Analysis of Behaviour Change Ideological Dynamics Beyond Open Defecation Free Certification; A Pathway to Sustainable Sanitation in Balaka, Malawi

PhD THESIS (SANITATION)

LASTON KAMWANA

Department of Water and Sanitation

Faculty of Environmental Sciences

NOVEMBER, 2025

Analysis of Behaviour Change Ideological Dynamics Beyond Open Defecation Free Certification: A Pathway to Sustainable Sanitation in Balaka, Malawi

LASTON KAMWANA

(MSc Env. Health, BSc Env. Health, Dip Env. Health, Cert Forestry)

A THESIS SUBMITTED TO THE FACULTY OF ENVIRONMENTAL SCIENCES,

DEPARTMENT OF WATER AND SANITATION

IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF

DOCTOR OF PHILOSOPHY (PhD) DEGREE IN SANITATION.

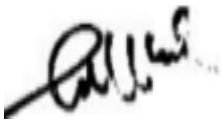
NOVEMBER, 2025

`

DECLARATION

I hereby declare that this thesis titled, ***"Analysis of Behaviour Change Ideological Dynamics Beyond Open Defecation Free Certification: A Pathway to Sustainable Sanitation in Balaka, Malawi"*** has been written by me and is a record of my research work. All citations, references, and borrowed ideas have been duly acknowledged. It is being submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy in Sanitation at Mzuzu University. None of the present work has been submitted previously for any degree or examination in any other University.

Student's name: Laston Kamwana

Signature:  **Date:** _____

`

CERTIFICATE OF COMPLETION

I, the undersigned, certify that this thesis is a result of the author's own work, and that to the best of my knowledge, it has not been submitted for any other academic qualification within the Mzuzu University or elsewhere. The thesis is acceptable in form and content, and that satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held on 24th July, 2024

Main Supervisor: Associate Professor Mavuto Tembo

Signature: _____ **Date:** _____

Co-Supervisor: Dr Russel Chidya (Ph.D.)

Signature: _____ **Date:** _____

Co-Supervisor: Dr Principal Mdolo (Ph.D.)

Signature:  **Date: 02-12-2026**

Postgraduate Coordinator: Dr Russel Chidya (Ph.D.)

Signature: _____ **Date:** _____

`

DEDICATION

This thesis is dedicated to the memory of my late father, Gideon Kamwana, and my mother, Allina Kamwana, who instilled in me perseverance, discipline, and determination in the pursuit of every vision. I also dedicate this work to my sons, Maxwell, Jonathan, and Stanley, with the hope that it inspires them to value commitment, integrity, and service to others. I further dedicate this work to my brothers, Careson (Late) and Thomson, and my sisters, Mellyn, Evelyn, Jeany, Alice, and Beatrice, for their encouragement and for entrusting me with the responsibility of carrying forward the Kamwana family legacy.

`

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to Mzuzu University for providing the academic environment and institutional support that made this doctoral study possible. I am profoundly grateful to my supervisors, Associate Professor Mavuto Tembo, Dr. Russel Chidya (PhD) and Dr Principal Mdolo (Ph.D.) for their mentorship, guidance and unwavering support in this study.

I acknowledge the profuse support of the Management of Malawi Adventist University, Malamulo College of Health Sciences, which enabled me to pursue my studies while continuing my professional responsibilities. My sincere appreciation goes to the Public Health Department staff Austin Nambindo, Ronald Chirwa, Steven Gulumba, Christine Selemani, Wyson Khomolina, McFerson Mphande, Annie Kamwendo and Dr F Panulo (Retired) for sharing knowledge, offering guidance, and providing motivation throughout this research journey. I also extend my appreciation to the Balaka District Council, particularly the Environmental Health Department and the communities of Balaka District for their time, cooperation and willingness to participate in this study. Your experiences and perspectives were invaluable in shaping the findings of this research. Special appreciation is extended to Dr Thumbalamoto, Billy Banwell and Emmanuel Masanje for their encouragement and for planting the idea that pursuing a PhD could be both meaningful and trans-formative.

Finally, I am grateful to all friends, colleagues, and family members who, in diverse ways, inspired, supported and encouraged me during this academic journey. Your guidance, motivation, and belief in me made this achievement possible. Above all, I thank God Almighty for the strength, wisdom and perseverance that enabled me to complete this study.

`

PUBLICATION DECLARATION

I, Laston Kamwana, hereby declare that parts of this thesis, titled *"Analysis of Behaviour Change Ideological Dynamics Beyond Open Defecation Free Certification; A Pathway to Sustainable Sanitation in Balaka, Malawi,"* are based on research that has been published in peer-reviewed journals during the course of my PhD studies at Mzuzu University.

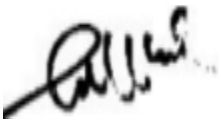
The publications arising from this research are as follows:

1. Kamwana, L., Tembo, M., & Chidya, R. (2024). Community Knowledge and Attitude on Community Led Total Sanitation After Open Defecation-Free Status Certification of Balaka District in Malawi. *Journal of Research Innovation and Implications in Education, 8(2), 274–291*. https://doi.org/10.59765/vuwg9482
2. Kamwana, L., Tembo, M., & Chidya, R. (2025). Sustained or Slipping? Community Sanitation and Hygiene Practices Four Years Post-ODF Certification in Balaka District, Malawi. *Global Research Journal of Public Health and Epidemiology, 13(7), 39–47.* Doi.grjphe/10.54978
3. Kamwana, L., Tembo, M., & Chidya, R. (2025). Community Stages of Behaviour Change for Sustained Sanitation: A Transtheoretical Model-Based Assessment Four Years Post-Open Defecation-Free Certification in Balaka District, Malawi. *Journal of Research Innovation and Implications in Education, 9(4), 594–607*. https://doi.org/10.59765/fty37s

`

I confirm that:

- I am the primary author of all the above publications.
- The co-authors contributed according to academic norms, and their contributions are duly acknowledged.
- These works have not been submitted for any other degree at Mzuzu University or any other institution.
- The published sections have been integrated into this thesis in line with Mzuzu University's thesis guidelines.



Laston Kamwana Date: _____

`

ABSTRACT

Malawi adopted the Community-Led Total Sanitation behaviour-change approach to align with global sanitation standards and eliminate open defecation. Balaka became the first Open Defecation-Free (ODF) Model District, achieving latrine and hand-washing facility (HWF) usage rates above the 95% national guideline. However, within a year, the district experienced an 11% ODF slippage, raising concerns about the sustainability of behaviour change. This study assessed post-ODF behaviour change dynamics by examining community knowledge, attitudes, practices, stages of change, and change determinants. A descriptive cross-sectional mixed-methods design was guided by the SaniFOAMS framework, the Socio-Ecological Model, and the Trans-theoretical Model of Behaviour Change. Data were collected through household interviews, key informant interviews, focus group discussions, and direct observations. Quantitative data were analyzed using Excel and SPSS (V.25), while qualitative data underwent thematic analysis. Binary logistic regression and Chi-square tests assessed associations and predictors of ODF sustainability. Findings show that although communities demonstrated adequate CLTS knowledge and positive attitudes towards ODF, key hygiene indicators fell below national standards. Pit latrine coverage (89%) and usage (95.7%) were relatively high, yet HWF availability (36.5%) and hand-washing with soap (HWWS) (24.9%) remained far below the 95% guideline. Limited commitment to HWF construction and HWWS after defecation was the gap. Personal, social, technical, institutional, cultural, and religious factors significantly influenced HWF construction and HWWS ($p < 0.05$), while cultural and religious beliefs also affected latrine usage ($p < 0.05$). Overall, progression in hygiene-related behaviour change was minimal. Strengthening skills, improving access to construction materials and enhancing routine monitoring, ODF re-verification and re-certification are critical to reinforce and sustaining behaviour change post ODF-certification in Balaka.

Keywords: Certification, Community Led Total Sanitation, Hand-washing with soap, Open defecation, Sustainable sanitation.

