2 Specific objectives

i. To examine the influence of social and cultural factors on adoption of sanitation systems in rural communities of Tharaka North Sub County.
ii. To assess the influence of economic factors on adoption of sanitation systems in rural communities of Tharaka North Sub County.
iii. To assess how sanitation technologies influence the adoption of sanitation systems in rural communities of Tharaka North Sub County.

1.4 Research Questions

i. How do social and cultural factors influence adoption of sanitation systems in rural communities of Tharaka North Sub County?
ii. How do economic factors influence adoption of sanitation systems in rural communities of Tharaka North Sub County?
iii. How do sanitation technologies influence adoption of sanitation systems in rural communities of Tharaka North Sub County?

1.5 Justification of the Study

Lack of investing in sanitation is found to be more expensive yet households often do not prioritize their own resources on sanitation (World Bank, 2018). Inadequate or total lack of sanitation facilities is associated with many societal challenges including death as a result of diseases that could easily be contained through proper sanitation. If the trends of not investing in sanitation continue, it follows that both government and households are likely to continue spending more resources due to sanitation related illness.

The sustainable development goal agenda 6.2 explains that Kenya will have attained complete improved sanitation coverage by 2030 (United Nations, 2018). The study created awareness to members on adoption of acceptable sanitation facilities at the

community levels. The precise implementation of this study is one step in achieving a society that is free from sanitation-based illness and challenges. This study yielded knowledge for future research on sanitation studies.

1.6. Significance of the Study

The results from the study were essential in understanding the factors that influenced the willingness and ability to invest in sanitation in combating and reversing the impacts of inadequate sanitation in both Tharaka-North, Tharaka Nithi County and in Kenya. The findings from this study could be useful in informing decision-making process for future interventions that aimed to enhance communities' willingness and ability to invest in sanitation.

The results also pointed out opportunities and gaps for further research in designing, investments and implementation of sanitation systems in rural communities. Sanitation programmers may find the study results useful when designing various sanitation models that can be adopted and affordable to communities and households. Currently, Kenya lacks a robust sanitation act that could be used in budgetary consideration for counties. Rural households in the study area grapple with significant sanitation challenges. This research aimed to provide valuable insights for combating diseases like cholera, diarrhea, and other infections. By understanding the factors influencing sanitation practices, the study contributes to knowledge for researchers, practitioners, and policymakers. The findings can inform the development of effective strategies to improve sanitation conditions and promote sustainable solutions.

The findings of this study therefore, were to inform practical aspects of water, sanitation and hygiene practices in developing countries. The study provided information on socio-cultural aspects, community participation stage, accessibility to intervention and water sources which can be considered when designing a water, sanitation and hygiene

intervention programme and strategies. The findings can be used strengthen the designing and implementing projects as prescribed in the social pillar of vision 2030 where Kenya, envisions a society enjoying equitable social development in a clean and secure environment. The findings were be used in the implementation of national sanitation and hygiene policies such as the Water Act, National Environmental Sanitation and Hygiene policy among others.

1.7 Assumptions of the Study

According to Creswell (2013), assumptions are the elements in research that are presupposed by the researcher to be true. The household population was composed of the individuals with varying traits such as age, sex, and education level, social and economic statuses.

The study assumed that the selected sample size represented the study population. It also assumed that the data collection instruments were valid and reliable and that the data were relevant to the research. The researcher that assumed questions and methodology used were appropriate and would ensure attainment of what the study seeks to address.

Further it was assumed that the participants targeted in this study gave candid and honest responses to the given questions to generate the desired information. The research expected that participants were willing to take part in the exercise and gave honest responses. The analysis method considered was assumed to be sufficient and useful in unveiling significant relationship on the study population.

1.8 Study Delimitations

Delimitations refer to the boundaries set by the researcher while conducting research (Simo, 2013). Delimitations also include variables and factors not to be considered in the research. It involved data collection among the public health officers, community health volunteers, masons, and a chief and household heads at the household level. Institutions

were exempted. The findings were limited to the extent that it could not be purported to represent the views of the Tharaka Community. The findings of this study could be used to understand community participation, accessibility to intervention and socio-cultural practices among others that affect safe water use, sanitation and hygiene practices in this community and others who live in a similar context.

1.9 Study Limitations

A reliable and honest feedback was essential for this study. The researcher had no possibility of influencing the respondent's honesty. Although the questions were written in English, the researcher was verbally translating the questions into common and universally under stable languages such as Kiswahili and will always be available to elaborate the questions in such cases. The researcher faced the following limitations: bad terrain and poor network, which means that movement was a challenge. The researcher therefore made arrangements for suitable, flexible means to ease the movement and save time taken during data collection.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter entails an overview of factors relating to the study problem. The researcher presents empirical evidence on the factors influencing adoption of sanitation systems in rural communities. The chapter describes in details how social-cultural, economic factors and sanitation technologies influences adoption of sanitation systems in rural communities. The chapter also covers theoretical and conceptual frameworks for the study.

2.2 Adoption of Sanitation Systems in Rural Communities

A sanitation system is one having multiple processes to manage human excreta and domestic sewerage from the point generations to the point of views recycling and appropriate or safe disposal (GROS, 2020). WHO and UNICEF (2021) recognizes the necessity of adopting sanitation systems which ensures that the population is not exposed to the illnesses resulting from poor sanitation practices (Wasonga *et al*., 2016). According to United Nations (2018) countries are expected to ensure that toilets adopted in both rural and urban areas are improved. However, latrines availed in rural areas mostly remain unimproved and unacceptable, not conforming to approved standards (Busienei *et al*., 2019). A study by Kamara *et al.* (2017) established that Sub-Saharan African countries have poor quality latrines.

Most of these countries use traditional pit latrines with a sizeable number of the population engaging in open defecation. 50% of the population in Sub Saharan Africa access unimproved sanitation options.

Unimproved toilet facilities could be a major public health challenge due to its ability to facilitate diarrhea diseases like cholera and dysentery .Whist concerned effort by government to fight diarrhea diseases has been shown (Demise *et al.*, 2021), a better

strategy could include capacity building through advocacy and presentation of improved latrines .Latrines provision at the household is a critical step in ensuring proper disposal of human excreta (Mwirigi *et al*., 2020).

Defecation on the open could expose rural residents to vectors of diarrhea disease transmission and prevents rural communities from attaining improved sanitation standards. Inadequate sanitation practices continue to pose a serious threat to global development, affecting advancements in gender parity, health, education, and social and economic advancement. "Globally, 2.5 billion people do not use improved sanitation systems,"(WHO, 2019). People in rural regions, children, women, adolescent girls, youngsters, and infants are the most vulnerable to poor hygiene and sanitation services. "Taking into account the devastating consequences of inadequate sanitation, in the last few years sanitation programs including Community-Led Total Sanitation and Hygiene (CLTSH) have evolved dramatically, most of them which are rooted in catalyzing community behavior and social change" (Halage,2021). CLTSH is built to induce collective behavior change through the main principles of no toilet subsidy and no financial incentive when the community achieves 100% Open Defecation Free (ODF).

The practice of open defecation continues to be a global health challenge which affects 494 million people worldwide (WHO/UNICEF 2021). A report by Novotny *et al*., (2021) indicated that open defecation is the main cause of diarrhea-related mortalities and morbidities especially among children under the age of five years. African Countries established a pooled open defecation prevalence of 22.55% in the region. In Kenya, a study by Busienei *et al*. (2019) established that the practice of open defecation packed up to 72% even after provision of toilets.

In 2013, the United Nations (UN) Deputy Secretary - General issued a call to action on sanitation that included the elimination of open defecation by 2025 (WORLD HEALTH

ORGANIZATION, 2022). Sustainable Development Goals (SDGs), adopted by the UN, have initiated a renewed focus on strategies necessary to achieve universal access to safe water and basic sanitation by 2030. Open defecation practice continues to be a global health challenge and by 193 million people in Africa still practice open defecation by 2022. The majority of countries in Sub- Saharan Africa (SSA) lack sufficient human and financial resources to implement sanitation policies and plans in urban and rural areas (WHO/UNICE, 2022). In 2022, 419 million people still defecate in the open bodies of water (WHO & UNICEF, 2023). Poor sanitation and open defecation have dire consequences and are accepted as the main contributors to diarrhea diseases (WHO & UNICEF, 2023). If properly utilized, latrines can effectively keep faces out of the environment and prevent the spread of diseases.

An estimated 829,000 water, hygiene and sanitation (WASH)-attribute deaths and 49.8 million Disability-Adjusted Life Years (DALYs) occurred from diarrhea diseases in 2016, equivalent to 60% of all diarrhea deaths. In Children under 5 years, 297000 WASH-attributable diarrhea deaths occurred, representing 5.3 % of all deaths in this age group (Pruss-Ustun *et al*., 2019). Despite all the benefits from improved sanitation practices, only 68 % of the world population today has access to safely managed sanitation. It is difficult to know how many people actually use them hygienically. The evidence available suggests that many people do not use a toilet even when one is available (Davis, 2016).

A review of the Ethiopian Sanitation and Hygiene development status in rural and urban areas, a large number of people (82%) are still living in open defecation-free slippage in Ethiopia was 15.9 % after 12 studies were systematically reviewed (Abebe & Tucho, 2020), showing the severity of sanitation-related problems and the urgency of designing appropriate sanitation programs to meet SDG 6 and other commitments by 2030. A lack

of awareness and limited economic capacity are the main reasons that sanitation is given a low priority as households prioritize other basic needs (UNICEF, 2017). In most rural areas, sanitation facilities are unavailable and force people to use the bush as their toilets. This is a source of contamination of unprotected surface water bodies. In Odisha , India residents preferred to defecate near local surface water bodies for anal cleansing and body bathing and cloth rinsing as one of the key elements of sanitation rituals especially after defecating in the morning (Routray *et al*., 2015).

The new sanitation target of the Sustainable Development Goals (SDGs), which is to achieve universal access to equitable and adequate sanitation (UN, 2016), poses a significant challenge to a developing country like Indonesia, where only 47% of the population has access to safe sanitation and 20% of the population continues to practice Open Defecation (OD), mostly in rural areas (WHO/UNICEF, 2018). Addressing disparities in sanitation coverage remains a challenge, with only a few projects demonstrating success in reaching vulnerable populations. Projects that demonstrated equitable sanitation improvements used inclusive water, sanitation, and hygiene (WASH) techniques to close sanitation gaps and target vulnerable communities.

The UNICEF/JMP (2010) data indicates that the number of people accessing improved water and sanitation in rural areas has increased since 1990. Although a variety of technologies are available across the sanitation supply chain, their selection is always determined by desire, affordability, and material availability (Katukiza et al., 2018). Poor sanitation, defined as the disposal of liquid and solid waste and the absence of suitable sanitation facilities such as decent latrines / toilets and clean water supply systems, has had a negative impact on public and environmental health. Access to better sanitation is defined as the percentage of the population who has access to at least appropriate excreta

disposal facilities, both private and shared but not public, that can successfully avoid human, animal, and insect contamination with excreta.

Challenges for the provision of safe water and sanitation are getting harder due to rapid population growth, increased urbanization and industrial activities and poverty in rural areas and increasing habits of environmental degradation. Environmental Sanitation involves the state of creating a clean and safe water supply, clean and safe ambient air, and emphasizes on the management of human behavior and Sanitation facilities which work together in achieving hygiene environment (UWUSE, 2017).

2.2.1 Existing sanitation and hygiene policies and structures

According to Kenya's GLAAS 2018/2019 nation overview reaction: devolution of administrators to the areas with particular capacities and assets' is an example of an effective policy measure (GLAAS, 2018). The adoption of a new constitution in 2010, which created the devolved governance system, changed the sanitation and hygiene sector in Kenya. Due to this change of power, new laws, policies and plans were needed to match the new governing structure. The Kenyan Environmental Sanitation and Hygiene Strategic Framework (KESSF) notes that with sanitation made a granted human right and its services having been devolved to 47 County Governments. A new water law, the Water Act 2016, brings the water and Sanitation sector in line with the constitution, The Ministry of Health has adopted an environmental Sanitation policy and framework, and the Ministry of Water and Sanitation is currently developing a new policy.

The MOH's Kenya Environmental Sanitation and Hygiene Strategic Framework, 2016-2030 (KESSF) is a framework for the KESHP that provides structure for its implementation. By collaborating with the KESHP, the KESSF can serve both metropolitan and rural areas, as well as institutional WASH. The following activities are carried out to fulfill the aims in rural areas, facilitating reception of Total Sanitation

Model for communities of the populace of under 5000, initiating and guaranteeing latrines construction and appropriate use (minimal expense choice, adequately utilized and kept clean), initiate programs for inspiration, technical advice and negligence sponsorship (through the supply of materials just to penniless gatherings locally) for the development of ventilated pit restrooms and safe removal of Wastewater. African Countries, including Kenya, it has been found that sanitation and hygiene policies are a key factor influencing adoption of sanitation systems in rural communities.

2.2.2 The level of knowledge and awareness of the residents on policy instruments relevant to sanitation and hygiene

Kenya has regulations and norms in place to ensure the general well-being of its population, including sanitation and hygiene. It is vital to emphasize that if the rules are implemented, they play a critical role in providing and maintaining optimal well-being for everyone. Some of the rules include the Kenya Environmental Sanitation and Hygiene Policy (KESHP 2016-2030), the Kenya Environmental Sanitation and Hygiene Strategic Framework (KESSF 2016-2030), the National Health Policy Framework (2012-2030), and the County Environmental and Sanitation Bill (2016).

Policies and lawful systems are a portion of the instruments that Governments use as mediations in advancing sanitation management and ecological sustainability. To effectively accomplish sustainable behavior change influences how individuals value and perceive ecological change. Malik and Mohr (2017) findings on Sanitation and Hygiene information, attitude and practices in metropolitan setting of Bangalore in India revealed that sanitation and hygiene practices are vigorously affected by individuals' information towards it. It is for this reason that practices and knowledge assessment is especially value for research (Safadi, 2019).

Knowledge and awareness among residents regarding sanitation and hygiene policies is one of the most important determinants of successful implementation. Policies can only be effective if the target population is aware of their existence, understands their purpose, and believes in their relevance to everyday life. In the Kenyan context, although progressive policies such as the **KESHP (2016–2030)** and the **KESSF (2016–2030)** have been formulated, their translation into practice often remains limited by low levels of awareness among communities, particularly in rural and peri-urban settings.

A persistent challenge is the "policy–practice gap," where laws and frameworks exist on paper but are not widely disseminated to the public. For instance, while county governments are mandated to promote sanitation initiatives, many residents lack information on how these frameworks align with their rights and responsibilities. Studies show that awareness campaigns, when implemented through participatory approaches, significantly increase community involvement and ownership of sanitation initiatives. However, without such engagement, households may continue to practice unsafe behaviors, such as open defecation, despite the presence of policy directives against them.

Research across Sub-Saharan Africa also underscores that policy knowledge is unevenly distributed along socio-economic and educational lines. Educated households are more likely to be aware of sanitation-related policies, understand the health implications of poor hygiene, and comply with existing regulations. On the other hand, marginalized communities, such as those in informal settlements, often remain disconnected from such policy information. This lack of awareness undermines accountability, as residents cannot demand better services or monitor the effectiveness of sanitation programs if they are unaware of the governing frameworks.

In Kenya, cultural and linguistic diversity also shapes how sanitation policy information is communicated and absorbed. Policies framed in technical or legal language may not

resonate with local communities, particularly where literacy levels are low. Translating policies into accessible messages using local dialects, storytelling, and community forums can improve awareness and foster behavior change. Evidence from community-led sanitation programs shows that peer-to-peer education, local champions, and use of religious institutions as platforms can significantly improve awareness and adoption of sanitation policies.

International experiences also illustrate the importance of coupling policy instruments with public education. In India, for example, the Swachh Bharat Mission demonstrated that information campaigns, when combined with subsidies and local enforcement, led to significant increases in toilet construction and use. Yet, as Malik and Mohr (2017) emphasize, knowledge alone is insufficient—attitudes and social norms must also shift for long-term behavioral change. Similarly, in Ethiopia, sanitation interventions that combined awareness of national policies with practical demonstrations of hygienic practices led to greater compliance than information-only campaigns.

At the household level, awareness of sanitation policies influences not only compliance but also willingness to invest in improved facilities. Families that understand the link between sanitation policies and health outcomes are more likely to allocate resources toward constructing latrines, maintaining hygiene facilities, and participating in waste management initiatives. Conversely, where policy knowledge is low, sanitation is often deprioritized in favor of more immediate needs such as food and shelter.

In addition, awareness and knowledge play a crucial role in holding local governments accountable. When residents know about sanitation policies and their entitlements under frameworks such as KESHP, they are better positioned to demand equitable service delivery, transparency in resource allocation, and the maintenance of sanitation

infrastructure. Lack of such awareness can lead to acceptance of poor services or even neglect of public facilities, further worsening sanitation challenges.