`

TABLE OF CONTENTS

`

`

LIST OF FIGURES

`

LIST OF TABLES

`

LIST OF ACRONYMS AND ABBREVIATIONS

CLTS	Community-Led Total Sanitation
FGD	Focus Group Discussion
HWF	Hand Washing Facility
HWWS	Hand Washing with Soap
KII	Key Informant Interview
MDG	Millenium Development Goals
NGO	Non-Governmental Organization
OD	Open Defecation
ODF	Open Defecation Free
SaniFOAMS	Sanitation, Focus, Opportunity, Action, Motivation and Sustainability
SDGs	Sustainable Development Goals
SoC	Stage of Change
SEM	Social Economic Model
SSBT	Sustainable Sanitation Behaviour Transformation
TTM	Trans Theoretical Model
VDC	Village Development Committee
VHC	Village Health Committee
WASH	Water sanitation and Hygiene

`

CHAPTER ONE : INTRODUCTION

1.1 Background Information

Sanitation plays a crucial role in human health, dignity, and sustainable development, and is recognized as a fundamental human right (UN 2015). Sustainable sanitation requires not only infrastructure but also systems that are socially acceptable, economically viable, and environmentally sound, promoting long-term behaviour change (WHO 2018). The Community-Led Total Sanitation, a behaviour change approach has helped communities in many low- and middle-income countries stop open defecation (OD) and achieve Open Defecation Free (ODF) status through collective action (Kar & Chambers 2008). However, sustaining these gains remains a challenge, as many interventions neglect deeper behavioural, cultural, and ideological factors (Crocker et al. 2017; Cagnet 2022). This thesis explores these dynamics in Balaka District, Malawi, once a national ODF status certified model District, to identify sustainable pathways for maintaining improved sanitation behaviours beyond ODF certification.

This chapter provides an overview of Community-Led Total Sanitation (CLTS), a concept centered on behaviour change. It assesses the status of sustainable sanitation on a global scale, Sub Saharan Africa, with a specific focus on developing countries, including Malawi and the Balaka District, the designated study area. Additionally, it outlines the rationale for conducting this study

1.1.1 Global Context of Sanitation and Hygiene

Globally, sanitation remains a pressing public health and environmental challenge. An estimated 2.4 billion people lack access to improved sanitation facilities (Alzua 2018). Inadequate and poor

`

sanitation and the prevalence of open defecation contribute significantly to the burden of disease, particularly diarrheal diseases, cholera, typhoid, schistosomiasis, trachoma and respiratory infections (Njuguna 2016; Tessema 2017).

Each year, approximately 500,000 children under the age of five die from preventable diarrheal illnesses linked to poor sanitation services and hygiene practices such as open defecation (Boisson et al. 2016; Wolf et al. 2018). Vulnerable groups such as children, pregnant women, the elderly and girls are particularly affected due to the lack of privacy, safety and personal security. Globally, open defecation free (ODF) slippage rates of up to 92% have been reported (Tyndale-Biscoe 2013). In Africa, reports suggest an annual ODF slippage rate of 10–13% (Abebe and Tucho 2020). The Sustainable Development Goal (SDG) 6.2 aims to "achieve access to adequate and equitable sanitation and hygiene for all and end open defecation" by 2030, (UN 2020). Achieving this target is critical to improving public health, gender equality, economic productivity, physical and cognitive development, educational opportunities, and overall quality of life, which has significant implications for human well-being and sustainable development (Fagunwa et al. 2023).

1.1.2 Sanitation and Hygiene in Developing Countries

Despite global progress, many developing countries continue to face severe sanitation deficits. More than 890 million people still practice open defecation, primarily in rural areas of low- and middle-income countries (WHO 2020). Millions of people lack access to basic sanitation, hand washing facilities, handwashing with soap (HWWS), and hygiene education. More than 81% of people in low-income countries do not use soap for hand washing after defecation, increasing the risk of disease transmission (Abebe and Tucho 2020)

`

A viable response to the adverse effects of open defecation in developing nations is the implementation of Community-Led Total Sanitation (CLTS). The Community-Led Total Sanitation (CLTS) approach, introduced by Kar and Chambers (2008), aims to empower communities to eliminate OD without subsidies by triggering collective behaviour change. CLTS emphasizes self-reliance, local innovation, and social norms to encourage latrine construction, latrine usage and hand washing with soap (HWWS) after defecation

Though CLTS has shown success in improving latrine coverage and reducing OD in several countries, sustaining these changes over time remains challenging. Slippage, where communities revert to OD after being declared OD is common due to poor latrine quality, weak post-ODF follow-up, and limited access to materials (Bongartz et al. 2016).

1.1.3 Sanitation and Hygiene in Sub-Saharan Africa

Sub-Saharan Africa (SSA) is one of the most affected regions, with over 220 million people still practicing OD (Belay et al. 2022), contaminating water and soil and exacerbating cycles of disease and poverty. Sub-Saharan Africa countries face persistent barriers to achieving and sustaining ODF status, including poverty, low literacy, inadequate infrastructure, and weak governance.

The practice of open defecation continues to pose a significant public health challenge in Sub-Saharan Africa (Endalew & Gashaw 2022). Countries such as Kenya, Uganda, and Ethiopia have implemented CLTS extensively, often with initial success. However, studies report widespread slippage within 1–4 years post-certification, primarily due to poor latrine durability, socio-cultural resistance, and limited community support systems (Abebe & Tucho 2020; Chidziwisano et al. 2020).

`

Mozambique reported a 31% loss of ODF status after five years (UNICEF 2014). Uganda, and Zambia have lower OD rates compared to some SSA peers 10%, and 17% respectively (WHO/UNICEF JMP 2013) but sustaining progress remains a challenge. A growing body of research emphasizes the need for context-specific, multi-level strategies informed by behavioural science**.**

1.1.4 Sanitation and Hygiene in Malawi

Malawi, a least developed country in Southern Africa, has not been exempted from the global sanitation crisis. In 2008, only 57% of its population had access to basic sanitation, while 11% practiced open defecation (WHO/UNICEF 2015). In response, Malawi adopted the Community-Led Total Sanitation approach under the 2008 National Sanitation Policy which states that "open defecation shall not be tolerated in Malawi" (MoIWD 2008). In Malawi, CLTS methodology was first introduced in Mzimba District in 2007 and scaled to twelve districts, including Balaka, with UNICEF support (Maulit & Kang 2011; Snel et al. 2014).

Community-Led Total Sanitation was integrated into broader efforts such as the Sector Wide Approach (SWAP) and the Open Defecation Free Malawi Strategy (2011–2015), aiming to surpass 95% latrine and hand-washing facility coverage and 100% usage post-certification (GoM 2011; GoM 2018). These efforts aligned with the Millennium Development Goals (MDGs) and Malawi Growth and Development Strategy (MGDS) priorities. However, by 2012, inadequate sanitation still contributed to the deaths of nearly 280,000 people, predominantly children under five (Prüss-Ustün et al. 2014), reinforcing the urgency of accelerating progress.

`

Initial results were promising. Between 2011 and 2015, latrine coverage increased from 66% to 85%, open defecation rates fell from 29% to 4%, and latrine usage rose to 95% (WHO/UNICEF, 2015; Taulo et al. 2018). However, hand washing facility coverage remained limited (10% to 34%), and actual hand washing with soap at critical moments was even lower (3–18%) (Taulo et al., 2018). Only four districts, Balaka, Dowa, Nkhotakota, and Ntchisi achieved full ODF status by 2018, meeting the 95% benchmark for latrine and hand-washing facility coverage (GoM 2018).

Despite progress, the 2015 ODF target was not fully achieved. By 2018, open defecation prevalence had risen again to 11%, national ODF coverage was 41.7%, and HWWS behaviour remained low (6–18%) (UNICEF 2019). In response, Malawi launched the National Sanitation and Hygiene Strategy (NSHS) 2018–2024, aiming to achieve universal sanitation coverage and eradicate open defecation by 2025, while aligning with SDG 6.2 to ensure equitable sanitation and hygiene for all by 2030 (GoM 2018; United Nations 2018).

Current policy instruments including the 2018–2024 NSHS, the 2021 Sanitation Policy Brief, the National Research Agenda II (2023–2030), and the Malawi 2063 Implementation Plan emphasize the importance of behaviour change. This encompasses sanitation coverage, and sustainable hygiene practices to sustain gains and meet ODF targets and achieve SDG 6.2, yet, the long-term sustainability of sanitation behaviours remains a concern (GoM 2018; GoM 2023; UNICEF Malawi 2021). Understanding behavioural dynamics and motivational drivers is critical for Malawi to sustain its sanitation gains and achieve national targets under Malawi 2063 MIP-1 and the National Research Agenda II (2023–2030) in tandem with SDG 6.2.

`

1.1.5 Sanitation and Hygiene in Balaka District

Balaka District, located in Southern Malawi, was among the first to attain Open Defecation Free status certification. Balaka was designated a National ODF model District in 2017 due to its high number of ODF-certified Traditional Authorities than its counterparts, Dowa, Nkhotakota, and Ntchisi (NSHS 2018; Taulo et al., 2018). This success was driven by a strong multi-sectoral approach involving stakeholders from health facilities, Non-Governmental Organizations (NGOs), volunteers and communities, enabling coordinated implementation of CLTS activities.

Stakeholders actively engaged in planning, training, household follow-ups, and information-sharing, while NGOs provided essential resources for capacity building in CLTS, latrine and hand-washing facilities construction, and sanitation platform (san-plat) production. and hygiene promotion (Taulo et al. 2018). These integrated efforts reflected principles from the Sanitation, Focus, Opportunity, Action, Motivation and Sustainability (SaniFOAMS), the Socio-Ecological Model and the Transtheoretical Model promoting sustained sanitation behaviour change (Devine, 2009; Silva et al., 2019; Petit 2019).

However, Balaka experienced a 5% slippage within two years. Some communities reverted to open defecation and neglecting hand washing with soap after defecation indicating gaps in long-term behavioural sustainability (NSHS 2018; Crocker 2015; Vernon & Bongartz 2016). Existing policies and programs prioritize certification milestones but fail to adequately address post-ODF behavioural reinforcement (Tyndale-Biscoe et al. 2013; UNICEF 2014; Pasteur 2014). There is limited research on the long-term dynamics of sanitation behaviour, (Crocker 2017 and Garn et al. 2017). The unclear factors behind sanitation regression call for a deeper investigation into ideological, structural, and motivational drivers of behaviour change (Crocker et al. 2017) This

`

study aims to fill that gap by using behaviour change frameworks; SaniFOAMS, the Social-Ecological Model (SEM), and the Trans theoretical Model of behaviour change

1.2 Problem Statement

While CLTS has helped achieve ODF certification in many communities, including Balaka District, maintaining this status over time remains a major challenge. Despite initial success,in 2017, significant slippage of (5%) occurred in Balaka in 2019 due to behavioural backsliding (NSHS 2018; Taulo et al. 2018), indicating that infrastructure alone is insufficient to sustain sanitation outcomes (Jain et al. 2020). Current interventions lack a strong focus on long-term behaviour change and often overlook the complex interplay of social, cultural, ecological, and technological dynamics influencing hygiene practices (Cagnet 2022; Bhatt et al. 2019, Ashkenazi et al. 2018). In Balaka, an once ODF-certified district, the 5% slippage within two years highlights these sustainability gaps (NSHS 2018; Taulo et al. 2018)

Existing policies and programs prioritize certification milestones but fail to adequately address post-ODF behavioural reinforcement (Tyndale-Biscoe et al. 2013; UNICEF 2014; Pasteur 2014). There is limited research on the long-term dynamics of sanitation behaviour, particularly regarding what drives or hinders sustained practice (Crocker 2017 and Garn et al. 2017). The unclear factors behind sanitation regression call for a thorough investigation into the ideological, structural, and motivational drivers of behaviour change (Crocker et al. 2017)

This study aims to fill that gap by using behaviour change frameworks; SaniFOAMS, the Social-Ecological Model (SEM), and the Trans Theoretical Model (TTM) to analyze why communities relapse into open defecation and how sustained sanitation can be achieved. This research is critical

`

to inform policies, improve CLTS implementation, and help Malawi reach its national and global sanitation targets such as the Malawi's National Sanitation and Hygiene Strategy (2018–2024), the National Research Agenda II (2023–2030), Malawi 2063 MIP-1, and Sustainable Development Goal 6.2, that emphasize eliminating open defecation by 2030 (GoM 2018; GoM 2023)

1.3 Study Objectives

1.3.1 Main Objective

The main objective of this study is to analyze the behavioural change dynamics that can add value to the open defecation free certification model in Balaka District.

1.3.2 Specific Objectives

The study was guided by the following objectives:

1. To assess knowledge, attitude and practices of the community regarding sanitation and their stage of behaviour change subsequent to open defecation-free certification in Balaka
2. To behaviour, change determinants that influence sustainable sanitation practices after attaining open defecation-free status in Balaka
3. To develop a community-led total sanitation post-open defecation-free certification model for the sustainability of open defecation-free status.

`

1.3.3 Research Questions

For Specific Objective (i):

To assess knowledge, attitude and practices of the community regarding sanitation and their stage of behaviour change subsequent to ODF certification in Balaka.

i. What is the level of community knowledge on sanitation and hygiene practices in Balaka after ODF certification?
ii. What are the attitudes of community members toward sustaining ODF-related sanitation and hygiene behaviours?
iii. What sanitation and hygiene practices are currently being implemented by households post-ODF certification?
iv. What stages of behaviour change (according to the TTM) do community members fall into for latrine and HWF construction, latrine usage and handwashing with soap after defecation?

For Specific Objective (ii):

To analyze behaviour, change determinants that influence sustainable sanitation practices after attaining ODF status in Balaka.

i. What personal, social, cultural, religious, technical, and institutional factors influence the sustainability of sanitation and hygiene behaviours in Balaka?
ii. How do technological and resource-related factors (availability, accessibility, affordability) affect latrine and handwashing facility construction and use?

`

iii. What role do stakeholder involvement, community leadership and follow-up mechanism play in sustaining ODF practices?

iv. Which determinants significantly predict the likelihood of consistent latrine use, HWF construction, and handwashing with soap after defecation?

For Specific Objective (3):

To develop a Community-Led Total Sanitation post-ODF certification model for sustaining ODF status.

i. What components are necessary for a model that supports long-term sanitation and hygiene behaviour change in Balaka?

ii. How can insights from SaniFOAMS, SEM, and TTM be integrated into a comprehensive post-ODF sustainability model?

iii. What structures and processes should be strengthened or redesigned to ensure continuous community commitment to ODF behaviours?

1.4 Significance of the Study.

Although Malawi has made progress in promoting rural sanitation through the Community-Led Total Sanitation approach, sustaining ODF status remains a major challenge. In many communities, behaviour change achieved during CLTS interventions tends to diminish once ODF certification is granted, often leading to slippage. This gap underscores the need to move beyond ODF as a final outcome and instead focus on the ideological, social, cultural, ecological, and technical factors that shape long-term sanitation behaviours. Current WASH interventions often

`

emphasize infrastructure and outputs, while underestimating the complex behavioural dynamics that influence sanitation practices over time.

This study responds to this gap by investigating the deeper ideological and contextual forces that drive or hinder sustained sanitation behaviours post-ODF certification. By exploring how behaviour change is influenced and maintained across various domains; personal, social, institutional, and environmental, the study aims to generate new insights into the effectiveness of current strategies and identify opportunities for reinforcing positive sanitation behaviours.

The research also aligns with national development priorities, including Malawi's National Sanitation and Hygiene Strategy (2018–2024), the National Research Agenda II (2023–2030), Malawi 2063 MIP-1, and Sustainable Development Goal 6.2, all of which emphasize eliminating open defecation and promoting sustainable sanitation services. Findings from this study will support policy refinement, strengthen post-ODF monitoring systems, and guide the integration of behaviour change models into future CLTS programming. Ultimately, the study will contribute to academic discourse and public health practice by offering a robust framework for understanding and promoting sustainable sanitation behaviour in rural Malawi and similar contexts.

1.5 Thesis Structure

Chapter One provides introductory details of the study, encompassing the background, statement of the problem, aims and objectives, research questions, research hypotheses, and the significance of the study. It also defines key concepts such as community-led total sanitation, open defecation, open defecation-free status, slippage, and sustainability, among others.

`

Chapter Two provides a comprehensive review of the existing literature on the critical components of hygiene and sanitation, alongside the principles of Community-Led Total Sanitation. It delves into the dynamics and pathways of behaviour change, emphasizing their role in promoting sustainable sanitation practices. Various theories associated with sanitation and hygiene-related behaviour change are examined, including the SaniFOAMS framework, the Socio-Ecological Model, and the Trans-Theoretical Model regarding stages of change. The chapter expounds potential determinants of behaviour change as identified in various studies and concepts. Additionally, it presents the behaviour change pathways and the overarching conceptual framework of the study, highlighting the significance of the discussed theories in relation to the dynamics of behaviour change for sustainable sanitation post-ODF certification.

Chapter Three articulates the methodology employed in this research. It outlines the study area and design, detailing the sampling framework and methods that substantiate the selection of the case study and respondents. This chapter further describes the data collection techniques and tools utilized, as well as the approaches taken for data analysis.