Therefore, raising awareness of sanitation and hygiene policies is not merely an add-on to policy formulation—it is a core requirement for successful implementation. Governments, non-governmental organizations (NGOs), and community-based organizations (CBOs) must prioritize continuous sensitization campaigns. Leveraging mass media, school-based programs, mobile technologies, and grassroots networks can bridge the policy awareness gap and empower residents to participate actively in achieving sanitation goals.

Ultimately, without adequate knowledge and awareness at the community level, the ambitious goals of Kenya's sanitation and hygiene policies, as well as international targets like SDG 6.2, risk being unattainable. Thus, aligning policies with community knowledge systems, cultural values, and participatory communication strategies is fundamental to ensuring that sanitation and hygiene reforms deliver tangible and sustainable results.

2.2.3 Household access to sanitation and hygiene facilities and systems

WHO (2018) states that better sanitation systems must hygienically isolate human excreta from human touch. Globally, the utilization of upgraded sanitation facilities rose from 28% in 2000 to 45% by 2017.Not understanding the advancement that has been made worldwide, 4.5 billion people still have no access to improved sanitation facilities of these, 2.3 billion have no access to basic sanitation facilities and 892 million practice open poo (UNICEF, 2018). It has been estimated that improving WASH facilities might prevent 9% of the world disease burden (Mustapha, 2020). Children are among the most vulnerable groups to a shortage of water, sanitation, and hygiene services (WHO, 2018). Moreover, other than the absence of adequate sanitation facilities particularly toilets,

poorly constructed latrines without covers to keep flies from visiting latrines and picking faces on their limbs to defile food sources and cooking tools is additionally a significant issue looked in the counteraction of waterborne diseases.

Access to sanitation remains a concern, with 10% of Kenyan households still using open poo and just 38% having access to an unimproved sanitation facility, such as pit latrines with no slab or platform, hanging toilets, or bucket latrines (UNICEF/WHO, 2018). Domestic WASH provisions are significantly more terrible in rural regions, in spite of the sluggish yet consistent enhancements over the course of the past 7 years (UNICEF, 2021). To accelerate WASH coverage, global organizations, governments, civil society, and the commercial sector must prioritize it at the highest levels of decision-making.

Household access to sanitation and hygiene facilities is a critical determinant of public health and overall human well-being. Sanitation infrastructure plays a dual role: not only does it provide households with safe means of waste disposal, but it also acts as a frontline defense against the spread of infectious diseases. When human excreta are not hygienically managed, pathogens easily enter food and water systems, creating cycles of diarrheal diseases, cholera outbreaks, and parasitic infections that disproportionately affect children under five. In fact, diarrheal diseases remain one of the leading causes of child mortality worldwide, with inadequate sanitation being a principal driver.

Despite global progress, the distribution of improved sanitation remains highly unequal. Regions such as Sub-Saharan Africa and South Asia lag far behind the global average, and disparities exist within countries themselves. Wealthier, urban households are more likely to have private flush toilets connected to sewer systems, while rural and low-income families often rely on unimproved facilities or open defecation. This divide not only reflects broader patterns of inequality but also perpetuates them, as poor sanitation

exacerbates poverty through increased health expenditures, lost productivity, and diminished educational attainment.

Kenya provides a useful case study for understanding these disparities. As noted by **UNICEF/WHO (2018)**, 10% of households still rely on open defecation, while many others depend on unimproved facilities. In rural Kenya, households often construct makeshift pit latrines that lack slabs, ventilation, or protective coverings. These facilities may offer temporary relief but create serious hygiene risks. Flies and other vectors easily transfer pathogens from exposed faces to food preparation areas, undermining household food security and nutrition. This problem is compounded during the rainy season, when poorly built latrines collapse or overflow, contaminating nearby water sources.

Urban areas face different but equally pressing sanitation challenges. Rapid urbanization has outpaced infrastructure development, resulting in overcrowded informal settlements where shared latrines are common. These facilities are often poorly maintained, unsafe for women and children, and contribute to the spread of diseases such as typhoid and dysentery. Lack of privacy in shared or public sanitation facilities also creates gender-specific vulnerabilities, as women and girls may avoid using them altogether, particularly during menstruation. This leads to health risks and undermines gender equality in education and livelihoods.

Addressing household access to sanitation requires a multi-dimensional approach. Beyond infrastructure construction, behavioral change campaigns are essential to encourage consistent and proper use of toilets. Evidence from Community-Led Total Sanitation (CLTS) programs suggests that collective action, peer pressure, and awareness campaigns can reduce open defecation, although sustainability remains a concern when communities face economic barriers to upgrading facilities. Financing mechanisms—

such as microloans for toilet construction, subsidies for vulnerable households, and public-private partnerships—are crucial in bridging affordability gaps.

Moreover, sanitation must be integrated into broader development and governance frameworks. Investments in sanitation should not be seen merely as health interventions but as strategies for advancing education, reducing gender inequalities, and promoting economic growth. For example, ensuring that schools have clean toilets and handwashing facilities directly supports girls' education by reducing absenteeism during menstruation. Similarly, reliable household sanitation reduces the time women and girls spend seeking safe defecation sites, allowing them to engage more fully in economic and social activities.

Finally, sustainability and functionality of sanitation systems must be emphasized. Too often, coverage statistics reflect facilities built rather than those actually in use or maintained. Governments and development partners must strengthen monitoring systems to track not only infrastructure provision but also usage, maintenance, and user satisfaction. Only by addressing these issues holistically can global progress accelerate toward the SDG 6.2 target of universal access to safe and equitable sanitation and hygiene.

2.2.4 Governance gaps surrounding sanitation systems and sanitation challenges in sub -Saharan Africa

Achieving SDG Target 6.2—universal and equitable sanitation and hygiene, including ending open defecation by 2030—remains a significant challenge. The "leave no one behind" principle underscores the need to prioritize women, girls, and vulnerable groups. Eradicating open defecation by the target date is ambitious and requires careful consideration of appropriate sanitation approaches. Ensuring the functionality of

sanitation facilities is also crucial (WHO, 2018; WHO/UNICEF, 2017; Ekane & Nasman, 2018; Kvarnstrom et al., 2011).

Despite increasing attention over the years to the sanitation and hygiene conundrum and its debilitating implications of development, including policies set at global, regional and national levels and a concerted push for improved sanitation coverage and hygiene behavior change (GLAAS ,2017) reported progress is limited in SSA. Progress in sanitation lags behind water supply, with a disproportionate impact on rural and peri-urban areas heavily reliant on on-site sanitation facilities (WHO/UNICEF, 2017; WSP, 2010). To address this, international and donor organizations have promoted community-based sanitation approaches across Sub-Saharan Africa to foster collective adoption of improved hygiene practices (UNICEF, 2009; World Bank, 2018).

The governance gaps in sanitation across Sub-Saharan Africa are deeply rooted in institutional, financial, and socio-political challenges. At the institutional level, sanitation responsibilities are often fragmented across ministries of health, water, environment, and local government. This overlapping of mandates creates duplication of efforts, weak coordination, and accountability deficits. In many countries, water supply tends to receive more structured governance attention than sanitation, further widening the service gap. Financial governance is equally problematic. Sanitation receives less investment compared to water supply, despite being equally critical for public health. According to **GLAAS (2017)**, budget allocations for sanitation are often insufficient, donor-dependent, or poorly disbursed. The lack of sustainable financing mechanisms hinders the construction, maintenance, and monitoring of sanitation facilities. For example, while urban areas may benefit from large donor-funded projects, rural regions often rely on ad hoc community contributions, leading to uneven coverage and poor sustainability.

Decentralization has been promoted as a governance reform to improve service delivery. However, in many SSA countries, local governments lack the technical expertise, financial resources, and monitoring capacity to manage sanitation effectively. This gap results in poorly constructed facilities that quickly fall into disrepair, further undermining public confidence in sanitation programs.

Community-based approaches such as Community-Led Total Sanitation (CLTS) have gained traction across SSA as a means of addressing governance challenges. CLTS encourages communities to take ownership of sanitation improvements without external subsidies. While this approach has achieved success in some contexts by triggering collective behavior change, critics argue that it does not adequately address structural inequalities such as poverty and gender dynamics. Poor households, for example, may be unable to construct durable latrines even when motivated, perpetuating inequities within communities.

Another governance challenge is monitoring and evaluation. Official reports on sanitation coverage often focus on the number of facilities constructed rather than their usability, accessibility, or long-term sustainability. This creates a misleading picture of progress. In practice, many facilities are non-functional due to poor design, lack of water supply, or inadequate maintenance. Strengthening monitoring systems with disaggregated data on gender, disability, and rural-urban differences is essential to understanding who is truly being served and who is left behind.

Cultural and political factors further complicate governance. In some contexts, sanitation is perceived as a private household matter rather than a public governance priority. Politicians may also be reluctant to invest in sanitation because the infrastructure is less visible than roads, hospitals, or water supply systems. This contributes to sanitation

being deprioritized in national development agendas despite its critical role in reducing disease and improving quality of life.

Climate change and rapid urbanization add further stress to already weak governance systems. Flooding, for instance, can overwhelm pit latrines and contaminate water sources, while densely populated informal settlements in peri-urban areas often lack space or planning for sanitation facilities. These challenges require adaptive governance that integrates sanitation planning with climate resilience and urban development strategies.

Ultimately, closing the governance gaps in sanitation across Sub-Saharan Africa requires stronger political will, adequate financing, and institutional coordination. Policies must prioritize not just infrastructure provision but also long-term functionality, inclusivity, and community ownership. Equally important is the involvement of civil society and local communities in planning and monitoring, ensuring that sanitation solutions are culturally appropriate, affordable, and sustainable. Without addressing these governance gaps, achieving SDG 6.2 will remain an elusive goal for much of the region.

2.3 Influence of Social Factors on Adoption of Sanitation Systems

Despite latrine ownership, O'Reilly et al. (2017) reported persistent open defecation in India, particularly among women and casual laborers, often due to perceived convenience and pleasure. Knowledge and awareness significantly influence sanitation adoption. Nkatha et al. (2020) linked inadequate sanitation knowledge in Kenya to reduced latrine use, particularly those with poorly constructed and maintained pits, which can harbor disease-causing microorganisms. Poorly maintained toilets could lead habitation of diarrhea causing microorganisms.

Despite sensitization efforts, Abebe and Tucho (2020) found that 15.9% of Ethiopian households continued practicing open defecation due to inadequate and unacceptable

toilet facilities. This issue is not isolated to Ethiopia, as Busienei et al. (2019) also observed this practice in Lodwar, Kenya.

Sanitation facilities and systems located near households are easily accessible and safe especially for women and children (Hulland *et al*.,2015) Although location for toilets far from the households could be plagued with issues of safety sanitation of systems near homestead could contribute to odor and fly nuisances (Gokcekus *et al*., 2020).

Campbell *et al*. (2014) show that extensive, affordable, and good - quality, safe drinking, and hygiene are essential to human well-being .Safe WASH helps promote general health of a community. Drinking untreated water or ground polluted water negatively impacts health through diarrhea, cholera and other water-borne diseases (Clasen & Smith, 2019). Research shows that enhancements in WASH services such as controlled piped water and sewage system connections in developed economies along the lines of the U.S.A can benefit immensely human health by reducing deaths from diarrhea.

According to Berendes et al. (2017), approximately 2 billion people are still deficient in safe drinking water services, yet around 3.6 billion people go without proper hygiene. People's health is compromised by dangerous hygiene practices that are usually accepted. Sustainable WASH is a project focused on scaling up the impact of the impact of WASH actions in Kenya. It was designed with a strong focus on advocacy and policy change.

Many low - income residents in rural areas rely on sanitation on -site, particularly latrines that produce a concoction of solid and liquid waste known as fecal sludge. Proper sanitation services are vital in improving human health, dignity, and local environmental protection, economic stability, promoting good health and preventing disease outbreaks. Fecal sludge management processes have significant health and environmental risks, if there is no adequate post fill management plan the fecal sludge will remain under indisposed designed pit latrines and receive unsanctioned discharge

into waterways and unsanitary sites (Barreto *et al*., 2007). Excrete management, infrastructure, and systems are safe to manage and maintain to guarantee service provision and minimum environmental impact (Sikder *et al*., 2018). Hygiene remains a major issue in rural regions. Effective sanitation requires more than just infrastructure; it must also take into account community demands and affordability (Ananga et al., 2017). Access to adequate water, sanitation, and hygiene is critical for building a positive school environment that promotes equality and health development (Ying & Sovacool, 2021).

Every household should have a toilet block to cater for sanitation needs of household members, failure to which they may adopt poor sanitation practices such as open defecation (Mwirigi *et al*., 2020). Other studies have indicated that owning sanitation facilities does not guarantee their use. A study by O'Reilly *et al*. (2017) in India found out that although 66% of households in the study area possessed latrines, some people especially women and casual labourers practiced open defecation. Open Defecation was preferred because it was more comfortable, pleasurable and convenient than using toilets and saved time for daily chores. Another study in India by Juran *et al*. (2019) that examined barriers of latrine adoption established that although residents acknowledged the ability of latrines to promote household hygiene, toilets were considered sources of pollution to the environment. The most cited reason for failing to use the available toilets as reported by 50 % of the participants was that defecation in the open was a dominant historical norm deemed acceptable by everybody else in the community.

Increased skills for latrine erectors have been associated with increased toilet coverage. Proper toilet designs and toilet acceptability (Venkataramanan *et al*., 2018). A randomized trial by crocker *et al*. (2016) in West Africa that examined the impacts of training latrine constructors established a 19% point reduction in the practice of open defecation as toilets were built in proper designs. A similar survey in Meru by Mwirigi *et*

al. (2020) on toilet established that households which had their own latrines than those that lacked. Although latrine presence at the household could eliminate open defecation practices, their structural inequalities such as presence of odour and improper location could produce situations that impede latrine uptake.

A study by Nkatha *et al*. (2020) in Kenya established a link between inadequate knowledge on the importance of safe sanitation and reduced latrine utilization as a result of construction of latrines with unsafe pits which could not be easily maintained. Studies by Osumanu *et al*. (2019) found out that 48% of the respondents defecated in vacant plots due to the presence of large unutilized tracks of land in rural areas. Latrines construction in the presence of open spaces was cited as a waste of resources. Increased skills for latine erectors have been associated with increased toilet coverage, proper toilet designs and toilet acceptability (Venkataraman *et al*., 2018). Access to poorly maintained toilets could encourage the spread of Urinary Tract Infections while use of toilets with non-privacy guaranteeing superstructures could expose women to the risk of sexual assults when using toilets without privacy. Faeces left in the open could attract cockroaches and houseflies which ferry diarrheal- causing germs into food exposing the population to the risk of developing enteric complications.

2.4 Influence of Cultural Factors on Adoption of Sanitation systems

Various beliefs surrounding utilization of toilets in different communities could encourage negative and restrictive sanitation behaviors Osumanu *et al*. (2019) in Ghana found that latrines were not used at night because residents believed that witches and evils spirits visited latrines at night and could cause misfortunes.

When toilets were not provided near the homestead residents defecated in bushes. Similarly, while examining cultural and sanitation practices in Indonesia research by

Dwipayanti *et al.,*(2018) showed that latrines were regarded as contaminants of areas showed that households demand a home of certain tribes and could cause misfortunes.

A study by Ahmed and Ahmed (2017) that exploited accountability of toilets among members of different religion backgrounds period established construction materials inability to support water-based purification (anal cleansing). In Ghana Adu-Gyamfi (2018) found their cleaning ritual for Muslims emphasized more on anal cleansing of the environment. Sanitation is defined as the procedure of disposing of feaces to solve waste management (MOPHS, 2019). Toilets, latrines, and hand washing facilities relate to sanitary facilities in this context (UNICEF, 2019). According to Gizaw & Addisu (2020), only 59% of Kenyas have access to essential water services, and just 29% have access to sanitary services. To ensure the long survival of children, access to clean drinking and proper hygiene practices are extremely important. An integrated approach that combines water supply, sanitation, and hygiene (WASH) programs with agricultural , environmental ,governance , maternal and child health programs is most effective at improving the health of those in greatest need (McDougale *et al*., 2020).

Since the establishment of the Millennium Development Goals, however little progress has been made in extending improved sanitation access to the poor in rural areas, while the issues relating to the long - term usage and functioning of sanitations systems require more consideration. The new sanitation target of Sustainable Development Goals (SDGs), which is to achieve universal access to equitable and adequate sanitation (UN, 2016) poses a great challenge to developing countries. For instance, in Indonesia, only 47% of the population have access to safe sanitation and 20% of the population are still practicing Open Defecation (OD), mostly in rural areas,(WHO/UNICEF, 2015). Although the Government of Indonesia has implemented a national Programme to improve access to sanitation in rural areas, named STBM (Community based total

sanitation), progress has varied from district to district, (UNICEF, 2018). Socio-cultural understanding is important to the success of a sanitation programme. Social-cultural aspects may affect the acceptance of a technology in a particular community (Mosler, 2019). Some sanitation planning and assessment frameworks also include cultural aspects to ensure the sustainability of sanitation infrastructure (Radin, 2020). Recent studies from elsewhere have shown that many issues of sanitation access are related to cultural values and traditions (WHO, 2020). For example, In India, a quantitative study showed that the religious composition of a neighbourhood affects exposure to a sanitary environment , which explains why the toilets provided have not been used,(Coffey *et al*., 2014; Routray *et al*., 2015).