Chapter Four presents the findings derived from the collected data, addressing three major pivotal research questions that aim to bridge the identified gaps in the literature: (i) what is the community's knowledge, attitude, and practices regarding sanitation, as well as the community's stage of behaviour change subsequent to open defecation-free certification? (ii) What are the determinants of behaviour change that facilitate sustainable sanitation following the attainment of open defecation-free status? (iii)What is the proposed behaviour change model that can enhance sustained sanitation and hygiene practices post-ODF certification

`

Chapter Five offers a general discussion of the findings corresponding to the diverse research objectives and methods, along with an interpretation of the research outcomes. This chapter underscores the complex dynamics and theoretical frameworks integrated throughout the study.

Chapter Six synthesizes the main findings in relation to the theoretical frameworks discussed. Finally, the chapter outlines recommendations tailored to the distinct concepts and objectives identified throughout the research.

`

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section analyzes the literature on Community-Led Total Sanitation on a global scale, with a particular emphasis on its implementation in Africa and specifically Malawi. It concentrates on the community-driven total sanitation paradigm, the attainment of ODF status, and the community's knowledge, attitudes, and practices regarding CLTS. Additionally, the section examines the stages of behavioural change within the community four years post-ODF status, as well as the behaviour change determinants that contribute to the sustainability of sanitation and hygiene practices post-ODF certification. The discussion provides foundational information concerning the theoretical and conceptual frameworks pertinent to sustainable sanitation behaviour change and science. This analysis explores various factors; social, cultural, technical, and ecological that influence behaviour change, particularly with respect to the construction and maintenance of latrine and hand-washing facilities, as well as the use of latrines and hand-washing with soap after defecation.

2.2 Community-Led Total Sanitation Strategy

Community-led Total Sanitation is an innovative and integrated behaviour change approach aimed at mobilizing communities to eradicate open defecation and sustaining ODF status. The approach seeks to inspire a transformation in sanitation behaviour across the entire community, rather than solely promoting latrine construction (Kar & Chambers 2008). Total sanitation embodies the ideal condition in which all households within a community, along with social institutions such as churches and schools, as well as public places such as bus stands and marketplaces, are equipped with adequate sanitation systems (Kar & Chambers 2008). Central to the CLTS methodology is

`

the understanding that mere provision of toilets does not guarantee their usage or result in improved sanitation and hygiene outcomes. One significant achievement of CLTS has been the shift from a hardware-focused model to one that emphasizes collective behaviour change (Vernon & Bongartz 2016).

The CLTS methodology was initiated by Kamal Kar in Bangladesh in 1994 (Snel et al. 2014). Kamal Kar re-evaluated a historically supported program in order to motivate communities to construct latrines using their own resources and defecate in the latrines. The success of sanitation initiatives focused solely on latrine coverage does not necessarily translate to the prevention of open defecation (Kar and Pasteur 2005). Therefore, Kamal Kar and his friends adopted a transformative strategy that leveraged the inherent strengths, collective capacity, and knowledge of communities to latrine construction and inherent usage. Following its initial success, the CLTS approach was adopted in Bangladesh and subsequently disseminated across Asia, Latin America, and Africa (Kar and Chambers 2008).

According to Kar and Chambers (2008) and the National Sanitation and Hygiene Strategy (NSHS) of 2018, CLTS encompasses facilitating communities in evaluating their sanitation services and hygiene practices and understanding the impacts of collective action in attaining ODF status. The CLTS strategy encourages households to construct latrines utilizing their own resources, refraining from reliance on subsidies, and to ensure proper hand-washing following defecation (NSHS 2018).

Total Sanitation Led by the Community represents a behaviour modification methodology characterized by a "trigger-based" approach aimed at facilitating significant behavioural change. Within this framework, communities assess their unsanitary conditions and recognize the health risks associated with consuming each other's feces, which adversely impacts their physical health

`

as well as emotional states such as "disgust," "shame," and embarrassment. This awareness subsequently motivates individuals to discontinue the practice of open defecation (Sigler et al. 2014; Jerneck et al. 2016). To attain and maintain Open Defecation Free status autonomously, communities construct and utilize latrines, internalize the consequences of open defecation, acknowledge the importance of collective action, and foster ownership through behaviour modification (Kar & Chambers 2008).

The CLTS process comprises three distinct participation-driven phases: pre-triggering, triggering, and post-triggering (Kar & Chambers 2008). These phases correspond to the individual-level transformation stages outlined in the Trans theoretical Model of Change (Prochaska et al. 1992).

Pre-triggering: This initial phase involves identifying and selecting a community for CLTS implementation (Kar and Chambers 2008). The objective of pre-triggering is to establish rapport with local leaders, gather baseline data regarding community characteristics, latrine and hand-washing facility (HWF) coverage, and facilitate entry into the community (Venkataramanan et al. 2018). This phase is instrumental in assessing the community's readiness for a successful CLTS initiative, thereby enhancing the likelihood of success (Harter et al. 2018). According to Jimenez et al. (2019) and Kar & Chambers (2008), facilitators can identify enabling factors for ODF status such as demographic, cultural, historical, geographic, and economic dimensions of participation during the triggering phase.

Triggering: This phase is considered the most critical component of the CLTS process and focuses on educating communities regarding the negative effects of open defecation on both environmental and human health (Kar & Chambers 2008; Bateman & Engel, 2018). Community gatherings, referred to as "triggering events," are organized during this phase to facilitate observation, analysis,

`

and community assessment (Sigler et al. 2014). Triggering involves convening a gathering in which facilitators employ interactive activities designed to evoke a "collective sense of disgust and shame" among participants as they confront the unpleasant realities of open defecation and its consequences on environmental and human health (Venkataramanan et al. 2018; Kar and Chambers 2008). This phase fosters community collaboration with the ultimate aim of eradicating open defecation (Harter et al. 2018).

Participatory village mapping, transect walks to identify sites of open defecation, and demonstrations illustrating fecal-oral contamination pathways such as observing the movement of flies between food and face are illustrative examples of triggering tools in the Community-Led Total Sanitation approach. When these triggering tools are effective, community members undertake the construction of latrines using locally available materials and commit to adhering to open defecation prohibitions (Harter et al. 2018; Zuin et al. 2019). To guarantee a collective cessation of open defecation and to promote consistent hand washing after defecation, the community develops plans regarding the construction of latrines and hand-washing facilities. Additionally, a monitoring schedule and action plan is formulated.

The post-triggering: This phase represents the concluding stage in the CLTS process, where all activities following the triggering event are implemented. The primary objective of this phase is to foster sustained behavioural change aimed at achieving and maintaining Open Defecation Free Status. This is accomplished through ongoing education, community discussions, and support (Kar & Chambers 2008). During this phase, the plans established during the triggering phase receive reinforcement and progress is monitored. This phase occurs weeks or months following the triggering events, necessitating frequent and regular follow-up visits (Zuin et al. (2019)

`

During this period, the community's ODF status is verified and certified (Venkataramanan et al. 2018; Harter et al. 2018). The process through which ODF status and improvements in hygiene behaviour are evaluated to obtain certification is referred to as verification. The final step in attaining ODF status is certification, representing formal recognition of the community's fulfillment of ODF criteria and relevant requirements (Figure 1). Initially, local leaders perform an internal review, after which the community issues a self-declaration to Local Government or an affiliated Non-Governmental organization (Jain et al. 2020). Moreover, accomplishments related to ODF status are celebrated through ceremonies and village recognition to acknowledge the community's achievements and promote awareness for replication by other communities (Zuin et al. 2019). Upon certification, a sign is frequently displayed at the entrance of the village to indicate its open defecation-free status (Pasteur 2017)

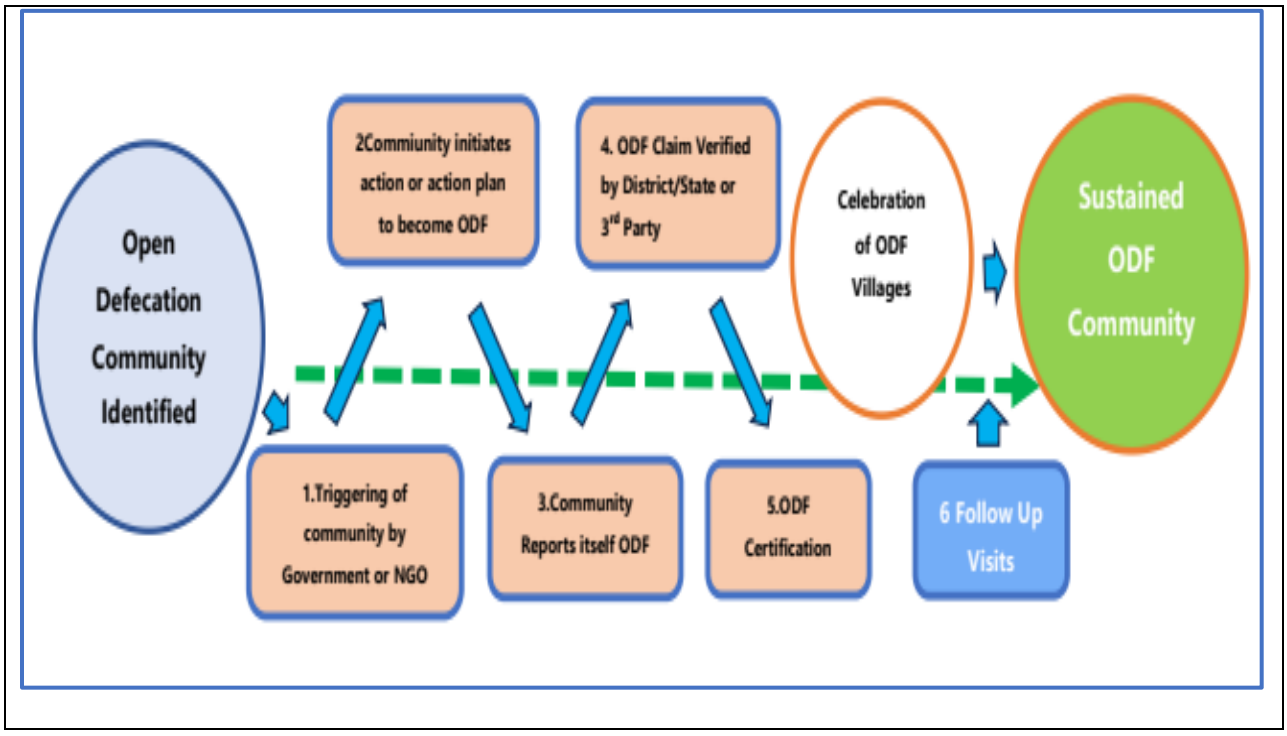


Figure 1 Flow diagram of standard Open Defecation Free Certification Process.

Source: Thomas and Bevan (2013)

`

2.3 Open Defecation Free, Certification, Sustainability and Slippage.

2.3.1 Open Defecation Free

Open defecation refers to the practice of disposing of feces in open fields or water sources, leaving excrement exposed (Kar & Chambers 2008). Pit latrines constitute the most prevalent method of excreta disposal and represent a fundamental form of basic sanitation worldwide (Nakagiri et al. 2016; WHO 2020). Pit latrines that lack a covering or a fly-proof lid are categorized as open defecation and are thus classified as unimproved sanitation (Jain et al. 2020; Saleem et al. 2019).

The term Open Defecation Free signifies universal coverage and utilization of latrines within households and institutions. This status indicates that a community has ceased the practice of open defecation and that the management of feces is conducted in a safe manner. Although the definition of ODF may vary across different countries, it typically implies that every household possesses a latrine that is utilized by all household members, each latrine is equipped with a HWF, and all members engage in hand washing with soap subsequent to utilizing a latrine (SSCC 2019).

Hand washing with soap stands as one of the most cost-effective interventions against diarrheal diseases. Research conducted by De Buck et al. (2017) in low- and middle-income countries indicates that CLTS can enhance sanitation behaviour and potentially increase the adoption of HWWS, although long-term improvements remain less clearly defined. Hand washing with soap serves as an effective preventive measure against infectious diseases. Meta-analyses have demonstrated that HWWS can decrease the risk of diarrheal disease by 23% to 48% (Cairncross et al. 2010; Freeman et al. 2014; Wolf et al. 2018) and lower the risk of respiratory infections by 21% to 23% (Rabie and Curtis 2006; Aiello et al. 2008).

`

In Malawi, CLTS is a pivotal intervention for promoting sanitation and hygiene, with hand washing with soap (HWWS) after defecation being a fundamental component towards achieving ODF status. The Open Defecation Free Malawi 2015 Strategy and National Hand-washing Campaign has led to an intensified focus on the practice of HWWS. Consequently, it is imperative to promote this practice.

2.3.2 Open Defecation Free Status Certification

It is an official acknowledgment that a community that has undergone CLTS triggering has achieved ODF status and fulfilled related criteria (Vernon & Bongartz 2016). The conditions associated with certification encompass latrine ownership, latrine quality, the presence of HWF, and the existence of community committees and action plans (USAID 2018). Certification is contingent upon a verification process that assesses whether the CLTS-triggered community has attained ODF status, thereby determining if a meaningful behaviour change has occurred to warrant certification (Vernon & Bongartz 2016). Verification is typically conducted by a team comprising Governmental leaders, NGO employees, community members, educators, or leaders from a nearby certified ODF community (USAID 2018). The verification of an ODF community represents an initial step toward achieving behavioural change maturity (Jerneck et al. 2016).

In order for a village to be designated or certified as free of open defecation, all households must be equipped with latrines featuring drop-hole covers, hand-washing facilities located adjacent to the latrines, demonstrable use of these facilities, and a complete absence of human excrement throughout the village (DAPP 2021). The criteria for latrine construction may vary by country, necessitating that between 80% and 100% of households possess functioning latrines for ODF status to be confirmed (Zuin et al. 2019). Each latrine must be actively utilized, show no visible

`

signs of open defecation in the vicinity, and allow for a maximum of 5% latrine sharing (NSHS 2018). Initially, ODF status at Level 1 was achieved by four districts: Dowa, Balaka, Nkhotakota, and Ntchisi. Following certification, communities must meet Level 2 requirements for re-verification. To meet Level 2 standards, all households are required to have latrines that are well-maintained, possess roofs for privacy, avoid latrine sharing, exhibit signs of regular use, and include a hand-washing facility (NSHS 2018).

The National Sanitation and Hygiene Strategy 2018 stipulate additional criteria for ODF status in Malawi, encompassing the use of fecal-containing hygiene toilets, the presence of lids on defecation holes (drop-hole covers), safety and privacy features, roofs to shield users, nearby hand-washing stations with water and soap, and regular HWWS after toilet use. Malawi categorizes its open defecation declaration status into Level 1 and Level 2, wherein all household and community members are mandated to utilize toilets, ensuring that all latrines offer privacy, are maintained in good repair, have suitable roofing, and that all households properly dispose of infant feces.

Research indicates that achieving ODF status represents merely the initial step, with the greater challenge being its maintenance. The Community-Led Total Sanitation initiative aims to create a world free of open defecation. Progressing through the sanitation ladder, communities can advance from constructing toilets to achieving overall health and well-being (Kar and Chambers 2008; Snel, Carrasco, & Dubé 2014; Vernon & Bongartz 2016). The primary outcome of the CLTS approach is the initiation of latrine construction and utilization of hand-washing facilities following defecation, which prompts significant behavioural transformation within communities (Dreibelbis et al. 2013; Movik & Mehta 2010). However, many individuals may ultimately fail to

`

ascend the sanitation ladder and may revert to open defecation if behavioural changes are not sufficiently reinforced (UNICEF 2014)

2.3.3 Open Defecation Free Sustainability

Sustainable sanitation is the ongoing effectiveness of sanitation interventions and practices to effectively protect and promote public health over an extended period (McConville 2008 and Carter 2009). Indicators of sustainable sanitation include observable trends within a community that reflect an upward progression along the sanitation ladder through the improvement and consistent maintenance of sanitation behaviours (Kar & Chambers 2008).

In the context of Community-Led Total Sanitation, the sustainability of sanitation is evident in behaviours such as the construction and usage of latrines and HWFs, the proper containment of feces, and evidence of households rebuilding durable latrine structures amidst various challenges (Kar & Chambers 2008). Using a behaviour change pathway approach, sustainability is framed as the community's ability to eliminate open defecation while continuing to construct and utilize latrines and HWFs, as well as to engage in proper hand-washing practices after defecation. This thesis employs a normative understanding of sustainability within the behaviour change pathway framework as the ability to preserve the essential features of the sanitation system, social norms, values, and environmental integrity across the community through the attainment and maintenance of ODF status. The sustainability of ODF status encompasses the community's success in eliminating open defecation through the provision of hygienic toilets, safe fecal containment, privacy, structural components such as drop hole covers and roofs, universal use of toilets by all household members, and access to hand washing facilities with soap.