Generally, sanitation development programmes are implemented by professionals with a technical and health background but without cultural understanding. There is an urgent need to provide a systematic way for local professionals to explore the local culture and assist them to incorporate those understandings in a sanitation programme (UNICE, 2019). To understand culture and sanitation in rural areas, one must first have insight into the community's culture. Furthermore, the pace of improvement in sanitation is slower compared with that of safe drinking water.

Various beliefs surrounding utilization of toilets in different communities could encourage negative and restrive sanitation behaviours. In India, a study by Nagla (2020) that examined the role of culture in facilitating sanitation problems found out that although toilets were available, people preferred open defecation because it promoted body purity and long life. People from different religions backgrounds hold dearly their religious values (Adugyamfi, 2018) and therefore, insensitivity to the values related to sanitation could interfere with toilet adoption and use. A study by Vgas and Spears (2018) in South Asia that explored religion and sanitation found that Hindus held rituals of

purity which discouraged latrine construction near homes as it was perceived as a source of pollution. When toilets were not provided near the homestead, residents defecated in bushes.

In India, Stopnitzky (2017) established that it was obligatory for men who wished to marry to have their own latrines. The fact that men could not acquire a bride without first constructing a household latrine led to 21% increase in adoption of latrine facilities. A study by Sahoo *et al.,* (2015) in Odisha that sought to examine sanitation stressors for the female gender established that women struggled to cross high fences and walls to identify tidy places for menstrual management and defecation as they feared contracting genitourinary infections. When sanitation facilities are untidy, women could be forced to seek for alternative sanitation solutions which do not provoke anxiety for them. If gender empowerment in sanitation policies could be embraced, gender - based sanitation inequalities would reduce.

The influence of Cultural and Economic Factors on Sanitation Systems Coverage

An equitable, safe, sanitary, and accessible sanitation facility is critical to all aspects of human development (JMP, 2021). Target 2 of Goal 6 of the Sustainable Development Goals (SDGs) is to achieve universal access to and sustainable management of sanitation by 2030. The primary purpose of SDG 6.2 is to limit human interaction with fecal pathogens in order to reduce disease incidence. To effectively capture nations' progress toward sanitation for everyone, sanitation coverage (the proportion of the human population with access to appropriate sanitation services) is reviewed globally (WHO & UNICEF, 2021).

Sanitation system coverage improves understanding of present practices, planning, and evaluation of sanitation interventions' efficacy in achieving the global sanitation for all objective. Sanitation coverage is critical at the global, municipal, and local levels since it

has been linked to improved public health and reduced morbidity (WHO 2020) Meanwhile, the lack of an indexing tool for tracking countries' actual performance can jeopardize the deployment of necessary interventions to improve performance in pursuit of the sanitation agenda.

With detrimental effects on urban and community development in Mali, Africa, WHO (2018) found that inadequate sanitation service delivery, a lack of a sense of community, as well as improper involvement of civil society organizations are the primary causes of poor sanitation coverage. Community sanitation coverage also turned out to have a strong association with child growth indicators like height. However, access to private safe sanitation facilities shows a weaker association (Harris et al., 2017).

Several factors contribute to inadequate sanitation coverage globally. For instance, the JMP's 2021 household report highlights the substantial gap in Sub-Saharan Africa's progress towards the 2030 sanitation goal. Rapid population growth in these regions has outpaced sanitation infrastructure development.

Inadequate sewage treatment and management significantly contribute to environmental health risks. Improperly treated sewage introduces various diseases into the environment. As highlighted by Wee & Aril (2017) and Hadibarata et al. (2019), this issue is critical. The global burden of sanitation-related diseases underscores the urgency of improving sanitation access. For instance, schistosomiasis has claimed over 2 million lives, while soil-transmitted helminths (STH) impact over 1 billion people, as reported by Freeman et al. (2017).

The influence of culture on sanitation is not merely a matter of belief but often intersects with social identity, traditions, and daily routines. For instance, in Ghana and Indonesia, fears of spiritual harm and taboos around pollution show how sanitation facilities are viewed beyond their technical function. They are embedded in wider cultural systems

that determine what is acceptable, safe, and pure. These perceptions shape how individuals and communities use or reject sanitation systems.

Religious considerations are particularly significant. In Islam, the emphasis on water-based purification means that toilets must accommodate practices of ablution. In regions where such facilities are unavailable, even newly constructed toilets may remain unused. Similarly, Hindu notions of ritual purity and pollution influence whether toilets can be built close to living quarters. These cultural frameworks illustrate why one-size-fits-all sanitation policies are often ineffective.

Economic factors interact with cultural beliefs to compound sanitation challenges. Even where toilets are technically available, financial limitations may restrict households from constructing or maintaining them. If cultural norms further discourage use, investments in sanitation infrastructure can fail to produce meaningful behavioral change. This interplay highlights the need for culturally tailored and economically feasible interventions.

Gender adds another critical dimension. In many rural settings, women face unique sanitation burdens, particularly concerning menstruation and safety during defecation. When facilities are inadequate or stigmatized, women often risk infections, harassment, or violence when seeking private spaces. Addressing these challenges requires not only infrastructure but also gender-sensitive planning that recognizes the lived experiences of women and girls.

The slow pace of sanitation progress compared to water access underscores the complexity of these cultural barriers. Drinking water initiatives are often more readily accepted, while sanitation remains tied to taboos, beliefs, and privacy concerns. For example, in South Asia, open defecation persists partly because it is socially normalized,

even celebrated in some contexts as healthier or more spiritual. Thus, behavior change campaigns must address deeply rooted values, not just promote facilities.

Community-driven approaches have proven more successful in overcoming cultural resistance. Programs that engage local leaders, religious figures, and women's groups can reframe sanitation in ways that resonate with cultural values. For instance, promoting toilets as symbols of dignity, modernity, or marital eligibility—as observed in India—has shifted community attitudes. Similarly, integrating sanitation into broader health and development programs ensures that it is not seen as an isolated intervention but as part of holistic wellbeing.

Ultimately, sustainable sanitation adoption requires recognizing that cultural values are not obstacles to be dismissed but realities to be understood and worked with. Professionals must approach communities with respect for their traditions, while also fostering dialogue that bridges cultural practices with public health goals. Without this, sanitation investments risk becoming underused, abandoned, or even rejected.

2.4.1 Demographic, cultural and economic factors affecting the adoption of sanitation systems among rural communities

Novotny and Mamo (2022) identified a research gap in understanding factors beyond basic latrine adoption in Ethiopia. While progress has been made, research on latrine upgrades and sustainability remains limited. Rashid and Pandit (2019) emphasized the need for improved toilet disposal systems and user willingness to invest in better sanitation services. Meanwhile, Anand and Apul (2014) and Swathy et al. (2022) advocate for green toilets as a sustainable and environmentally friendly waste management solution.

Access to basic sanitation is critical for human dignity, health, and well-being, particularly among women and girls in developing countries like India (O'Reilly & Louis,

2014; Sinha et al., 2017; Abubakar, 2018). Sanitation-related diseases considerably reduce the quality of life in rural populations (Murray & Lopez, 1997). Recognizing this, the United Nations Sustainable Development Goals (SDGs) prioritize universal access to sanitation and hygiene, with a particular emphasis on eliminating open defecation by 2030, especially among vulnerable populations such as women and girls (WHO, 2019).

Ignacio et al. (2018) found that understanding the nutrient value of human excreta positively influences the adoption of eco-toilet systems in the Philippines. Tamine and Afework (2021) identified contextual, psychosocial, and technological barriers hindering latrine use in rural Ethiopia. Mishra et al. (2021) challenged the traditional metric of toilet construction for assessing open defecation free (ODF) status, emphasizing actual toilet usage instead.

Open defecation has severe implications for health, dignity, and societal well-being, particularly for women and girls (Gauri et al., 2020; Saleem et al., 2019). Research by Spears et al. (2013) linked open defecation to stunted child growth in India, highlighting the practice's impact on child health. Harter et al. (2019) identified unsafe sanitation as a major source of environmental pollution and a threat to human life in developing countries. Panda et al. (2017) emphasized the connection between improper toilet waste management and increased mortality rates in low-income nations.

Bhatt et al. (2019) identified several reasons for continued open defecation among Nepalese households with latrines, including social interaction, personal preference, habit, convenience, religious beliefs, and hygiene concerns. Vegas and Spears (2018) linked religious practices in Bangladesh, India, and Nepal to higher rates of open defecation, as certain rituals discourage toilet proximity to homes.

Given the serious effects of open defecation, researchers have looked into factors that influence toilet adoption and use in rural areas (Kumar et al., 2017; Adhikari & Ghimire,

2020). Augsburg and Rodriguez-Lasme (2020) identified the link between toilet ownership and improved health, economic, and social situations, with health serving as the key incentive for toilet adoption.

The link between sanitation system coverage and socioeconomic development cannot be overstated. Countries with high sanitation coverage often demonstrate parallel improvements in education, economic productivity, and gender equality. Children who grow up in environments with reliable sanitation are more likely to attend school regularly, avoid preventable illnesses, and perform better academically. Conversely, in regions where sanitation is lacking, repeated bouts of diarrheal disease and parasitic infections undermine children's capacity to learn and contribute to cycles of poverty.

Economic disparities remain one of the strongest determinants of sanitation coverage. Wealthier households are better positioned to build, maintain, and upgrade private sanitation facilities. In contrast, poorer households, especially in rural areas, may rely on shared or unimproved facilities—or may have no facilities at all. This creates a sanitation divide within communities that mirrors existing inequalities in income, education, and access to services. Governments and NGOs have attempted to reduce this gap through subsidies and community-led total sanitation (CLTS) programs, yet coverage rates continue to show stark disparities between rich and poor, as well as urban and rural areas.

Cultural practices and beliefs also directly shape sanitation coverage. For example, in parts of South Asia, deeply ingrained norms of purity and pollution discourage the construction of toilets near homes, even when financial and technical resources are available. Similarly, in parts of Sub-Saharan Africa, taboos associated with sharing latrines between genders or across generations often reduce usage, thereby undermining sanitation coverage statistics. These examples demonstrate that achieving universal

sanitation coverage is not simply a matter of infrastructure but also requires cultural adaptation and community engagement.

Another challenge is sustainability. Coverage statistics often reflect the number of toilets constructed rather than the number of functional toilets in use. Many facilities fall into disrepair due to poor maintenance, lack of spare parts, or inadequate water supply. This creates a misleading sense of progress, where coverage rates improve on paper but real access remains limited. Scholars such as Murray et al. (2018) argue for shifting attention from "coverage" to "effective coverage," which accounts for functionality, use, and sustainability.

The political economy of sanitation also shapes coverage outcomes. In many low-income countries, sanitation investments are skewed toward high-visibility urban projects rather than rural or peri-urban areas where needs are greatest. Moreover, donor-driven programs sometimes prioritize meeting numerical targets quickly, which can compromise the quality and sustainability of sanitation systems. In contrast, countries such as Rwanda and Vietnam have demonstrated that strong government leadership, coupled with long-term investment in both infrastructure and behavior change, can yield sustained improvements in coverage.

Environmental considerations are increasingly relevant to sanitation coverage as well. Climate change and rapid urbanization put additional pressure on sanitation systems. Flooding, for example, can damage pit latrines, contaminate groundwater, and spread pathogens across entire communities. Therefore, sustainable sanitation coverage requires climate-resilient systems that can withstand environmental shocks.

Finally, the health impacts of sanitation coverage go far beyond the immediate prevention of diarrheal disease. Poor sanitation is now recognized as a driver of malnutrition, maternal mortality, and even reduced economic productivity at the national

level. The World Bank estimates that inadequate sanitation costs countries billions of dollars annually in lost productivity and healthcare expenditures. Expanding coverage is therefore not just a health priority but also an economic imperative.

In summary, cultural and economic factors intersect in complex ways to shape sanitation coverage. Cultural traditions can inhibit adoption even where infrastructure exists, while economic disparities restrict access for the most vulnerable. Addressing these challenges requires integrated approaches that combine infrastructure development, financial inclusion, cultural sensitivity, and sustained behavior change efforts. Without such strategies, the global sanitation agenda is unlikely to meet its targets by 2030.

2.5 Influence of Sanitation Technologies in the Adoption of Sanitation Systems

Successful sanitation more likely has proper management only if sufficient trust hold of latrines coverage and of use is attained by active community faces a translation phase a merge enabling the potential effort of the health of individual to materialized (Hariss, 2017) such technology of sanitation chain should be appropriate to the content to the specific health on the environment, economic social, demographic and institution (Spuhler, 2018).

Improved sanitation technology refers to the technologies which can hygienically separate human excreta from human content, (WHO/UNICEF, 2019). These includes compacting toilets, pit latrines with slabs, ventilated improved pit latrines (VIP) Flash/Pour Flash toilet connected to either pit latrines/sewer. The most appropriate /sustainable technology among the various alternative that would meet the beneficial standards of environment, economy and society successful determining using Multicriteria design making method (Busienei, 2019).

In 2017 appropriately 66%, 75% and 74% of the households did not have the access to basic sanitation services in urban areas, rural areas and nationally respectively (UNICEF,

2019) converting 1% and 7% of these have practiced open defecation in urban and rural areas respectively because of the increased population density in an ecological sanitation technologies/system must be well managed to reduce the causality such as diarrhea and helminthiasis (Kamunda, 2017). The choice of a particular sanitation technology can be influenced by motivating and demotivating factors. The social and economic factors for adoption of Sanitation practices are complex and varying. Social factors that contribute to choices of Sanitation practices involving learning various ways. The factors include social and religious practices, demographic characteristics, income status and education. Environmental factors such as climatic and physiographic factors are also important.

Cultural beliefs in relation to hygiene, fears and perceptions of sanitation, practices are also important in influencing technology choices. Religious leanings which tend to influence communal life, ineffective promotion and low public awareness, ignorance of people, lack of hygiene, education and training, negligence of people are said to be de-motivating factors for adoption of sanitation practices. Numerous researchers have recognized the need to determine user - acceptability of sanitation technologies (Ahmad,2020). Some of the factors that influence user acceptance of Sanitation technologies include: lack of training, construction quality, levels of hygiene, the acceptability by disabled, perceived maintenance problems, levels of safety for children and other age groups, internal and external perceptions of users, capital, knowledge of existing adaptation strategies for users, compliance with cultural norms of users, ease of cleaning, economic benefit (WHO,2017)

In rural areas of China, lack of sanitary toilet facilities has been the main cause of odor and disease (UNICEF,2019). According to the results of the third national agricultural census published by the National Bureau of Statistics of China, there were 230 million sanitary toilets in rural areas in 2016, accounting for only 48.6% of toilets in those areas.

Moreover, only 14.6% of rural households (about 265 million households in total) had toilets connected to a sewage system by the end of 2017 (Obeng, 2020). The potential environmental hazards of fecal sludge in China are still serious.

Of all human excreta, faeces are the most dangerous.

Existing literature has highlighted the impact sanitation on individual health (Hammer and Spears, 2016 ; Foster *et al.,*.,2021 ; O'Gorman , 2021. ;Cameron *et al*., Kmush *et al*.,2021). A lack of sanitary toilet facilities is closely correlated with a high incidence of intestinal infectious diseases, due to the fact that lower levels of sanitation coverage increase human fecal pollution and pathogen exposure , thus causing a variety of human diseases

For every 1% increase in the rate of access to sanitary toilets , the incidence of hepatitis A drops by 5.6% and the incidence of dysentery decreases by 36.5 %. Sanitation technologies include strategies for safely handling human excreta and wastewater. Sustainable sanitation systems promote human health and environmental protection while minimizing resource depletion (Nagla,2020)

By 2010, many developing countries faced a significant challenge in providing improved sanitation technologies to their large populations (Bourne, 2013). While access to improved water sources reached approximately 89% of the global population by 2012 (WHO,2021), the sanitation situation remained critical. In 2020, despite progress, 2.7 billion people, predominantly in rural areas, lacked access to basic sanitation facilities (WHO, 2017).

Shockingly, two billion lack basic sanitation services and 80% of the global wastewater remains untreated (Mosler, 2019). As a result health damage, loss of productivity and absenteeism are common in most developing countries (Porcella *et al*., 2023). WHO (2017) comfirms unmet sanitation targets, with only 27% of the global population

exposed to adequate sanitation since 1990. Approximately, 1.8 billion rely on basic pit latrines, and over a billion practice open defecation (WHO, 2017).

Many traditional sanitation systems, typically characterized by linear end-of-pipe approaches, adversely affect sustainability by compromising human health and the natural environment through the disposal waste and wastewater via multiple treatment steps (Wafula 2021). Designs like flush and discharge and drop and store technologies impose substantial costs on wastewater treatment plants. The need for sustainable sanitation solutions is underscored by the growing emphasis on compatibility with global challenges like water scarcity and food insecurity (Langergraber & Muelleger, 2005).

"A shift towards decentralized wastewater treatment approaches and increased interest in composting toilets are part of new paradigm (Anand & Apul, 2014). Studies highlight the potential of ecological sanitation technologies in recovering nutrients, particularly phosphorus, from regions with low sanitation coverage (Wilbur & Jonas, 2014). The provision of enhanced sanitation facilities in Ethiopia faces obstacles in rural areas with operational inconsistencies and infrastructural issues (Strengthening Ethiopia's Urban Health Program, 2015). Sanitation challenges persist nationwide, with approximately 70 million people relying on unimproved facilities in 2021, indicating systemic issues related to organization, finance, and strategic implementation (Baye, 2021). Poor sanitation in Ethiopia stands as a substantial barrier to development, impacting health, education, gender equality and overall socio economic progress (Baye, 2021). Perceptions of modern sanitation systems, like UDDT, are shaped by adopters' experiences, highlighting the need to consider existing sanitation structures (Conroy & Mancl, 2022). Gender considerations play a pivotal role, emphasizing the importance of gender equity in both technical design and awareness - raising efforts (Dickin *et al*., 2018). Understanding hurdles and facilitators to the adoption of sanitation technologies,

such as UDDTs, reveals a complex landscape encompassing beliefs, infrastructure, costs and cultural values (Conroy & Mancl, 2022).

2.6 Influence of Economic Factors on the Adoption of Sanitation Systems

Globally, from 2015 to 2030, it is estimated that roughly 1.1 billion people would need services to open defecation which translates to a budget of US $6 billion annually which 7.4 billion people equivalent budget of US $33 billion annually would need basic sanitation services (Mudombi, 2018). According to the world statistical data of 2016, roughly 62% of the global 2030 would need to be spent not on the above items but on safe management of the faecal sludge (Mudombi 2018). Economic factors focus more on availability of income and are considered to be one of the motivating factors for choice of sanitation technologies. The provision of affordable sanitation products and services with more equitable distribution to reach the low-income groups and to enhance access to and demand for goods and services is viewed as critical (Onjala & K'Akumu,2016).

However greater emphasis would still need to be placed on safe management of faecal sludge from all sources, including but not limited to waste water treatment plants, with 32 million people (annual budget of us $ 970 million or 69% of expenses on sanitation) requiring this service (Mudombi, 2018). For instance, the annual investment by South Africa into sanitation in 2019/2022 was estimated to be R17.5 billion (World Bank, 2017) this was insufficient for both the backlogs and the new services (WHO, 2019). Alternatively, ecological sanitation technologies and systems must be well managed, however to reduce the possibility of diseases such as diarrhea and helminthiasis (Kumwendu, 2017).

Investing in Sanitation and hygiene has been shown to lead to direct health and indirect economic benefits. In terms of health benefits, report that improved Sanitation can decrease diarrhea diseases by 28 % and that there are notable differences in illness

reduction according to the type of improved water and sanitation, system implemented. Regarding economic benefits, WHO (2019) estimates that a return of more than US$ 6.60 can be derived for every US$ 1 dollar invested in sanitation in SSA. These are good arguments for universal compliance in handwashing and defecating practices, but due to different factors these are yet to trigger a complete transformation of undesirable behaviours and practices in communities where they prevail. High prescribed standards for sanitation facilities , high cost of piloted solutions (McGranahan, 2015), structural inequities and remoteness of rural settlements (O'Reilly *et al*.,2017) and unavailability of building materials and expertise are some of many factors perpetuating the problem.

Several factors influence sanitation choices, including financial resources, household income, affordability, competing household expenses, and willingness to pay (World Bank, 2017). For instance, in Kenya, constructing a pit latrine cost approximately USD 360, representing 70% of the average annual income for the poorest households. This financial burden often led to unimproved sanitation or a return to open defecation (OD) (Munkhondia et al., 2016). Conversely, wealthier households had greater flexibility to invest in more expensive sanitation options. Additionally, the cost of using communal latrines scaled with household size, increasing the likelihood of OD among larger families.

Subsidized sanitation solutions and installment payment plans could mitigate the affordability challenges faced by low-income households (World Bank, 2017). However, competing household needs often prioritize other expenses over sanitation, especially for those in their economically productive years (Barchi, 2019). Insufficient access to WASH facilities and knowledge can be indirectly linked to non - health factors such as safety and dignity. For example, Hutton *et al*. (2014) reveals that the perceived economic cost of sanitation can be a considerable barrier to families investing in an appropriate

sanitation solution. This despite the fact that families owning toilets cite a number of benefits. It was found out that the main reasons why some households owned toilets included safety , improved environment , source of pride , reduction in anxiety relating to one's children , comfort , comfort , convenience , easy installation and decreased embarrassment . Meanwhile, the main reason why other households did not own a toilet was the alleged high cost. According to Hutton and Chase (2016), WASH inequalities align with socio-economic status on a global level. They find that the impact of substandard sanitation amounts to a decrease in GDP of over 4% in South Asian countries and argue than non-health impacts should be taken into account when evaluating WASH interventions. The link between WASH access and socio-economic status is also observable at the household level. UNICEF (2017) offers a positive perspective on this in India, estimating that inhabitants of rural villages free of OD share savings of 50,000 Rs (484GBP) per year and the value of their property increase by an average 19,000 Rs (184 GBP).

2.7 Theoretical Framework

This research is guided by the Theory of Planned Behavior (TPB) hypothesized by Ajzen (1991). The theory relates on individual behavior which the person can exercise self-essential. The theory postulates that the intentions to engage in a given practice are determined by the attitude that the particular practice is likely to result in a known outcome (Ajzen, 199) according to Ajzen (1991), motivation or intention versus behavioral achievement.

The theory of planned behavior elaborated three sorts of beliefs which include control, behavioral and normative based on such baling's Ajzen (1991) develop the following constructs that represent an individual control over certain behavior:

Subjective norms which revolve around the speculation on whether majority will support or denounce the behavior people are believed to perform the behaviors which are approved by the pies.

The theory is relevant per this study in that individual and households may adopt safe sanitation and hygiene practices like construction of improved toilets use of the available latrines and maintenance of sanitation facilities only after eradicating subjective norms changing their altitudes on sanitation embrace perceived control only to positive sanitation practices.

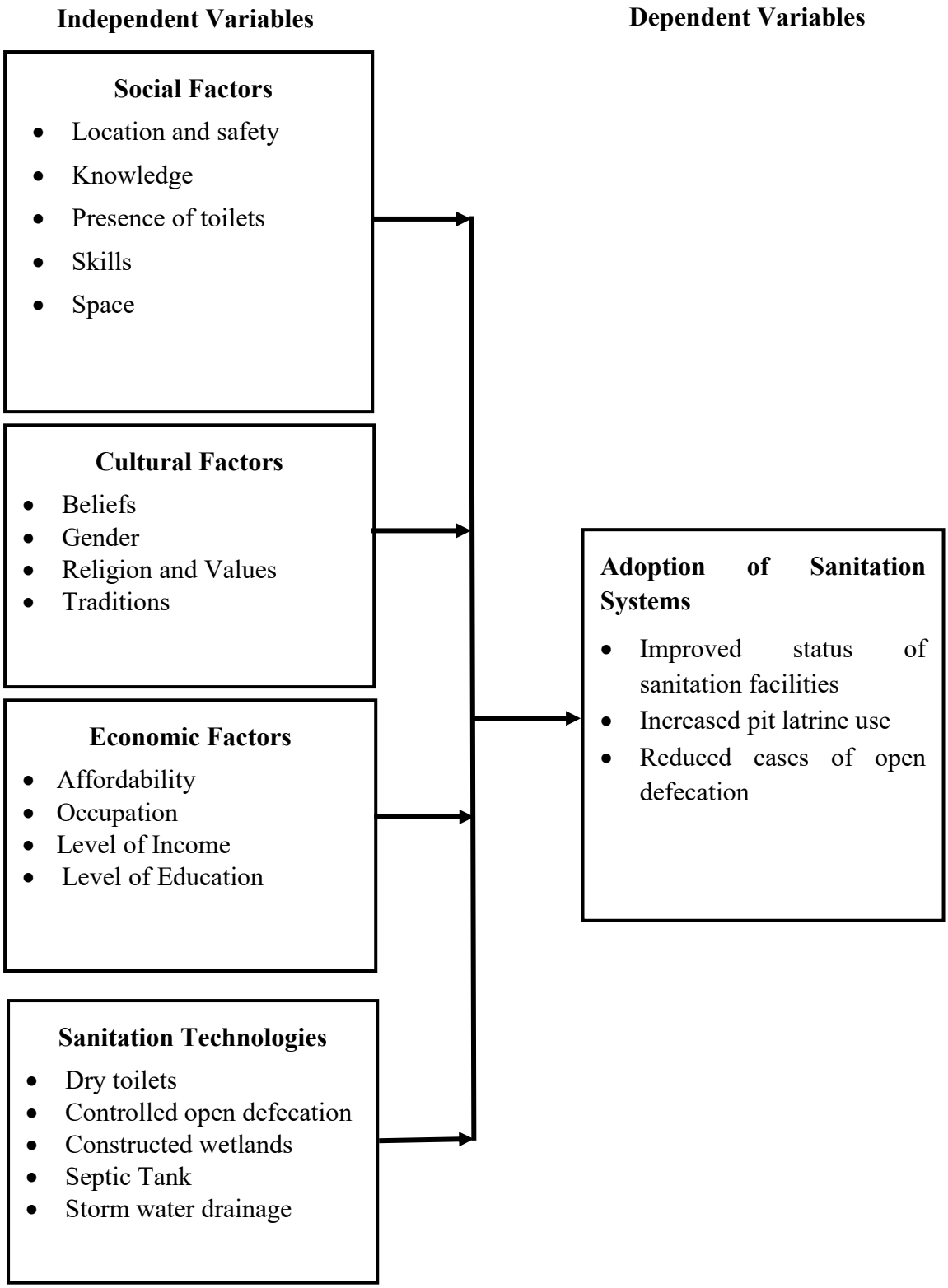
Ajzurs theory however has several limitations because it assumes that the individuals performing a given behavior have already acquired the resources and opportunities regulation of their intention.

2.8 Conceptual Framework

Mathew (1988) defined a conceptual framework as a visual /written product one that explain either graphically or in narrative for the main things to be studied, the key factors, concept or variable and presumed relationship among them. The dependent variables indicate total influence arising from the independent variable. A conceptual frame work is a diagrammatic or virtual representation of the link between variable (Regoniel 2015). As indicated adoption of sanitation practices may be influenced by social factors, cultural practices, economic factors and technology.

Figure 2. 1

Conceptual framework



Source: Researcher, 2023

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In this chapter the study outlines the study methodology. A justification is provided for the selected method used in answering the study questions under this section, details on sampling approach, participant and ethical issues are also outlined besides the process of the data collection, sampling and analysis is explained. The research designed and research instrument.

3.2 Study Area

The study was done in Tharaka North Sub County of the Tharaka-Nithi County which borders Embu County to the East, Kitui County to the west and Meru County to the north. Tharaka North Sub County was selected because it is a semi -arid area. The main economic activity for the people of Tharaka North Sub County is agriculture. They mainly grow green grams, sorghum and millet since the area is an arid and semi-arid region which frequently experiences drought. The area is predominantly inhabited by the Tharaka tribe who live in homesteads containing male household heads, their wives, children and sometimes their children's families.

The sub county has a total population of 58,345 and 13,415 households.

3.3 Research Design and Approach

A mixed methods approach was used. It involved quantitative and qualitative techniques. According to Bentahar and Cameron (2015), mixed methods permit collection of data from various sources. The study adopted a cross sectional survey design where researchers collected data from many household heads at a single point in time. The design allowed for extensive data collection on issues based on the variables of study. The design permited the researcher to treat the strands in the analysis phase as

independent and eventually merge the data when interpreting, enabling the information presented to be comprehensive and reliable as the design allowed for accurate view of objectives from the group or individual point of view.

3.4 Target Population

According to Onjala (2017), population is the aggregate accumulation of components about which we wish to make decisions. Tharaka North Sub County has a population 58,345 people. The study consisted of households' heads from the households, Public Health Officers, Community Health Volunteer, a chief and masons from Tharaka North Sub County.

Table 3. 1

Distribution of population and households in Tharaka-North Sub-County

Location	Number of Households	Population
Gatunga	1815	7723
Kathangachini	2191	9934
Maragwa	1822	8216
Kanjoro	2258	9712
Gikingo	3091	13131
Ntoroni	1101	4653
Thiiti	1137	4976
Total	**13415**	**58345**

Source: Researcher, 2024

3.5 Determination of Sample Size and Sampling Techniques

Out of 13,415 households in Tharaka North Sub-County, a sample was selected with the participants being the household heads. The basis of picking households heads was that they took overall charge of their families and therefore were likely to give the desired information concerning their homes. Following the arguments of Mwirigi et al. (2020), members of one household share a single toilet block hence laying the consideration of household heads. Public health officers and community health volunteer were engaged

because they were assumed to have an in-depth knowledge and information and sanitation issues at the community and household levels respectively. On the other hand, masons were considered since they designed and constructed sanitation facilities.

3.5.1 Sample size

To determine the sample size, Yamane's (1967) formula was employed. This method calculated an appropriate sample size based on the target population and desired margin of error. By using this formula, the study ensured that findings could be generalized to the broader population.

The sample size was therefore determined as follows÷

$n= N/(1+N(e^2)$

where:

n= desired sample

N= total number of households

E= sampling error (taken to be ± 5 %)

$= 13415/ (1+13,415(0.05^2)$

The sample size was 388 households.

3.5.2 Sampling techniques

Cluster sampling technique was employed in categorizing Tharaka-North Sub-County into clusters of Seven locations namely: Gatunga (1815 households), Kathangachini (2191 households), Maragwa (1822 households), Kanjoro (2258 households), Gikingo (3091 households), Ntoroni (1101 households) and Thiiti (1137 households)).

Cluster sampling technique was appropriate because the population is heterogeneous. The researcher then considered simple random techniques to identify participants within the locations as it ensured that all subjects had an equal chance of being considered for

participation. To fairly select responsibilities from each location, the researcher employed the proportionate random sampling technique where participants are chosen from unequally distributed clusters (Mukadi, 2016). The samples per location were obtained from the following calculation: Households per cluster divided by total households multiplied by desired sample size.

Table 3. 2

Distribution of samples for Tharaka North Sub County

S/No.	Location	Number of Households per Cluster or Location	Sample per Location
1.	Gatunga	1815	53
2.	Kathangachini	2191	63
3.	Maragwa	1822	53
4.	Kanjoro	2258	65
5.	Gikingo	3091	89
6.	Ntoroni	1101	32
7.	Thiiti	1137	33
	Total	**13415**	**388**

Source: Researcher, 2024

Additionally, the study considered purposive sampling technique to select 3 Public Health Officers, 3 Community Health Volunteers, 3 Household Heads, 1 Chief and 3 Masons as interviewers for focus groups discussions.

3.5.3 Eligibility criteria

The study targeted household heads within Tharaka North Sub County. Individuals aged below the age of 18 years were not incorporated in the study.

3.6 Research Instruments

The primary data collection instruments were mixed questionnaires which were used to quantitative data from household heads at the household level. Observation checklist was

employed at the household levels. Interview schedules were administered to the respondents.

The interview guides administered for focus group discussions to aid in the collection of qualitative data. Topics related to toilets were most likely sensitive hence there was need to ensure that participants did not feel embarrassed while taking part in the study and that they did not have a feeling of invasion of privacy when the researcher will be observing toilets. As a result, the researcher first created good rapport and clearly elaborate to the participants what they expect from the survey, giving few examples of the sensitive questions they were to encounter in the questionnaire or interview and assuring them that participation was voluntary and that they were free to decline participating. Further, permission to make observation on toilets was given on confidentiality of the information obtained.

3.6.1 Pilot testing of research instruments

The researcher tested the suitability of data collection instruments and ensure standardization before the actual field work. Following the arguments of Muganda (2003), a pilot study of 10% of the sample size was done to pre-test the interview schedules effectiveness. It was also used to make corrections, classifications and highlight omissions to improve the data collection tools in the preparation and data collection exercise.

Piloting was done in Kamarandi Location, a region in Tharaka South Sub County of Tharaka Nithi County. A total of 10 respondents' were randomly selected from the location to participate in the pilot study. The exercise ensured that any probable instrument arrows are identified and unclear questions rephrased. 10 questions were distributed to 10 respondents and returned when fully filled. Validity done showed that

the research instruments effectively measured the influence of social cultural factors, economic factors and sanitation technology on adoption of sanitation systems.

3.6.2 Validity of research instruments

The researcher developed good rapport in the interview settings. To ensure validity, data triangulation was employed by collecting from varied sources. As a way of assured content validity, all the possible responses were captured to provide adequate coverage of the survey. Determining content validity of a measure involved an expert from the WASH field, Mugenda and Mugenda (2003). To as sustain the validity of the research instruments, the researcher therefore consulted with expert including the investigator's supervisors and lecturers whereby the content of qualitative data was discussed before making conclusions and generalization to refine the research instruments. I had three research assistants in the entire study.