`

2.3.4 Open Defecation Free Slippage

Slippage means the proportion of households that revert to open defecation following the attainment of ODF status (Jerneck et al. 2016). Despite its critical importance, there exists a notable scarcity of studies assessing the long-term sustainability of ODF status (Crocker et al. 2017). Research suggests that a significant number of communities certified as ODF revert to open defecation over time (Crocker et al. 2017; USAID 2018; Abebe & Tucho 2020). The factors that contribute to this reversion are not fully understood (Mosler, Mosch, & Harter 2018). Numerous studies conducted globally have identified various reasons why individuals may fail to alter their sanitation practices. Slippage is influenced by changes in behaviour and attitudes towards open defecation, as well as deterioration of sanitation facilities due to natural disasters and aging infrastructure (Jerneck et al. 2016). According to Meyer et al. (2019), a primary contributor to slippage is the absence of follow-up, with personal engagement from health promoters correlated with the sustainability of ODF status (Garn et al. 2017). Jain et al. (2020) have reported that some individuals choose to practice open defecation, often for social reasons or convenience, as evidenced in rural Nepal (Bhatt et al. 2019).

Demographic and geographic variables such as education, socioeconomic status, gender, and access to water significantly influence open defecation practices in Ghana. It has been found that men, individuals residing in remote areas, those with lower educational attainment, and those lacking access to improved water sources are more likely to engage in open defecation (Abubakar 2018). Furthermore, the quality of latrine constructed, structural deficiencies, and the usability of older latrines can lead to abandonment, thereby adversely affecting the sustainability of ODF status (Orgill-Meyer et al. 2019).

`

Slippage is a dynamic phenomenon influenced by both internal and external factors that may be beyond the control of the community (Jerneck et al. 2016; Heckling 2019). It may also result from technological, behavioural, and economic considerations. Institutional factors, such as Governmental policies and inadequate coordination, can give rise to overlapping interventions and conflicting practices, which may further worsen slippage. A prevalent factor contributing to slippage is often cited as the lack of follow-up interventions aimed at reinforcing social norms and attitudes (Jerneck et al. 2016; Ribeiro 2019).

A study examining Community-Led Total Sanitation in Bangladesh, Nepal, and Nigeria reported a slippage rate of 21%, with a significant reversion rate for HWWS reaching as high as 75% (Tyndale-Biscoe 2013). In rural Indonesia, six villages certified as ODF displayed a slippage rate of 14.5% two years post-certification. This slippage was attributed to weaker social norms, limited access to water throughout the year, and varying economic conditions among residents (Odagiri et al. 2017). Another CLTS study conducted across Ethiopia, Kenya, Sierra Leone, and Uganda indicated slippage rates ranging from 2% to 57% (Cavill et al. 2015). Singh and Balfour (2015) reported slippage exceeding 70%, primarily linked to inadequate latrine access, deteriorating latrine conditions, and children's reluctance to utilize latrines due to safety concerns (Mirabel et al. 2021). In Malawi, access to hand-washing facilities equipped with soap and water remains critically low at 8% (UNICEF, 2023). These findings highlight that while CLTS effectively encourages the construction of latrines and the promotion of HWWS, it does not ensure consistent usage of latrines and hand-washing with soap following defecation.

A study by Phiri et al. (2014) in Malawi indicated that the impact of CLTS on the sustainability of ODF status was minimal, with only half of damaged toilets being repaired and reused. Between

`

2012 and 2017, four districts, Balaka, Dowa, Nkhotakota, and Ntchisi achieved ODF certification; however, Balaka District experienced slippage just two years later (Taulo et al., 2018; Go 2020). Despite CLTS being designed as a behaviour change initiative, concerns regarding the sustainability of ODF status persist, particularly relating to community behaviour. Stakeholders have expressed dissatisfaction with slippage indicators shortly after receiving ODF certification (Fick & Novotný 2019). Crocker et al. (2017) noted a scarcity of published research on the sustainability of ODF initiatives. A significant challenge arises from the misconception that ODF status is exclusively linked to latrine coverage; however, it is argued that mere possession of a latrine does not guarantee its utilization (USAID 2018).

The CLTS experience underscores that the sustainability of ODF status is contingent upon community-wide behaviour change. The inability to maintain ODF status post-certification suggests that enduring behaviour change has not been sufficiently achieved. If behaviour change is not thoroughly integrated into sanitation practices, the likelihood of reverting to open defecation increases (UNICEF 2019). Gensch and Tillett (2019) underscore the importance of focusing on behaviour, alongside efforts to eliminate open defecation, to achieve sustainable sanitation for all. Ultimately, the stability and longevity of CLTS are dependent on long-term behaviour change, making it essential to understand the factors that hinder behaviour change for the sustainability ODF status.

2.4 Behaviour Change and Open Defecation-Free Status Sustainability.

Behavioural change constitutes a critical component of hygiene and sanitation at both the household and community levels. Behaviour change is an essential component of hygiene and sanitation practices at both household and community levels, significantly impacting human health

`

(Zemichael & Ayenew 2020). In the context of this research, positive hygiene behaviour change may be defined as the transition from unsafe hygiene practices, such as open defecation, to improved behaviours, specifically the use of latrines and HWWS after defecation (Kar & Chambers 2008). Such change facilitates the achievement of better sanitation outcomes through the attainment of open defecation-free status.

The pursuit of behaviour change for sustained sanitation remains a paramount public health objective in the effort to reduce diarrheal prevalence (WHO/UNICEF 2015). Sanitation programs oriented towards behaviour change, such as CLTS, typically concentrate on supporting communities in achieving ODF status (Kar & Chambers 2008; Mosler, Mosch & Harter 2018). These initiatives inspire community-wide behaviour change and collective action, ensuring that every household adopts a latrine and ceases open defecation, alongside consistent HWWS after defecation (Sigler et al. 2014; NSHS 2018). Understanding the specific elements related to latrine use and HWWS after defecating is critical for developing effective behaviour change interventions that extend beyond ODF certification (Contzen & Mosler 2015).

Through concentrated behaviour change efforts, Malawi aims to fulfill the objectives outlined in the 2018-2024 National Sanitation and Hygiene Strategy, targeting ODF status by 2025, as well as meeting the UN SDG 6.2, the National Research Agenda II (2023-2030), the 2021 Sanitation Policy Brief, and the Malawi 2063 MIP-1 goal of achieving open defecation-free status by 2030 (GoM 2018; GoM 2023; UNICEF Malawi 2021). Effecting behaviour change will reinforce the sustainability of CLTS outcomes and facilitate the community's progression up the sanitation ladder.

`

The process of behaviour change exceeds the mere achievement of ODF status (Tesserae 2017; Venkataramanan et al. 2018). Efforts to attain ODF have not consistently provoked stable behaviour change, as this process is inherently gradual (Njuguna 2019; Venkataramanan et al., 2018). After ODF status attainment, individuals may progress, regress or bypass certain steps and revert to ODF or move up the sanitation ladder. Behaviour change remains a significant public health concern within the context of CLTS. To achieve sustainable sanitation services and hygiene practices, it is imperative to address the associated behaviour change factors that extend beyond the ODF certification and avoid likelihood of reverting to open defecation practices (WHO/UNICEF 2015 and Mirabel et al. 2021). Venkataramanan et al. (2018) itemized that it is essential to recognize behaviour change as a pathway to sustainable sanitation and to contextualize the CLTS methodology in relation to behaviour change

2.5 Behaviour Change Dynamics Pathways and Open Defecation-Free Status Sustainability

The journey of behaviour change is inherently long-term, and sustainable sanitation within the CLTS framework is subject to dynamics. Numerous factors influence behaviour change as a pathway to sustainable sanitation practices. Sustainable sanitation is a dynamic concept that encompasses the interplay of personal, demographic, technical, social, cultural, and ecological determinants that affect behaviour change. Analysing and understanding the dynamics of behaviour change within social, ecological, and technological contexts is critical for achieving sustainable sanitation practices post-ODF certification (Tyndale-Biscoe et al. 2013; O'Connel 2014; Kar 2008; Cavill et al. 2015) (Fig 2)