The extent at which data collection instruments was able to measure the parameters was tested prior to the real data collection exercise to ensure that the study yields authentic results (Kimberlin & Winsterstain, 2008). Opinion was sought from four experts who were conversant with sanitation and have a Doctor of Philosophy in a related field. The peers considered had prior experience in sanitation related data collection and analysis. This characteristic qualified the experts and peers to conducted appropriate confirmation of instruments validity.

3.6.3 Reliability of research instruments

Reliability refers to the consistence of a measure (Mugenda and Mugenda, 2003). A task is considered reliable if the same results are achieved repeatedly. The test retest malted was applied in the sample to test reliability. Any research instruments ought to generate consistent results even after repeated surveys (Thanasagaran 2009). The researcher was subject the same participants to the same trials on two separate instances to test whether

the scores for one test was similar or closer to the previous test. A reliability test using cronbach's alpha was carried out to ascertain whether the data set was fit for analysis.

Table 3. 3

Reliability statistics

Cronbach's Alpha	Number of Items
0.72	0.3

Source: Researcher, 2024

3.7 Data Collection

Data collection employed self-administered mixed questionnaires which involved FGD tools, observation tools and interview guides to the respondents. This method was chosen for its minimal cognitive burden. To gather richer data, unstructured interviews were conducted to establish rapport and explore diverse perspectives. Research assistants were trained locally and met daily to compare findings, ensuring data consistency. To accommodate participants with limited literacy, questionnaires were verbally translated and administered in Kiswahili and Kitharaka languages.

3.7.1 Use of questionnaires

Information at the household level was gathered by the use of mixed questionnaires. The tool entailed demographic information, the influence of social factors, cultural factors, economic factors and sanitation technologies on adoption of sanitation systems.

Household heads filled in the questionnaires after conceding to take part in the study. The actual name of participants were not be captured in the questionnaires to hide their identity and ensure privacy of information.

3.7.2 Observation method

Observation method "is a technique of gathering data through direct exploration",(Creswell, 2013). Observation check-list containing information on the status of sanitation systems in terms of cleanliness, presence of nuisances such as smell,

flies, maggots and cockroaches was used. It entailed data on, presence of feaces in the open, the materials and size of the super structure and the condition of the latrine slab and the aperture. The data gathered was treated with strict confidentiality through observing privacy of the highest degree on the information gathered from households. The data in soft copy was stored in password-protected computers to avoid access by third party. The information in hard copies was be stored in a lockable box and kept in private place. Respondents were reassured of the safety of their information and that it was not to be used for any malicious reasons.

3.7.3 Focus group discussion

Qualitative data was collected via a focus group discussion consisting of nine purposively selected participants to unveil knowledge gaps on the influence of social, cultural, economic factors and sanitation technologies on adoption of sanitation systems. For this study, the participants for the focus group discussion were : - 3 public health officers, 3 masons, 1 chief, 3 community health volunteers and 3 household heads who received a verbal invitation to participate in the discussion scheduled in the middle of the household survey exercise. One focus group was conducted among the 13 participants and occured at convenient times and accessible venue for every participant. The discussion protocol included 15 open ended questions and stay not longer than 60 minutes. Responses were recorded through notes taking with a pen and a notebook and also through audio recording using a mobile phone.

3.8 Ethical Considerations

Before embarking on this research, the proposal was presented to the supervisors for approval and ethical approval was sought from the Meru University Institutional Research and Ethics Reviews Committee (MIRERC). A research permit was obtained from the National Commission for Science, Technology and Innovation (NACOSTI) and

a letter of introduction from Meru University of Science and Technology to enable the researcher collect data.

The purpose of the study and its objectives was explained. The respondents' confidentiality of the response was assured and use of data as well as benefits and risks of participating in the study was explained. There was a written consent form which was signed by respondents to ascertain their participation willingness.

3.9 Data Analysis

Thematic Analysis of data was conducted on non-numerical data using the MAXQDA Software. Following the arguments of Braun and Clarke (2014), thematic analysis is a suitable method when the researcher desires to understand behaviors, thoughts and people's experiences. The method involved identifying, examining and reporting repeated themes.

3.9.1 Analysis of quantitative data

Quantitative data obtained from questionnaires at the household was analyzed using both descriptive and inferential statistics in SPSS version 25.0 Descriptive data entailed the indicators of social, cultural, economic factors and sanitation technologies was presented in frequencies, percentage, means and standard deviations in tables. Correlation analysis using Pearson’s Product Moment approach was conducted to establish the link between indicators of social cultural factors, economic factors and sanitation technologies on adoption of sanitation systems and findings presented in tables.

3.9.2 Analysis of qualitative data

A separate analysis for the quantitative data was conducted. The audio files which had been recorded were transcribed to produce written texts which were compared with the handwriting notes to check for word similarities and generalizations. The data was coded and grouped into themes using the MAXQDA software. Following the arguments of

Brian and Clarke (2014), thematic analysis was a suitable method when the researcher desired to understand behaviors, thoughts and people's experiences. The analysis method involved identifying, examining and reporting repeated themes. Sentences or phrases with the same meaning were highlighted to formulate codes which explain the texts common and recurring patterns that formed themes were reviewed to confirm their suitability, usefulness and accuracy.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents results from statistical analysis of the findings from a study conducted in Tharaka-North Sub-County of Tharaka-Nithi County and their interpretation is presented per objectives. Descriptive and inferential statistics for each variable are presented in tables and graphs.

4.2 Response Rate

The rate of response for the study was as depicted in table 4.1.

Table 4. 1

Response rate

Location	Expected number	Number that showed up	Percent
1. Gatunga	53	53	14%
2. Kathangachini	63	63	16%
3. Maragwa	53	53	14%
4. Kanjoro	65	65	17%
5. Gikingo	89	86	23%
6. Ntoroni	32	30	8%
7. Thiiti	33	30	8%
Total	**388**	**380**	**100%**

Source: Researcher, 2024

The study involved 388 respondents. The research instruments included structured questionnaires, interview guide for focus group discussion and observation checklists. Questionnaires were administered to 388 household heads. The 388 questionnaires distributed to the household heads were returned fully filled by 380 respondents, an indication that data collected was adequate. In addition, a focus group discussion was held among 13 participants who included 3 household heads, 3 Community Health

volunteers, 3 Public Health Officers, 3 masons and 1 Chief. The group showed up in time and responded to the questions adequately. Self-administration of the questionnaires led to 98% response rate which qualified the data gathered appropriate for analysis and reporting.

4.3 Demographics

In this section summary statistics based on respondent's gender, age, level of education, religion, occupation and household size are represented.

4.3.1 Gender distribution

Table 4.2 indicates a gender imbalance in the sample, with males comprising 63% and females 37%. This overrepresentation of males likely reflects the cultural norm of males as primary household decision-makers in the study area. The findings also implied that women took lesser roles in decision making and they availed themselves only when the males, who are the household heads, were absent.

Table 4. 2

Participants' distribution by gender

Gender	Frequency	Percent
Male	241	63%
Female	139	37%
Total	**380**	**100%**

Source: Researcher, 2024

4.3.2 Distribution by age

It is shown in the table 4.3 that the highest number of participants in the survey were aged between 18-33 and 34-49 years covering 42% and 39% of the sample respectively .The high participation of the group aged between 18 and 33 and 34 and 49 years indicated that most families were headed by young adults who were mostly not occupied. Only 19 % of the respondents were aged above 50 years.

The low participation rate of household heads above 50 years could be attributed to the fact that such members did not live in the village or were absent at the time of the study.

Table 4. 3

Distribution of respondents by age

Age (years)	Frequency	Percent
18-33	159	42%
34-49	149	39%
Above 50	72	19%
Total	**380**	**100%**

Source: Researcher, 2024

4.3.3 Distribution by education level

Most of the respondents (47%) had attained a post-secondary level of education followed by 26% who had schooled up to secondary level,21% had reached primary level and only 6% had no formal education as shown in table 4.4.

This study indicated that more people in the study area had attained basic education, which showed that the people in the study were literate. The 6% of the respondents who had not attained formal education could have been raised up during the period when education was not valued especially for the female gender. Literacy could have an implication on adoption of sanitation systems. Questionnaires were interpreted to them in Kitharaka language and their responses filled by the research assistants.

Table 4. 4

Participants' distribution by education

Education level	Frequency	Percent
No education	23	6%
Primary	81	21%
Secondary	98	26%
Post-secondary	177	47%
Total	**380**	**100%**

Source: Researcher, 2024

4.3.4 Distribution by religion

Results in table 4.5 illustrate that almost all the respondents (99%) were Christians and only 1% were Muslims. There were no Hindus or people who did not belong to any religion. These findings showed that Christianity was the predominant religion in the study area. Some religious practices facilitate adoption of sanitation practices (Adogyamfi, 2019).

The number of anal washers (Muslims) was almost negligible. Anal washing practices could be a challenge especially in regions faced with water scarcity like Tharaka-North Sub-county.

Table 4. 5

Respondents' distribution by religion-Source

Religion	Frequency	Percent
Christians	376	99%
Muslims	4	1%
Hindus	0	0%
Any other religion	0	0%
Total	**380**	**100%**

Source: Researcher, 2024

4.3.5 Distribution by occupation

In table 4.6, 43% of the participants were casual laborers, 17% were salaried employees, 32% were self-employed and 10% had no work at all. The implication of having majority of the respondents being casual laborers, unemployed and others self-employed could be

that there were no employment opportunities presented for the residents. On the other hand, having 17% salaried employees implied that some people especially those that attained post-secondary education were economically stable. The findings therefore showed that majority residents might have challenges in affording the construction of improved sanitation facilities.

Table 4. 6

Distribution of participants by occupation

Occupation	Frequency	Percent
Salaried	66	17%
Casual	163	43%
Self-employed	120	32%
No work	31	8%
Total	**380**	**100%**

Source: Researcher, 2024

4.3.6 Distribution based on household size

Most of the households had 2 to 5 members covering 64% of the sampled population, followed by 6-to 10 members (28%).The households with more than 10 members were 5% while only 3% of the households had less than 2 members as indicated in table 4.7. The suggestion of having few household members could be that residents understood the importance of family planning. Having few household members was that they did not strain in sharing sanitation facilities.

Table 4.7

Participants' distribution by household size

Size (members)	Frequency	Percent
< 2	12	3%
2-5	244	64%
6-10	105	28%
>10	19	5%
Total	**380**	**100%**

Source: Researcher, 2024

4.4 Descriptive Statistics

This section describes responses on sanitation systems in Tharaka-North Sub-county and the influence of social cultural, economic factors and sanitation technologies on the adoption of sanitation practices in frequencies, percentages and means. The findings are presented in tables and graphs.

4.4.1 Adoption of sanitation systems

The study sought to establish the existence of sanitation systems such as abandonment of latrines when provided, open defecation and construction of unimproved sanitation systems such as septic tank, storm water drainage, waste stabilization ponds urinals etc. To find out whether residents possessed improved or unimproved latrine types, residents were requested to indicate the type of sanitation facilities they used and the findings are contained in Table 4.8.

Table 4. 8

Types of sanitation facilities adopted in the study area

Sanitation Facility Type	Frequency	Percent
Traditional pit latrine	328	86%
Ventilated improve pit latrine	35	9%
Flush toilets	12	3%
No latrine facility	8	2%
Urine Diverting Dry Toilet	0	0%
Buckets	0	0%
Total	**380**	**100%**

Source: Researcher, 2024

Traditional pit latrines are unimproved forms of sanitation options and cannot completely prevent peoples contact with excreta (WHO/UNICEF, 2021) and their widespread adoption implied that the residents were below the expected sanitation standards. Only 3% of the household population had flush toilets while 9 % had ventilated improved pit latrines. A majority 86% used the traditional pit latrine. In Lowdar, for instance, Busienei et al. (2019) established that 18% of household toilets were unimproved with poorly

designed floors. The study revealed that that the toilets needed proper design. Whilst concerted efforts by governments to fight diarrhea diseases like cholera and dysentery have shown (Demissie et al.,2021), a better strategy could include capacity building through advocacy and provision of improved sanitation systems and technologies. Latrines provision at the household is a critical step in ensuring proper disposal of human excreta (Mwirigi et al., 2020).

Table 4. 9

Open defecation cases

Defecation status	**Frequency**	**Percent**
Defecation in toilets	330	87%
Open defecation	50	13%
Total	**380**	**100%**

Source: Researcher, 2024

From Table 4.9, open defecation was only recorded in 13% of the households while 87% of the households had zero cases of open defecation. These findings demonstrated that defecation in the open was not widely practiced in Tharaka-North Sub-county. The reason for open defecation could be attributed to the ignorance of the available toilets and lack of caregiver awareness on the need of effective disposal of children excreta as demonstrated in the focus group discussion findings. A study by Nagla (2020) for instance, revealed that men defecated in the open because it promoted body purity and long life.The study also revealed that men defecated in the open because they believed that the latrines were for the sick. The practice of open defecation continues to be a global health challenge which affects 494 million people world (WHO/UNICEF, 2021).

Table 4.

Summary of the adoption of sanitation systems

Sanitation practice	N	Mean	Mode	Minimum	Maximum
Latrine use	380	2.6357	2.5	1.9	3.4
Open defecation	380	2.5970	2.5	1.5	5.0
Unimproved toilets	380	3.3094	3.5	1.75	4.5

Source: Researcher, 2024

From the Table 4.10, adoption of unimproved toilets was the main form of sanitation practices in the study area covering a mean of 2.5970. From the findings most of the toilets adopted in Tharaka-North Sub-county did not prevent human contact from excreta. Residents were therefore low on the sanitation ladder and were exposed to the risks of poor sanitation such as interaction with nuisance life flies which easily transmit diarrhea diseases. From the findings open defecation cases were rare in Tharaka-North Sub-county which confirmed that open defecation was a solution for few residents. In Kenya, Wasonga et al. (2016) found that latrine sharing among in - laws was a taboo which facilitated open defecation practices.

4.4.2 Influence of social factors on adoption of sanitation systems

From the study the influence of social factors like presence of toilets, knowledge, space availability, toilet locations and skills was established. The results were presented in frequencies, percentages, means and standard deviation (SD).

Influence of presence of toilets on adoption of sanitation systems

Respondents were asked to indicate their level of agreement to some statement given in a five-point Likert scale to reveal whether presence or absence of sanitation practices influenced their utilization. Results were as shown in table 4.11.

Table 4. 10

Influence of presence of toilets on adoption of sanitation systems

Perception level	Toilet presence encourage use	Open defecation resulting to lack from toilets	Insufficient shared toilets discourage use
Strongly disagree	206 (53%)	147 (39%)	89 (23%)
Disagree	147 (39%)	151 (40%)	237 (62%)
Neutral	8 (2%)	47 (12%)	27(7%)
Agree	19 (5%)	19 (5%)	12 (4%)
Strongly agree	0 (%)	16 (4%)	15 (4%)
Total	**380 (100%)**	**380(100%)**	**380 (100%)**

Source: Researcher, 2024

The findings showed that some residents failed to use sanitation facilities even when toilets were available. The result of the study Tharaka-North Sub-county rhymed with the findings obtained in Nepal by Bhattuk *et al.* (2019) who reported that residents ignored using the available sanitation facilities. The implication of the high negative opinion was that open defecation was hardly tied to toilet presence. Residents would ignore the available sanitation facilities when they were not acceptable and user friendly. The results also revealed that sharing of toilets among households did not influence toilet use, an indication that all groups in the households could comfortably share toilets and there existed no barriers to toilet sharing in the community. Thus, even with strained access to toilets, people in the study area would strive to use the available toilets, an implication that defecating in the open was the least option for the residents even with strained access to sanitation facilities.

Influence of knowledge on adoption of sanitation systems

The researcher also desired to examine whether knowledge influenced the adoption of sanitation practices in Tharaka-North Sub-county. Participants were required to indicate their degree of agreement to the statements and the findings were recorded in Table 4.12.

Table 4. 11

Influence of knowledge on the adoption of sanitation systems

Perception	OD risks children to diseases	Lack of caregiver awareness and open disposal	Children faeces not harmful	Information sharing influence use	Unimproved toilets and disease transmission.
Strongly disagree	0 (0%)	19(5%)	120 (32%)	147 (38%)	167 (44%)
Disagree	8 (2%)	43(11%)	155 (41%)	108 (28%)	177 (47%)
Neutral	23(6%)	31 (8%)	82(22%)	66 (17%)	27 (7%)
Agree	163 (43%)	190 (50%)	19 (5%)	43 (11%)	4 (1%)
Strongly agree	186(49%)	97 (26%)	4(1%)	27 (7%)	4 (1%)
Total	**380 (100%)**	**380(100%)**	**380(100%)**	**380 (100)**	**380 (100%)**

Source: Researcher, 2024

The study revealed that 49% of the respondents strongly agreed that open defecation put children at risk of diseases, 43% agreed and only 2% disagreed, of the sampled population, 26% strongly agreed that lack of caregiver awareness had an influence on open disposal of children's faeces, 50% agreed, 2% disagreed and 5% of the population sampled strongly disagreed with the argument. The analysis also recorded that 32% of the respondents strongly disagreed with the argument that children's faeces were not as harmful as adult faeces,42% disagreed, 11% agreed and 7% of the respondents strongly agreed with the opinion. With respect to information sharing, 39% of the participants strongly disagreed that it influenced sanitation practices, 30% disagreed, 11% agreed and only 7% of the respondents strongly agreed. About exposure of people to diseases by unimproved sanitation facilities, 44% of the participants strongly disagreed that unimproved toilets were capable of enabling disease transmission, 48% disagreed, 1% agreed and 1% strongly agreed with the argument. The results showed a mean of 4.95,

SD=4.92 indicating that the participants supported that knowledge influenced adoption of sanitation practices.

Adoption of unimproved sanitation facilities would encourage habitation of flies and cockroaches in toilets which are potential factors for the transmission of diarrhea infections including Cholera and Typhoid. One of the respondents in the focus group said "Although people are taught on toilets, they will still construct toilets using shrubs with sacks as doors". Researchers have explored the influence of knowledge and awareness on adoption of sanitation systems. A study by Russpatrick et al. (2017) in Zambia engaged 13,688 to find out whether villagers would progress up the sanitation ladder through construction and use of improved toilets.

Influence of skills on adoption of sanitation systems

Table 4.13, illustrates the findings from the respondents who were required to indicate their extent of agreement to statements on the influence of mason skills and training on adoption of sanitation practices.

Table 4. 12

Influence of skills on adoption of sanitation systems

Perception	**Skilled masons available where needed**	**Skilled masons construct improved toilets**	**Untrained masons and good latrines**	**Mason training wastes resources**	**H/H head dictating toilet design**
Strongly disagree	70 (18%)	4 (1%)	12 (3%)	23 (6%)	8 (2%)
Disagree	147 (39%)	8 (2%)	66 (17%)	27 (7%)	35(9%)
Neutral	31 (8%)	54 (14%)	66 (17%)	78 (21%)	27(7%)
Agree	116 (30%)	233 (61%)	139 (37%)	124(33%)	179 (47%)
Strongly agree	16 (4%)	82 (22%)	97 (26%)	128 (35%)	137(35%)
Total	**380(100%)**	**380(100%)**	**380(100%)**	**380(100%)**	**380(100%)**

Source: Researcher, 2024

The study showed that 18% of the respondents strongly disagreed that masons with toilet construction skills were available when needed, 39% disagreed, 33% agreed and only 4% strongly agreed. Concerning capacity of skilled masons to construct improved toilets, 61% of respondents agreed that masons with toilet construction skills constructed improved toilets, 22% strongly agreed, 2% disagreed and 1% strongly disagreed.

The study also showed that 39% agreed that untrained masons constructed good toilets, 26% strongly agreed, 17% strongly disagreed, and only 7% disagreed. From the study, 30% of the respondents agreed that mason training was a waste of resources, 35% strongly agreed and 6% agreed. From the findings, 35% strongly agreed that household heads dictated the toilet designs, 46% agreed, 9% disagreed and 2% strongly disagreed. The results showed that the ability to construct latrines could not only be based on mason training but also on the work experience. The findings showed that the household heads had the mandate of dictating the design of the toilets to be constructed in their households. The findings implied that there was need to sensitize the communities on Public Health approved toilet designs for adoption by masons in order to improve toilet conditions in Tharaka-North Sub-county. Tha importance of Mason skills was also acknowledged by Crocker et al. (2017) who monitored changes in toilet use for 3831 households in Ghana and Ethiopia after Masons training.

Summary on the influence social factors on adoption of sanitation systems.

Table 4.14 shows that average scores for responses on the influence of social factors on adoption of sanitation practices. All indicators had a mean of more than three (3) suggesting that the participants agreed that the factors influenced the adoption of sanitation practices. However, each factor had a different degree of facilitating adoption of sanitation practices. At the highest mean of 3.96, respondents supported that knowledge influenced adoption of sanitation practices followed by toilet presence at the

households which recorded a mean of 3.82, spaces available (mean=3.51) and toilet location and safety (mean=3.18).Majority of the participants demonstrated a nearly neutral stand on the influence of mason skills on adoption of sanitation practices (mean=3.01). One of the respondents in the focus group said "Mostly masons build latrines with the instructions of the household head and do not follow the required design specifications". A similar study by Nkatha et al. (2020) in Kenya also established a link between inadequate knowledge on the importance of safe sanitation and reduced latrine utilization as a result of construction of latrines with unsafe pits which could not be easily maintained.

Table 4. 13

Influence of social factors on adoption of sanitation practices

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Knowledge	380	3.96	0.496	2.48	4.98
Toilet presence	380	3.82	0.641	1.23	4.98
Space availability	380	3.51	0.603	1.57	4.58
Location and safety	380	3.18	0.500	0.98	4.58
Masons skills	380	3.01	0.461	1.57	4.40

Source: Researcher, 2024

4.4.3 Influence of cultural factors on adoption of sanitation systems

This study examined the influence of cultural factors on adoption of sanitation practices. Results on the cultural factors like gender roles, traditions, religion and beliefs were discussed.

Influence of gender roles on adoption of sanitation systems

The study aimed at examining the extent of support to the statements given on the influence of gender roles on adoption of sanitation in Tharaka-North Sub-county. The findings were summarized in Table 4.15.

Table 4. 14

Gender roles and adoption of sanitation systems

Perception	Males as decision makers	Male roles influence OD	Female roles influence OD	Toilet separation by gender influence use
Strongly disagree	12(3%)	82(22%)	19(5%)	43(11%)
Disagree	19 (5%)	132 (35%)	112 (30%)	144 (38%)
Neutral	50 (13%)	70 (18%)	116 (31%)	147(39%)
Agree	159 (42%)	74 (19%)	101(27%)	43 (11%)
Strongly agree	140 (37%)	23 (6%)	31 (9%)	4 (1%)
Total	380 (100%)	380 (100%)	380(100%)	380 (100%)

Source: Researcher, 2024

The study showed that 35% of the respondents strongly agree that males were the decision makers on toilet construction, 42% agreed with the statement, 3% strongly agreed and 5% disagreed. Regarding male roles, 22% of the participants strongly disagreed that make males roles influenced open defecation, 37% disagreed while 19% agreed and only 6% strongly agreed that roles taken by men influenced defecation in the open. From Table 4.17, 8% strongly agreed that female roles influenced open defecation, 27% agreed, 30% disagreed and 5% strongly disagreed. Concerning toilet separation by gender, 11% strongly disagreed that if influenced toilet use, 38% diagreed,11% agreed and only 1% strongly agreed. From a mean of 3.39, participants demonstrated that gender roles had an influence on adoption of sanitation practices (SD=0.560).

Men were the primary decision makers on sanitation matters at the household level, a situation attributable to the cultural values in the area that men took control of household matters. The fact that females were mostly engaged in the household chores such as looking after children who had the tendency of defecating in the open, fetching water and collecting firewood and male roles such as rearing livestock in bushes where there were no toilets facilitated open defecation. The findings also showed that having separate

toilets for males and females did not guarantee their use although support to the importance of toilet separation by gender could be attributed to the fact that males and females desired privacy and each gender would feel comfortable while using separate toilets. One of the respondents in the focus group said " I have to walk up to 5Km daily to fetch water from home, there is faeces all over the grazing shrubs and forests since there are no toilets." A study by Caruso et al. (2017) found that men had the primary role of constructing toilets while women participated in household chores.

Influence of religion and beliefs on adoption of sanitation systems.

The responses on the influence of religion and beliefs on adoption of sanitation practices were presented in Table 4.16.

Table 4. 15

Religion and beliefs and adoption of sanitation systems

Perception	Association of diarrhea with demons	Pit latrines and evil spirits	Children faeces not harmful	Church leaders talk about sanitation maters
Strongly disagree	182 (48%)	213 (56%)	151(40%)	225 (59%)
Disagree	140(37%)	120 (32%)	144 (38%)	113 (30%)
Neutral	8(2%)	16 (4%)	66 (17%)	8 (2%)
Agree	23(6%)	19 (5%)	12(3%)	11 (3%)
Strongly agree	27 (7%)	12 (3%)	7 (2%)	23 (6%)
Total	380 (100%)	380 (100%)	380(100%)	388 (100%)

Source: Researcher, 2024

Most of the respondents, 48%, strongly disagreed that diarrhea was associated with demons, 38% disagreed, 6% agreed and 7% strongly agreed. 56% of the participants strongly disagreed and 37% disagreed that toilet pits harbored evil spirits. Besides 39% of the sampled population strongly disagreed that children faeces were not harmful, 37% disagreed, 3% agreed and 2% strongly agreed with the statement. About church leaders

discussing sanitation matters in churches, 59% strongly disagreed, 29% disagreed and 6% strongly agreed. From the findings religion and beliefs factors had a mean of 2.14, SD=0.694 which implied that participants disapproved the influence of religion and beliefs on adoption of sanitation practices in the study area.

These findings implied that majority of the respondents were aware that children faeces could cause diseases. The widespread awareness could be attainable to the high literacy levels as people had attended school and learnt about the negative implications of poor sanitation. The study further showed that sanitation matters were not prioritized in gatherings such as churches. In Ghana, Adugyamfi (2018) found that cleaning rituals for Muslims emphasized more on anal cleansing and ignored cleanliness of toilets.

Influence of traditions on the adoption of sanitation systems

Table 4.17 illustrates the responses on the relationship between traditions and sanitation practices.

Table 4. 16

Traditions and adoption of sanitation systems

Perception	Traditions discouraging toilet construction	Traditions encouraging OD	Traditions encouraging toilet construction
Strongly disagree	89(23%)	105(28%)	23 (7%)
Disagree	264 (69%)	233(62%)	42 (11%)
Neutral	12 (34%)	16 (4%)	31(8%)
Agree	8 (2%)	13(3%)	202 (53%)
Strongly agree	8(2%)	13 (3%)	82 (21%)
Total	380 (100%)	380 (100%)	380 (100%)

Source: Researcher, 2024

The findings illustrated that 23% of the respondents strongly disagreed that there existed traditions which discouraged toilet construction in Tharaka-North Sub-county, 69% disagreed while 2% strongly agreed, 28% strongly disagreed on the existence of traditions which encouraged open defecation, 62% disagreed and 1% strongly agreed.

Furthermore, 21% strongly agreed on the existence of traditions that encourage toilet construction in the region, 53% agreed.11% disagreed and 6% strongly disagreed. The findings signaled that the traditions which existed in the area encourage positive sanitation practices. These findings were supported by the results obtained from discussions in the focus group which revealed the existence of witchcraft on faeces left in the open as uttered by a respondent that; "People feared leaving their faeces in the open as they would be taken for witchcraft purposes"

Summary on the influence of cultural factors on adoption of sanitation systems

On average gender roles had the highest influence of adoption of sanitation practices as shown by the highest mean of 3.37, followed by traditions, mean 2.58 and religion and beliefs with a mean of 2.16 as illustrated in Table 4.20. The results implied that respondents agreed on the influence of gender on adoption of sanitation practices.

Table 4. 17

Summary of means and standard deviation for cultural factors

Variable	N	Mean	Std. Deviation	Minimum	Minimum
Gender	380	3.37	0.596	1.95	4.98
Traditions	380	2.58	0.569	0.98	4.30
Religion and beliefs	380	2.16	0.727	0.98	4.47

Source: Researcher, 2024

4.4.4 Correlation between cultural factors and adoption of sanitation systems

Indicators of cultural factors such as gender roles, religion and beliefs and traditions were correlated with sanitation practices to reveal the direction and extent of relationship between the variables. The findings showed that the correlation between gender roles and open defecation was positive and significant ($r=0.474$, p-value=0.000<0.04). The relationship between religion and beliefs and open defecation and with improved toilets was non-significant, (p-value=0.007<0.05). The findings suggested that gender roles

facilitated latrine use issues and increased chances of open defecation practices. People from different religious backgrounds hold dearly their religious values and beliefs (Adugyamfi, 2018) and therefore, insensitivity to the values related to sanitation could interfere with toilet adoption and use. Presence of toilets and their use is rooted in traditions and misconceptions (Stopnitzky, 2017; Wasonga et al., 2016). Researchers demonstrated various traditions surrounding sanitation in different communities.

4.4.5 Economic factors influence on adoption of sanitation systems

Household income was found to be the most influential factor in sanitation facility selection, with a mean score of 4.9271. Employment situation also had a significant impact on this decision (mean = 4.1146). Furthermore, soil type and latrine design were important factors (mean = 3.9792 and 3.9271, respectively). Educational level had a substantial impact on sanitation facility selection among Wajir town residents, which is consistent with Olujimi, Omole, and Olajuyigba's (2015) results that socio economic determinants, excluding gender, influence sanitation choices.

Table 4. 18

Economic factors influence on adoption of sanitation systems

Factor	N	Minimum	Maximum	Mean	Std. Deviation
Household income	380	4.00	5.00	4.9271	0.26136
Employment status	380	1.00	5.00	4.1146	0.85680
Type of soil	380	2.00	5.00	3.9792	0.28943
Design of Latrine	380	1.00	5.00	3.9271	0.44117
Education level	380	2.00	5.00	3.7187	1.03317
Community culture	380	1.00	5.00	2.1146	0.55951

Source: Researcher, 2024

4.4.6 Whether sanitation system fits all

The vast majority (91%) of respondents stated that their sanitation facilities were not built to accommodate all users, including those with impairments and the elderly. This demonstrates a disregard for the unique demands of vulnerable people in facility design.

Mwirigi et al. (2020) emphasize the importance of maintaining sanitation facilities and keeping them clean in order to minimize the accumulation of diarrheal infections.

Table 4. 19

Fitness of sanitation facility

Status	Count	Percent (%)
Yes	36	9
No	344	91
Total	**380**	**100**

Source: Researcher, 2024

4.4.7 Hospital bill incurred on sanitation diseases

The study looked at healthcare costs associated with sanitation-related disorders over the last five months. According to Table 4.23, 64.5% of respondents reported no such expenses, while 35.5% spent money on treating these disorders. This shows that a sizable proportion of the population suffered health consequences as a result of poor sanitation. Alhassan and Anyarayor (2018) discovered a similar trend in Nadwoli, Ghana, where sanitation facility ownership was associated with lower exposure to sanitation-related diseases.

Table 4. 20

Hospital Bill incurred on sanitation diseases

Response	Count	Percent (%)
Yes	135	35.5
No	245	64.5

Source: Researcher, 2024

4.4.8 The influence of sanitation technologies on adoption of sanitation systems

Table 4. 21

Types of Sanitation Technologies adopted in the study area

Sanitation Technology Type	Frequency	Percentage
Dry Toilet	271	72%
Urine Diverting Dry Toilet	0	0%
Septic Tank	35	9%
Hand Washing Facility	39	10%
Manual Emptying and Transporting	8	2%
Storm water Drainage	19	5%
Transfer Station and Storage	4	1%
Waste Stabilization Ponds	4	1%
Total	380	100%

Source: Researcher, 2024

The predominant sanitation technology in the study area was the dry toilet, utilized by 72% of households. Transfer stations and storage, along with waste stabilization ponds, were minimally used (1% each). Urine-diverting toilets were absent. Only 10% of households had handwashing facilities with running water. Busienei et al. (2019) reported that 18% of sanitation technologies were in poor condition due to factors like poor floor design and missing slabs. Toilets require proper design to enhance user privacy and dignity (Garn et al., 2017). Durable sanitation technologies, constructed with robust materials, are crucial for long-term effectiveness (Crocker et al., 2017).

CHAPTER FIVE: SUMMARY, CONCLUSION, RECOMMENDATIONS AND PUBLICATION

5.1 Introduction

This chapter explains the summary of the study based on the influence of social factors, cultural factors, economic factors and sanitation technologies on the adoption of sanitation systems and presents the conclusion and recommendation based on the findings per each objective.

5.2 Summary

The study examined factors influencing adoption of sanitation systems in rural communities, case of Tharaka-North Sub-County, Tharaka-Nithi County, Kenya. The study was therefore necessary to unveil the influence of social-cultural factors, economic factors and sanitation technologies on adoption sanitation systems in rural communities. The data obtained from households and focus group discussion formed the foundation of the study. The researcher conducted a household survey to find out the sanitation practices in the households and the possible factors related to adoption of sanitation systems like construction of unimproved toilets, open defecation, traditions and gender. The study areas rural sanitation status needs attention if at all communities have to attain improved sanitation standards and envisioned in SDG 6.2 in 2030.The findings on the influence each variable on adoption of sanitation practices were summarized in this section.