`

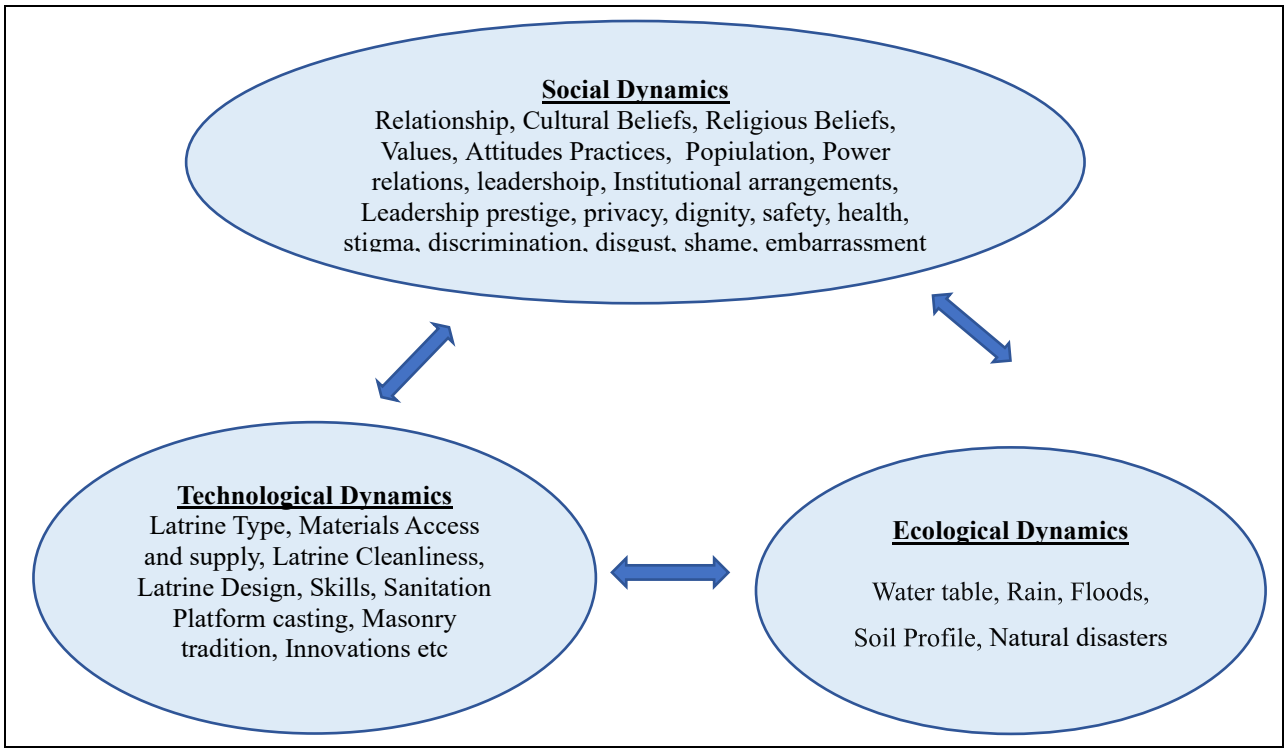


Figure 2 Behaviour Change Sustainable Sanitation Practices Dynamics.

Source: Mehta and Marshal et al. (2007) and Gonzalez (2013)

Sustainable Development Goal 6.2 sets an ambitious target for universal access to improved sanitation by 2030, including the elimination of open defecation (UN 2015). The Brundtland Report defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987). Sustainable Development Goal 6.2 establishes an ambitious target for universal access to improved sanitation by 2030, which includes the elimination of open defecation (UN 2015). This definition underscores the necessity of integrating social, environmental, and technical considerations (Scoones et al. 2010). Critics of the technocratic perspective of sustainable development have led the Institute of Development Studies in Sussex to propose a new vision called the Pathway to Sustainability, prioritizing social, environmental, and technical equity.

`

The Pathway to Sustainability approach is grounded in equilibrium thinking, acknowledging that sustainability requires the maintenance of a natural balance. The world is complex and dynamic, with social, technological, and ecological systems rapidly evolving and interconnecting (Scoones et al. 2010). In a commonly held epistemological understanding, sustainability involves sustaining systems in a dynamic process that co-evolves over time. Within the CLTS framework, sustainable sanitation is characterized by consistent construction and utilization of latrines, as well as HWWS following defecation (Movik 2011). Viewed through the lens of behaviour change pathways, sustainable sanitation reflects a community's capability to uphold an ODF environment while fostering social integrity, technological fairness, and ecological sustainability. The pathways concept illustrates various trajectories for knowledge, intervention, and behaviour change, emphasizing diverse goals to facilitate dynamic change (Scoones et al. 2010).

Sustainable sanitation evaluates whether water, sanitation, and hygiene (WASH) services remain functional and whether healthy hygiene behaviours are consistently practiced (Cole 2015; Davis et al. 2019). Communities must shift from achieving sanitation coverage to maintaining sustained sanitation practices, ensuring stable behaviour change following ODF status attainment (Venkataramanan 2010; Vernon & Bongartz 2016). Enabling conditions, including political prioritization, planning, training, financing, and post-ODF follow-up, are essential for the preservation of ODF status (Cavill et al. 2015). Key physical and technical dynamics, such as technical support, market accessibility, social norms, motivations, inclusion, and equity, represent core pathways for behaviour change in sanitation (O'Connell 2014). Communities are influenced by enabling elements as they move from a post-certification open defecation-free environment to a sustainable open defecation-free world where behaviours such as latrine construction,

`

maintenance, and improvement become normative practices (Vernon & Bongartz 2016; O'Connell 2014; Cole 2015; Davis et al. 2019).

The pathway toward sustainable sanitation encompasses a systematic behaviour change process that initiates with awareness and triggering, subsequently progressing to community mobilization, infrastructure development, social reinforcement, and ultimately, long-term sustainability measures. For sanitation programs to be effective, it is imperative to integrate institutional support, continuous community engagement, financial investment, and technical adaptability (Cavill et al. 2015; Scoones et al. 2010). By embedding social norms and providing incentives for sanitation practices, communities can achieve enduring ODF status, thereby ensuring enhanced public health and hygiene for future generations. (Fig 3)

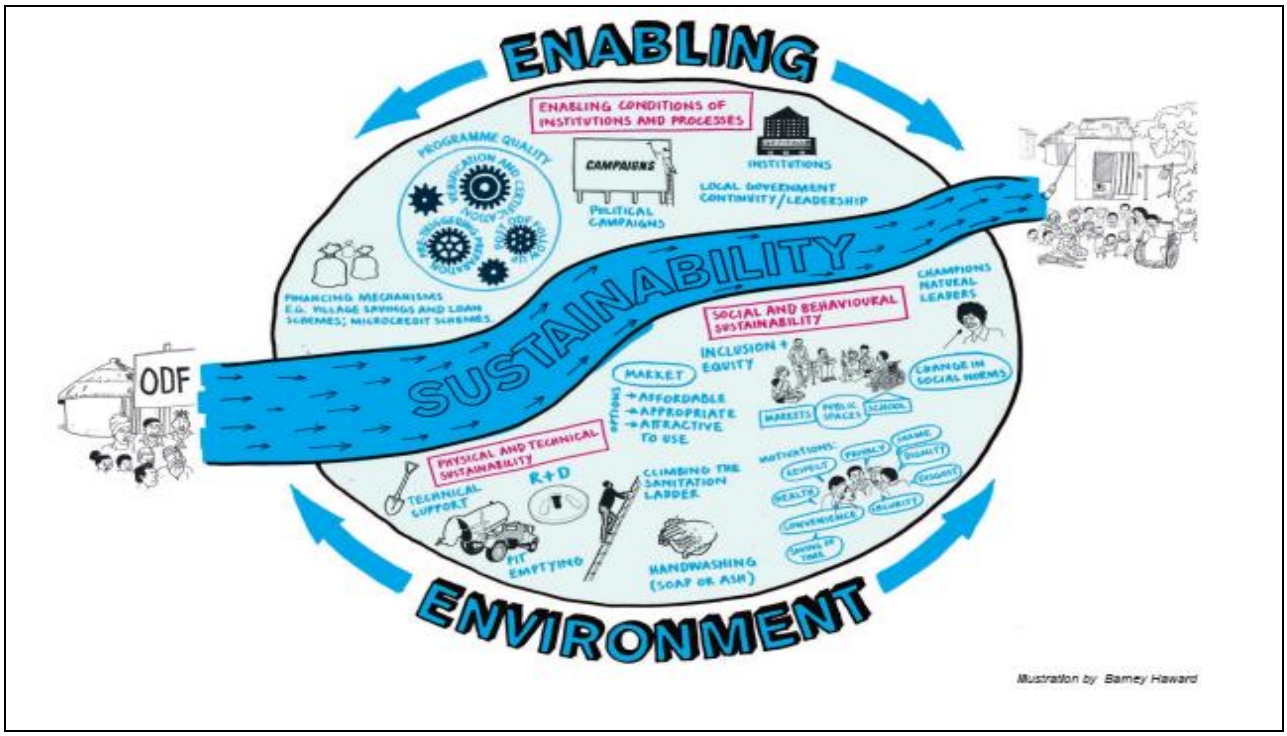


Figure 3 Institutional and Processes Enabling domains for Sustainable Sanitation Environment.