5.2.1 Influence of social-cultural factors on adoption of sanitation systems

The presence of toilets in the household was essential as it encouraged proper disposal of excreta. Location of toilets far from the households had an implication on women safety and could be avoided especially at night. At a mean of 2.98, respondents agreed that mason's skills were essential in construction of improved toilets, thus, without trained

masons, the type of toilets constructed could be poor. Defecation in the open did not result mostly from lack of toilets as 41% of the participants strongly disagreed that presence of toilets in their households encouraged their use and 46% disagreed.

The study revealed that decision-making regarding sanitation is predominantly male-dominated, with 47% strongly agreeing and 42% agreeing to this assertion. This highlights the need for increased female involvement in sanitation decision-making to promote gender-sensitive facility design. Additionally, 40% strongly agreed and 45% agreed that local traditions encourage toilet use, suggesting a potential role for cultural practices in sanitation promotion.

The study found a gap in sanitation priorities in religious settings. Certain religious beliefs linked diarrhea to demonic influences, which hampered sanitation promotion attempts. This emphasizes the importance of focused awareness programs within religious communities to combat misconceptions and promote hygienic habits.

5.2.2 Influence of economic factors on adoption of sanitation systems

The household income influenced adoption of sanitation systems with a mean of 4.9271 with a minimum of 4.00 and maximum of 5.00. Employment status with a minimum of 1.00 and maximum of 5.00 influenced adoption of sanitation systems with a mean of 4.1146. This economic disparity impacted sanitation access with only 9% of respondents able to afford ventilated improved pit latrines. Consequently, 86% relied on traditional pit latrines, while 3% used flush toilets. A concerning 2% lacked any latrine facility, contributing to open defecation and associated health risks such as cholera, diarrhea, and typhoid.

5.2.3 Influence of sanitation technologies on adoption of sanitation systems

The study revealed that predominant sanitation technology in the study area was the dry toilet, utilized by 72% of households. Transfer stations and storage, along with waste stabilization ponds, were minimally used (1% each). Urine -diverting toilets were absent Only 10% of households had handwashing facilities with running water. Consequently, enhancing sanitation facilities through improved maintenance, technology, privacy, and structural integrity is essential for increasing usage and acceptance.

5.3 Conclusion

From the findings of this study, it can be concluded that social and cultural factors such as skills, traditions and gender roles influenced the adoption of sanitation systems. In addition, location of sanitation technologies and absence of toilets within the households played a significant role in influencing adoption of sanitation systems in rural areas.

It can also be concluded that economic factors such as household income and employment status influenced adoption of sanitation systems in the area. Household income was the most influential factor in sanitation facility selection.

The study also concluded that sanitation technologies such as dry toilets, hand washing facilities and septic tanks influenced adoption of sanitation systems in the area. The predominant sanitation technologies in the area were dry toilets while urine diverting dry toilets were absent

5.4 Recommendations

Based on the findings of this study, the following recommendations were arrived at.

There is need to formulate sanitation policies to embrace gender empowerment to reduce gender- based sanitation inequalities. Religious leaders should also be involved in sensitization of adoption of safe health sanitation systems.

The study recommended the need for the Ministry of Health and Non-Governmental Organizations to aid in construction of sanitation technologies for households with low income to increase sanitation systems acceptance and adaptability.

The study recommended the need to educate each other on the need for good sanitation systems to increase adaptability of adoption of safe sanitation systems.

5.5 Suggestion for future reference

The study established that social-cultural factors, economic factors and sanitation technologies influenced the adoption of sanitation systems. However, there could be other factors not considered in the study that could influence adoption of sanitation systems in the rural communities, hence, future studies should target to find out the influence of demographic, psychological and other factors on adoption of sanitation practices in rural areas.

The future studies should also seek to establish whether environmental and climatic factors have an influence on adoption of sanitation systems especially in other dry or water scarce rural communities.

5.6 Publication

Muthoni, E. M., Mutembei, J., & Too, V. (2026). Influence of social cultural factors on adoption of sanitation systems in rural communities: case of Tharaka-North Sub County, Tharaka- Nithi County, Kenya. *African Journal of Science, Technology and Social Sciences*, *4*(2), SS 184–192. https://doi.org/10.58506/ajstss.v4i2.247

REFERENCES

Adam, A. M. (2021). A Study on sample size determination in survey research. *New Ideas Concerning Science and Technology 4*, 125-134.

AduGyamfi, S. (2018). Religion and Sanitation in a City in Ghana: A Conundrum? SSRN 3211389.

Ahmed, S. K., & Ahmed, S. S. (2017). Socio-cultural acceptability of urine diverted composting toilets: A review of literature for possible adoption in peri-urban areas as a sustainable sanitation solution. In *AIP Conference Proceedings, 1919* (1), 020043.

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, *50*(2), 179-211.

Alemu, F., Kumie, A., Medhin, G., Gebre, T., & Godfrey, P. (2017). A socio-ecological analysis of barriers to the adoption, sustainablity and consistent use of sanitation facilities in rural Ethiopia. *BMC public health*, *17*(1), 1-9.

Alhassan, A., & Anyarayor, B. K. (2018). Determinants of adoption of open defecation-free (ODF) innovations: A case study of Nadowli-Kaleo district, Ghana. *Journal of Development and Communication Studies*, *5*(2), 54-69.

Ali, A. G., Muema, W., & Muriuki, M. (2021). Influence of Profitability on Dividend Payout in Deposit-Taking Savings and Credit Co-Operatives (SACCOs) in

Kenya. *International Academic Journal of Economics and Finance, 3*(7), 147-158.

Angoua, E. L. E., Dongo, K., Templeton, M. R., Zinsstag, J., & Bonfoh, B. (2018). Barriers to access improved water and sanitation in poor peri-urban settlements of Abidjan, Côte d'Ivoire. *PloS one*, *13*(8), e0202928.

Belay, D. G., Asratie, M. H., Aragaw, F. M., Tsega, N. T., Endalew, M., & Gashaw, M. (2022). Open defecation practice and its determinants among households in sub-

Saharan Africa: pooled prevalence and multilevel analysis of 33 sub-Saharan Africa countries demographic and health survey. *Tropical Medicine and Health*, *50*(1), 1- 12.

Bentahar, O., & Cameron, R. (2015). Design and implementation of a mixed method research study in project management. *Electronic Journal of Business Research Methods*, *13*(1), 3-15.

Bhatt, N., Budhathoki, S. S., Lucero-Prisno, D. E. I., Shrestha, G., Bhattachan, M., Thapa, J., & Pokharel, P. K. (2019). What motivates open defecation? A qualitative study from a rural setting in Nepal. *PLoS One*, *14*(7), e0219246.

Braun, V., & Clarke, V. (2014). What can "thematic analysis" offer health and wellbeing researchers?. *International journal of qualitative studies on health and well-being*, *9*(1), 26152.

Busienei, P. J., Ogendi, G. M., & Mokua, M. A. (2019). Latrine structure, design, and conditions, and the practice of open defecation in Lodwar town, Turkana County, Kenya: A quantitative methods research. *Environmental health insights*, *13*, 1178630219887960.

Busienei, P. J., Ogendi, G. M., & Mokua, M. A. (2019). Open defecation practices in Lodwar, Kenya: a mixed-methods research. *Environmental health insights*, *13*, 1178630219828370. https://doi.org/10.1177%2F1178630219828370

Caruso, B. A., Clasen, T. F., Hadley, C., Yount, K. M., Haardörfer, R., Rout, M., & Cooper, H. L. (2017). Understanding and defining sanitation insecurity: women's gendered experiences of urination, defecation and menstruation in rural Odisha, India. *BMJ global health*, *2*(4), e000414.

Clarke, V., & Braun, V. (2014). Thematic analysis. In *Encyclopedia of critical psychology*. Springer, New York, NY. 1947-1952. https://doi.org/10.1007/978-

1-4614-5583-7_311

Creswell, J. W. (2013). *Steps in conducting a scholarly mixed methods study.* https://digitalcommons.unl.edu/dberspeakers/48/

Crocker, J., Abodoo, E., Asamani, D., Domapielle, W., Gyapong, B., & Bartram, J. (2016). Impact evaluation of training natural leaders during a community-led total sanitation intervention: a cluster-randomized field trial in Ghana. *Environmental Science & Technology*, *50*(16), 8867-8875

Crocker, J., Saywell, D., & Bartram, J. (2017). Sustainability of community-led total sanitation outcomes: Evidence from Ethiopia and Ghana. *International journal of hygiene and environmental health*, *220*(3), 551-557.

Crocker, J., Saywell, D., Shields, K. F., Kolsky, P., & Bartram, J. (2017). The true costs of participatory sanitation: Evidence from community-led total sanitation studies in Ghana and Ethiopia. *Science of the Total Environment*, *601*, 1075-1083.

Demissie, G.D., Yeshaw, Y., Aleminew, W., Akalu, Y. (2021) Diarrhea and associated factors among under five children in sub-Saharan Africa: Evidence from demographic and health surveys of 34 sub-Saharan countries. *PLoS One, 16*(9), e0257522. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0257522

Doshi, S., Phophalia, K., Lakhotia, T., Patel, H., & Gaikwad, T. (2016). Design and Cost Analysis of Rural and Urban Toilet. *GRD Journals-Global Research and Development Journal for Engineering*, *1*(5), 16-26.

Dwipayanti, N. M. U., Rutherford, S., & Chu, C. (2019). Cultural determinants of sanitation uptake and sustainability: local values and traditional roles in rural Bali, Indonesia. *Journal of Water, Sanitation and Hygiene for Development*, *9*(3), 438-449.

Fuente, D., Allaire, M., Jeuland, M., & Whittington, D. (2020). Forecasts of mortality and economic losses from poor water and sanitation in sub-Saharan Africa. *PloS One*, *15*(3), e0227611

Garn, J. V., Sclar, G. D., Freeman, M. C., Penakalapati, G., Alexander, K. T., Brooks, P., & Clasen, T. F. (2017). The impact of sanitation interventions on latrine coverage and latrine use: A systematic review and meta-analysis. *International Journal of Hygiene and Environmental Health*, *220*(2), 329-340.

Gokçekuş, H., Kassem, Y., Yunusa, N., Musa, M. K., John, S. O., Usman, S., & Ahmad, S. M. (2020). Study on Pit Latrine Minimum Design Requirement and Considerations in Northern Nigeria. *International Journal of Scientific & Technology Research, ISSN*, 2277-8616.

Hulland, K. R., Chase, R. P., Caruso, B. A., Swain, R., Biswal, B., Sahoo, K. C., & Dreibelbis, R. (2015). Sanitation, stress, and life stage: a systematic data collection study among women in Odisha, India. *PloS One*, *10*(11), e0141883.

Islam, M. R. (2018). Sample size and its role in Central Limit Theorem (CLT). *Computational and Applied Mathematics Journal*, *4*(1), 1-7.

Kenya National Beaural of Statistics. (2019). Kenya Populations and Households census data, (2).

Khanna, T., & Das, M. (2016). Why gender matters in the solution towards safe sanitation? Reflections from rural India. *Global Public Health*, *11*(10), 1185-1201.

Kimberlin, C. L., & Winterstein, A. G. (2008). Validity and reliability of measurement instruments used in research. *American Journal of Health-system Pharmacy*, *65*(23), 2276-2284.

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods. Quantitative and qualitative approaches.* Acts Press, Nairobi.

Mukadi, L. N. (2016). *Factors Influencing Adoption of Water Sanitation and Hygiene Practices in Kenya: A Case of Shivanga Location, Kakamega County* (Doctoral dissertation, University of Nairobi).

Munai, D., Ochieng, M., & Gatwiri, N. (2018). Community based solutions for sustainability of rural sanitation behaviour change in Kenya.

Mwirigi, S. N., Muchiri, E. M., Kubai, P., & Kamari, K. M. (2020). Effect of social demographic factors on utilization of pit latrines in Tigania East, Meru County, Kenya.

Nagla, B. K. (2020). Problems of sanitation in india: Does culture matter?. *Sociological Bulletin*, *69*(2), 252-269.

Nkatha, S., Muteti, P., Muchiri, E., & Rutto, J. (2020). Effect of knowledge and culture on utilization of pit latrines in Tigania East, Meru County, Kenya.

Novotný, J., Kolomazníková, J., & Humňalová, H. (2017). The role of perceived social norms in rural sanitation: an explorative study from infrastructure-restricted settings of South Ethiopia. *International journal of environmental research and public health*, *14*(7), 794.

Nunbogu, A. M., Harter, M., & Mosler, H. J. (2019). Factors associated with levels of latrine completion and consequent latrine use in Northern Ghana. *International Journal of Environmental Research and Public Health*, *16*(6), 920.

Obeng, P. A. (2020). Factors associated with perception of bad odor by users of ventilated improved pit latrines in Cape Coast, Ghana. *International Journal of Energy and Water Resources*, *4*(1), 55-62.

O'Reilly, K. (2016). From toilet insecurity to toilet security: creating safe sanitation for women and girls. *Wiley Interdisciplinary Reviews: Water*, *3*(1), 19-24.

O'Reilly, K., Dhanju, R., & Goel, A. (2017). Exploring “the remote” and “the rural”:

Open defecation and latrine use in Uttarakhand, India. *World Development*, *93*, 193-205.

Osumanu, I. K., Kosoe, E. A., & Ategeeng, F. (2019). Determinants of open defecation in the Wa municipality of Ghana: empirical findings highlighting sociocultural and economic dynamics among households. *Journal of environmental and public health*, *2019*.

Pandya, M. N., & Shukla, P. S. (2018). Role of women led sanitation in community development. *Journal of Content, Community and Communication*, *7*(4), 71-77.

Radin, M., Wong, B., McManus, C., Sinha, S., Jeuland, M., Larbi, E., & Whittington, D. (2020). Benefits and costs of rural sanitation interventions in Ghana. *Journal of Water, Sanitation and Hygiene for Development*, *10*(4), 724-743.

Regoniel, P. A. (2015). *Conceptual framework: A step by step guide on how to make one.* Simply Educate. Me.

Routray, P., Torondel, B., Clasen, T., & Schmidt, W. P. (2017). Women's role in sanitation decision making in rural coastal Odisha, India. *PloS One*, *12*(5), e0178042.

Rowley, J. (2014). *Designing and using research questionnaires.* Management Research Review.

Russpatrick, S., Tiwari, A., Markle, L., Musonda, E., Mutunda, A., Osbert, N., & Larsen, D. A. (2017). Mobility up the sanitation ladder following community-led total sanitation in rural Zambia. *Journal of Water, Sanitation and Hygiene for Development*, *7*(3), 436-444. https://doi.org/10.2166/washdev.2017.111

Sahoo, K. C., Hulland, K. R., Caruso, B. A., Swain, R., Freeman, M. C., Panigrahi, P., & Dreibelbis, R. (2015). Sanitation-related psychosocial stress: a grounded theory study of women across the life-course in Odisha, India. *Social*

Science & Medicine, *139*, 80-89.

Saxton, R. E., Yeasmin, F., Alam, M. U., AlMasud, A., Dutta, N. C., Yeasmin, D., & Winch, P. J. (2017). If I do not have enough water, then how could I bring additional water for toilet cleaning?! Addressing water scarcity to promote hygienic use of shared toilets in Dhaka, Bangladesh. *Tropical Medicine & International Health*, *22*(9), 1099-1111.

Scorgie, F., Foster, J., Stadler, J., Phiri, T., Hoppenjans, L., Rees, H., & Muller, N. (2016). "Bitten by shyness": menstrual hygiene management, sanitation, and the quest for privacy in South Africa. *Medical anthropology*, *35*(2), 161-176.

Ssemugabo, C., Wafula, S. T., Ndejjo, R., Osuret, J., Musoke, D., & Halage, A. A. (2021). Characteristics of sanitation and hygiene facilities in a slum community in Kampala, Uganda. *International health*, *13*(1), 13-21.

Stopnitzky, Y. (2017). No toilet no bride? Intrahousehold bargaining in male-skewed marriage markets in India. *Journal of Development Economics*, *127*, 269-282.

Venkataramanan, V., Crocker, J., Karon, A., & Bartram, J. (2018). Community-led total sanitation: a mixed-methods systematic review of evidence and its quality. *Environmental Health Perspectives*, *126*(2), 026001.

Vyas, S., & Spears, D. (2018). Sanitation and religion in South Asia: what accounts for differences across countries? *The Journal of Development Studies*, *54*(11), 2119-2135.

Wasonga, J., Okowa, M., & Kioli, F. (2016). Sociocultural determinants to adoption of safe water, sanitation, and hygiene practices in Nyakach, Kisumu County, Kenya: a descriptive qualitative study. *Journal of Anthropology*, *2016*.

WHO/UNICEF Joint Water Supply and Sanitation Monitoring Programme. (2021). *Progress on household drinking water, sanitation and hygiene 2000-2020.*

https://www.washdata.org/

Winter, S., Dreibelbis, R., & Barchi, F. (2019). Women's sanitation practices in informal settlements: A multi-level analysis of factors influencing utilization in Nairobi, Kenya. *Global public health*, *14*(5), 663-674. https://doi.org/10.1080/17441692.2018.1534256

World Bank. (2019). *Makueni County inclusive sanitation strategy: Situation analysis: Technical Assistance for Supporting Kenya to Tackle Sanitation Challenges.* http://documents1.worldbank.org/curated/ar/403001588139210739/pdf/Makueni-Countywide-Inclusive-Sanitation-Strategy.pdf

Yamane, T. (1967). *Statistics: An introductory analysis*. No. HA29 Y2 1967.

APPENDICES

Appendix A. Informed Consent

This study is aimed at assessing factors influencing adoption of sanitation systems among the residents of Tharaka North Sub County of Tharaka Nithi County. The data gathered will only be used for academic purposes and will not be accessed by any other third party. The aim is to yield insight into adoption of sustainable and acceptable sanitation solutions.

The researcher only wants to learn your views on sanitation to expand the existing knowledge about sanitation systems and practices. If you agree to participate in the exercise, your honest response to questions will be required. Note that there will be no right or wrong argument. Participants will be permitted, if they wish to, to decline participation even when the survey vis mid-way. You will be engaged for the survey or interview for 30 to 40 minutes. Kindly indicate your stand in participating in this study by signing this consent form :

I agree to take part in this exercise (tick where appropriate) Yes ( ) No ( )

Name: _____

Location:_____

Signature: _____

Appendix B. Questionnaire for Household Heads

Questionnaire Serial No……

Please respond by ticking in the brackets [ ] or by writing your brief comment where applicable in the special provided. All the responses given are of great value to the researcher. The information that you will provide will be used strictly for purposes of the study and will be treated in strict confidence. NB DO NOT WRITE YOUR NAME ON THE PAPER

SECTION A: DEMOGRAPHIC INFORMATION.

1) Gender.
    a. Male []
    b. Female []
2) Age of respondent
    a. 18-33 []
    b. 34-49[]
    c. Above 50 []
3) Religious Affiliation
    a. Christians []
    b. Muslims []
    c. Hindus []
    d. Any other religion
4) Highest educational level attained

a. No education []

b. Primary education []

c. Secondary Education []

d. Post Secondary education []

5) What is the number of family members living in this household?

a. <2 [] b. 2-5 [] c. 6-10[] >10[]

Section b: occupation level.

6) What is your occupation level?

a. Salaried []

b. Casual []

c. Self-employed []

d. No work []

SECTION B: SANITATION SYSTEMS

7) Which kind of sanitation facility do you use at home?

   a. Traditional pit latrine []

   b. Ventilated improved pit latrine []

   c. Flush toilets []

   d. Shared latrine []

   e. No latrine facility []

   f. Urine Diverting Dry Toilet []

   g. Buckets []

8) Where do you defecate at?

   a. Defecation in toilets[]

   b. Open defecation []

   9) do you wash your hands with soap after visiting the toilet?

   a. Yes []

   b. No []

ii) if no give your reason why!.....

9) I) Do you separate water from solid garbage before disposing?

   a. Yes []

   b. No []

   ii) where do you dispose your waste from your household?

a. Trenches []

b. Septic Tanks []

c. Open places []

d. Any other (specify)…….

a. Any other (specify)……

SECTION C: FACTORS THAT INFLUENCE THE CHOICE OF SANITATION SYSTEMS.

9) This section helps to determine the factors that influence the choice of sanitation system

I. why is you unable to wash your hands after toilet use?

a. No soap available [ ]

b. No time [ ]

c. No need [ ]

d. Any other (specify)……

10) please indicate the extent to which you agree to the following statements.

"I am satisfied with the place I choose to defecate/ dispose when I am at home."

a. Full agree [ ]

b. Somewhat agree [ ]

c. Full disagree [ ]

d. Do not know [ ]

SECTION D: SOCIAL ASPECTS

Instruction: Please indicate your level of agreement to the following statement by ticking where possible.

i) Presence or Absence of sanitation systems					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Presence of sanitation systems in the household encourages its use.					
• People defecate in the open areas when sanitation systems are provided					
• Lack of sanitation systems influence defecation in the open places					
• Knowledge on adoption of sanitation systems					
ii) Sanitation systems location and Safety					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Sanitation systems located far from the household are unsafe for women and children.					
• Setting sanitation					

systems near the household encourage open defecation					
• People get harassed while visiting sanitation systems situated away from household					
iii) Availability of Space					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Strained spaces in the household discourage sanitation systems construction					
• People defecate in the open space around the household especially at night					
• Sanitation systems are widely situated in the open spaces around the household especially at night.					
iv) Skills					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Masons with latrine construction skills					

construct improved toilets					
• Masons with skills of latrine construction are available when needed.					
• The person who dictates the design for sanitation systems in the household and not the mason.					
Untrained Masons and good latrines					
Mason training wastes resources					

SECTION E: CULTURAL FACTORS

Instructions: Please tick in the appropriate box to indicate the extent to which you agree with the following statements.

i) Religion and Belief					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• All sanitation systems are spirits					
• Diarrhea is caused by demons					
• Religious leaders encourage people to use toilets • Children faeces not harmful					
ii) Traditions					
	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Tradition upholds in this location influence open defecation practices					
• Some traditions uphold in this community encourage people to construct toilets					
• Some traditions uphold in this community encourage people to construct toilets					
iii) Gender Roles					

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
• Male roles influence open defecation					
• Female roles influence open defecation					
• Separation of toilets by gender influence their use					
• Males are the primary decision makers on sanitation (toilet construction) in the region					
• Females are the primary decision makers on sanitation (toilet construction) in the region					

SECTION F: SANITATION TECHNOLOGIES

11)Which kind of sanitation technology do you use at home?

a) Dry Toilet ()

b) Urine-Diverting Dry Toilet ()

c) Urinal ()

d) Fish Toilet ()

e) Controlled Open defecation ()

f) Hand washing Facility ()

g) Single Ventilated Improved Pit (VIP) ()

h) Twin Pit Dry System ()

i) Single Volt UDOT ()

j) Septic Tank ()

k) Biogas Reactor ()

l) Aromatic Filter ()

m) Manual Emptying and Transport ()

n) Motorized Emptying and Transport ()

o) Simplified Sewer ()

p) Stormwater Drainage ()

q) Transfer Station and Storage ()

r) Waste Stabilization Ponds ()

s) Constructed Wetland ()

t) Trussing Filter ()

u) Sedimentation and Thickening Ponds ()

v) Co-composting ()

w) Vermicomposting and Veri filtration ()

x) Activated Sludge ()

SECTION H: ECONOMIC FACTORS

12) Economic factors influence on adoption of sanitation systems.

a) Household income[]

b) Employment status[]

c) Type of soil. []

d)Design of latrine. []

e) Education level. []

f) Community culture []

Appendix C. Key Informant Interview Guide

Introduce the study to the key informants and inform them the purpose of the study seek their consent to participate in the study as key informants and start the interview guided by the following questions:

1. How would you describe sanitation in this area?

……

……

……..

2. What do you think has contributed to the sanitation situation in this area?

……

……

……

3. Do you think the attributes of the residents affect sanitation practices in this area? If yes, how? If no, why?

……

……

……

……

4. Have you seen any behavioral intention to improve sanitation practices among the residents? If yes, how has it helped?

……

……

……

……

……

5. Do you think social norms among the residents affect sanitation practices in this area? If yes, which are these social norms? If no, why?

……

……

……

……

……

6. What recommendations would you give to improve sanitation systems in the informal settlement?

……

……

……

Appendix D. Observation Checklist

ITEMS TO OBSERVE	YES	NO	REMARKS
Pit latrines Toilets Type of sanitation systems			
Water pipe Water availability			
Dish pack Nature of dish pack			
Water treatment			
Availability of soap Hand washing			

Appendix E. Distribution of Thematic Factors from the Focus Group Discussion

Thematic	Number of participants contributing to the theme	Percentage Contributing to the theme	Number of Codes
Roles by gender	9	69.27%	17
Religion	7	53.84%	19
Resources	10	76.92%	22
Space	8	61.53%	15
Traditional	8	61.53%	26
Sanitation Systems Condition	11	84.61%	28
Awareness	7	53.85%	30
Total Thematic = 7 **Participants = 13**			

Appendix F. Introductory Letter

MERU UNIVERSITY
OF SCIENCE & TECHNOLOGY

P.O Box, 972-60200 Meru-Kenya
Phone: +254 (0) 712 524 293, +254 (0)799 529 958, +254 (0)799 529 959
Email: engineering@must.ac.ke *Website:* www.must.ac.ke

SCHOOL OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

To: Whom It may concern **Date:** 19th April, 2024

Dear Sir/Madam,

RE: INTRODUCTORY LETTER FOR MUGENDI EDWIN MUTHONI, REG NO. EG407/201116/20

The above-named, is a student in the Department of Civil and Environmental Engineering at Meru University of Science and Technology, pursuing a Master's degree in Sanitation. He has been approved to conduct research on **"Assessment of Factors Influencing Adoption of Sanitation Systems in Rural Communities: Case of Tharaka-North Sub County, Tharaka-Nithi County, Kenya"** aimed at completing his studies. This is therefore, to request that you grant him any assistance needed to enable him meet the program requirements for his graduation.

Kindly contact us for any further enquiries.

Thank you

Mirara simon w.
Chair of Department Civil and Environmental Engineering
Meru University of Science and Technology

Email: CODcivilengineering@must.ac.ke
Smirara@must.ac.ke

MUST IS ISO 9001:2015 CERTIFIED

Appendix G. NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **842288**

Date of Issue: **22/May/2024**

RESEARCH LICENSE

This is to Certify that Mr.. MUGENDI EDWIN MUTHONI of Meru University of Science and Technology, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Tharaka-Nithi on the topic: ASSESSMENT OF FACTORS INFLUENCING ADOPTION OF SANITATION SYSTEMS IN RURAL COMMUNITIES: CASE OF THARAKA NORTH SUB COUNTY, THARAKA NITHI COUNTY. for the period ending : 22/May/2025.

License No: **NACOSTI/P/24/35559**

842288

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix H. Publication

AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES, 4 (2) 2025, ss 184-192

OPEN ACCESS

AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES

Journal website: https://journals.must.ac.ke

A publication of Meru University of Science and Technology

Influence of social cultural factors on adoption of sanitation systems in rural communities: case of Tharaka-North sub-county, Tharaka-Nithi County, Kenya.

Edwin Mugendi Muthoni[1*], *Josephine Mutembei*[1], *Vitalis Too*[1].

[1]*Meru University of Science and Technology, Meru, Kenya*

ARTICLE INFO

KeyWords:

Cultural Factors

Social factors

Rural communities

Improved sanitation

Sanitation practices

ABSTRACT

The Sustainable Development Goal agenda 6.2 targets to achieve universal basic sanitation and hygiene by 2030 (United Nations, 2018). This paper assessed the influence of social cultural factors on adoption of sanitation systems in rural communities. The article was based on field research that employed convergent research design where both qualitative and quantitative data was gathered simultaneously. Quantitative data was gathered using mixed questionnaires from 388 household heads selected using stratified proportionate simple random sampling techniques.The study objectives were to assess the influence of religion, traditions and gender on adoption of sanitation systems in rural communities and to assess the influence of toilets on adoption of sanitation systems in rural communities Qualitative data was collected using an interview guide from a purposively selected focus group consisting of 13 participants. The findings were organized into themes and presented in narratives. Quantitative data was analyzed using the statistical package for social sciences (SPSS) version 25.0 which generated descriptive and inferential statistics to unveil the relationship between variables. The findings, established that the adoption of unimproved toilets was the main form of sanitation system, covering a mean of 2. 9807.A unit increase in traditions led to a 0.029 decrease in adoption of sanitation systems (p.value=0.009) in the rural communities. A unit increase in gender roles led to a 0.142 increase in adoption of sanitation practices (p.value=0.001). Residents believed that faeces left in the open could be used for witchcraft purposes, a tradition that had a positive impact in eradication open defecation. Some religious denominations like the Kavonikia and Agendi associated diarrhea with demons other than the poor sanitation which was seen to facilitate poor sanitation practices and systems. The study recommended that the Community Led Total Sanitation (CLTS) strategy should target both open defecation and enlighten residents on the dangers of adopting unimproved latrines. The study also recommended that inclusion of women in household sanitation matters to ensure adoption of women and children friendly household sanitation facilities and incorporation of religious leaders as advocates of sanitation systems alongside demographic, psychosocial and environmental factors.

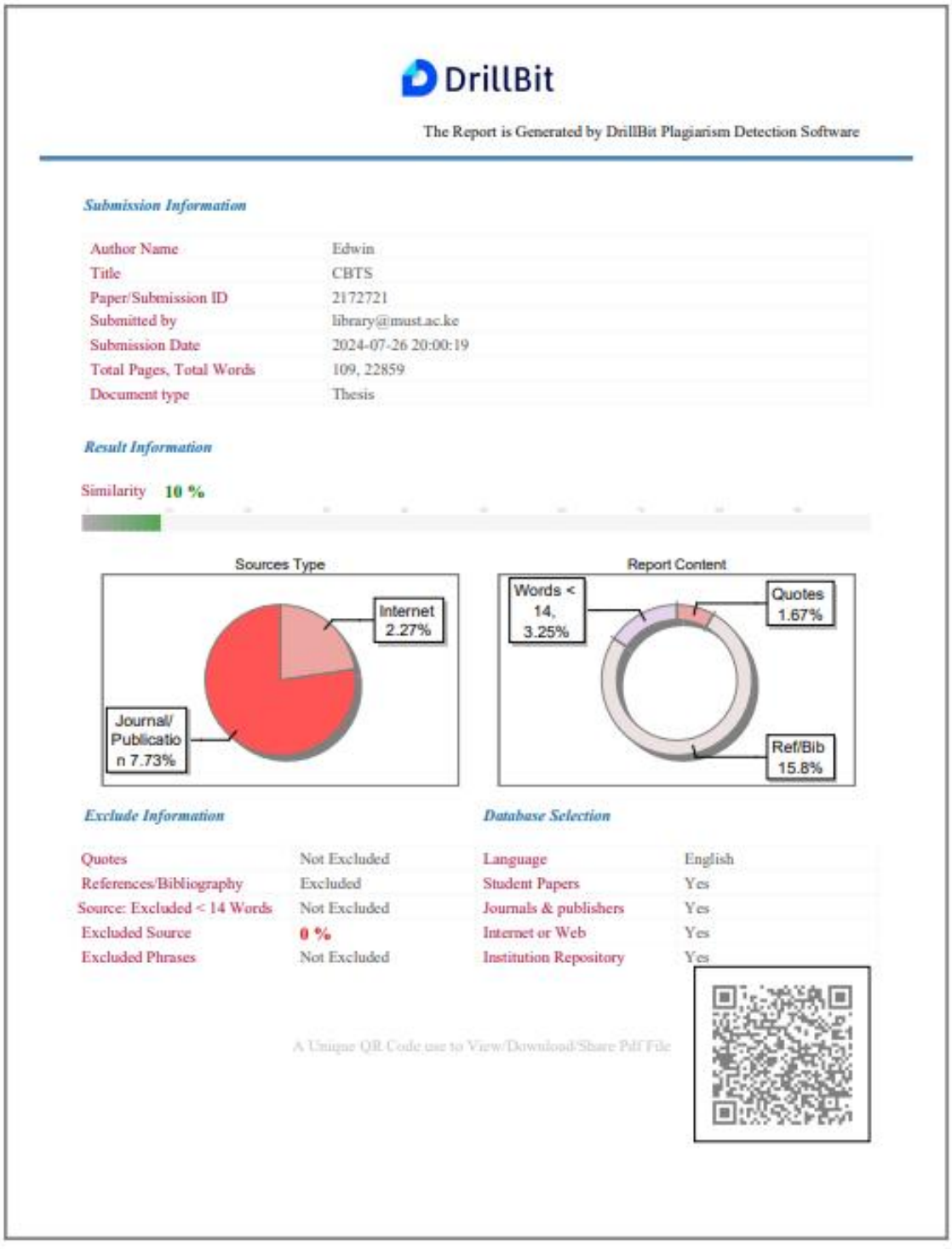
*Corresponding author: *Edwin Mugendi Muthoni* Email: edwinmugendi59@gmail.com

https://doi.org/10.58506/ajstss.v4i2.247

AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES. ISSN:2958:0560

https://journals.must.ac.ke

Appendix I. Plagiarism Report



DrillBit

The Report is Generated by DrillBit Plagiarism Detection Software

Submission Information

Author Name	Edwin
Title	CBTS
Paper/Submission ID	2172721
Submitted by	library@must.ac.ke
Submission Date	2024-07-26 20:00:19
Total Pages, Total Words	109, 22859
Document type	Thesis

Result Information

Similarity 10 %

Sources Type

Report Content

Exclude Information

Quotes	Not Excluded
References/Bibliography	Excluded
Source: Excluded < 14 Words	Not Excluded
Excluded Source	0 %
Excluded Phrases	Not Excluded

Database Selection

Language	English
Student Papers	Yes
Journals & publishers	Yes
Internet or Web	Yes
Institution Repository	Yes

A Unique QR Code use to View/Download/Share Pdf File