Source: Cavill et al. (2015)

`

The pathway toward sustainable sanitation encompasses a methodical behaviour change process that initiates with awareness and triggering, subsequently progressing to community mobilization, infrastructure development, social reinforcement, and ultimately, long-term sustainability measures. For sanitation programs to be effective, it is imperative to integrate institutional support, continuous community engagement, financial investment, and technical adaptability (Cavill et al. 2015; Scoones et al. 2010). By embedding social norms and providing incentives for sanitation practices, communities can achieve enduring ODF status, thereby ensuring enhanced public health and hygiene for future generations.

2.5.1 Community Sanitation Knowledge, Attitude, Practices and Stage of Behaviour Change After Open Defecation Free Status Certification

Community knowledge regarding sanitation and hygiene is fundamental in implementing CLTS to attain and maintain an ODF status. Community Led Total Sanitation promotes education and awareness related to sanitation within communities (Kapatuka 2013). An understanding of sanitation is essential as it allows individuals to recognize the health benefits associated with the use of latrines and the practice of HWWS after defecation, thereby contributing to safety, security, and cleanliness. Such comprehension can significantly reduce the incidence of preventable diseases linked to inadequate sanitation and hygiene, including cholera, dysentery, and eye infections (Okolimong et al. 2020). The Human Right to Sanitation Declaration mandates that every nation provide access to safe, hygienic, and culturally acceptable latrine facilities, thereby influencing latrine construction and hand-washing practices (Tamene & Afework 2021).

A comparative study conducted in Uganda by Okolimong et al. (2020) revealed that individuals residing in CLTS intervention areas possessed greater sanitation and hygiene knowledge than those

`

from non-intervention areas, which correlated with a lower prevalence of diarrheal diseases in the former group. Additionally, research by Lawrence et al. (2016) and Widowati (2015) indicated that individuals with adequate knowledge of sanitation and hygiene were more likely to possess and utilize latrines and hand-washing facilities. A study in Senegal concerning the Global Scaling Up of Hand-Washing projects demonstrated that awareness of critical hand-washing times and the significance of using soap greatly influenced hand-washing behaviours (Devine et al. 2010; Civill et al. 2015).

Community attitudes towards sanitation practices have a profound impact on the implementation of CLTS. While attitudes do not directly translate into actions, they represent predispositions toward behaviour. Positive attitudes significantly enhance the likelihood of latrine use and hand-washing with soap following defecation (Kapatuka 2013; Busienei et al. 2019). CLTS triggering tools, such as the "walk of shame," "shit calculation," and demonstrations illustrating how flies contaminate drinking water, facilitate the cultivation of negative attitudes towards open defecation. These triggering mechanisms promote social norms that oppose open defecation and encourage the utilization of latrines and HWWS (Sigler et al., 2014). Substandard sanitation conditions disproportionately affect women and girls, as inadequate safety and privacy in latrines may foster negative attitudes towards their usage (Merga et al. 2015; Okolimong et al. 2020). Conversely, positive attitudes toward sanitation and hygiene can reinforce sanitation practices, as the perception that latrines provide comfort can drive both construction and usage (Linggar et al. 2019).

Research conducted by Harvey (2011) indicated that men often experienced embarrassment about failing to ensure the dignity of their female family members, leading to an increase in latrine

`

construction to prevent women from resorting to open defecation and to enhance their safety. Latrine use and HWWS are also influenced by the quality and accessibility of facilities, which significantly impacts young children, particularly girls (Odongo et al. 2017). Unhygienic conditions and inadequate sanitation standards can deter the practice of hand-washing following defecation, especially when HWFs are dirty or neglected (Thys et al. 2015).

Numerous studies have demonstrated that CLTS effectively increases sanitation practices, such as latrine construction and ownership, thereby reducing instances of open defecation (Tesserae, 2017). In contrast, a pre-and post-CLTS intervention study conducted in Zambia indicated that communities experienced an increase in latrine coverage, a reduction in open defecation, and improvements in hand-washing practices (Yeboah-Antwi et al. 2019). In two post-CLTS studies conducted in the Lae Lay Mai Chew District of Tigray, Northern Ethiopia, latrine usage increased following ODF certification (Gebremariam et al. 2018; Gebremariam & Tshehaye 2019).

Subsequent to achieving ODF certification, communities must persist in advancing up the sanitation ladder. This progression necessitates consistent latrine use, the practice of HWWS after defecation, and the enhancement of sanitation services and hygiene practices, which serve as key indicators of behaviour change following ODF certification. It is crucial to identify individuals' stages of behaviour change for the maintenance of ODF status (Soberay et al. 2014).

The CLTS framework comprises three critical triggering process stages: pre-triggering, triggering, and post-triggering. These stages significantly influence behaviours related to latrine use and HWWS (Kar & Chambers 2008). They correspond with the individual-level stages of change articulated in the Trans Theoretical Model (TTM) which includes pre-contemplation, contemplation, preparation, action, and maintenance. The TTM serves to illustrate an individual's

`

readiness to change, willingness to take action, and capability to sustain new behaviours, reflecting the processes involved in constructing latrines, initiating their usage, and consistently practicing HWWS after defecation (Prochaska et al. 1992; Kar & Chambers 2008)

2.5.2 Behaviour Change Determinants that Influence Sustainable Sanitation Practices After Attaining Open Defecation-Free Status.

2.5.2.1 Social Sanitation Behaviour Change Elements

Social determinants of behavioural change greatly impact latrine usage and hand-washing practices. These determinants encompass cultural and religious beliefs, norms, taboos, values, participatory dynamics, decision-making processes, institutional commitments, latrine sharing arrangements, leadership, power dynamics, and relationships with external stakeholders, including Governmental entities and Non-Governmental organizations. Numerous studies have indicated that social factors intrinsic to CLTS play a key role in reinforcing the sustainability of open defecation-free status within communities (Cavill et al. 2016; Patkar 2016).

In certain rural communities, utilizing a latrine within the household may be perceived as taboo, as there is a belief that the presence of a latrine and feces indoors compromise cleanliness (Laungani 2007). Research conducted in Zambia (Thys et al. 2015; Abebe & Tucho 2020) and Malawi (UNICEF 2012) has revealed that some individuals revert to open defecation due to cultural beliefs associating the mixing of feces with in-laws or members of the opposite gender as taboo. However, studies by Sherin et al. (2017) and Routray et al. (2015) have found no cultural prohibitions against latrine use, emphasizing that having a latrine within the home offers privacy, security, and dignity.

`

Community coordination and support for sanitation services are essential in facilitating latrine construction and usage. For instance, in Kenya, the involvement of community health volunteers in Kakamega County, in collaboration with artisans, has enabled communities to advance up the sanitation ladder from basic hygiene practices to improved sanitation standards. A study conducted in Malawi indicated that the construction and usage of latrines increased when stakeholders, such as masons and entrepreneurs, collaborated with communities to design low-cost toilet options utilizing locally available materials (De Buck et al. 2017; Ashenafi, Dadi & Gizaw 2018).

Numerous studies underscore the importance of post-ODF follow-up in supporting and encouraging the maintenance of ODF status, as well as promoting community advancement up the sanitation ladder (Tribbe et al. 2021; Harter et al. 2019). Research in Indonesia established a significantly higher increase in latrine coverage within communities that had intensive ODF follow-up (USAID 2018). Follow-up efforts motivate households to enhance their sanitation practices and progress up the sanitation ladder. In Bangladesh, sustained latrine usage, improved sanitation practices, and movement up the sanitation ladder was linked to consistent CLTS program follow-up (Cavill et al. 2015). Engaging diverse groups in all phases of post-ODF follow-up, communication, and information dissemination is crucial in averting ODF slippage. Various channels, including mosques, churches, and women's groups, have proven effective in preventing such slippage (Odagiri et al. 2017).

2.5.2.2 Technological Sanitation Behaviour Change Determinants

Technological dynamics encompass latrine types, designs, material costs, and access to hardware, improvement processes, learning systems, creativity, market supply dynamics, latrine cleanliness, masonry traditions, and innovations. The selection of latrine types is influenced not only by

`

economic considerations but also by individuals' experiences with various latrine models, the availability of local materials, and knowledge regarding construction techniques. Socioeconomic factors significantly affect the sustainability of ODF practices, particularly in the context of latrine reconstruction, where challenges such as material unavailability, lack of technical skills, and unsuitable soil conditions may arise (Abebe & Tucho 2020). Masons typically possess the necessary skills to select suitable toilet options based on local building materials.

The sustainability of ODF practices such as latrine usage and HWWS, is dynamic. The availability, affordability, and durability of materials are critical factors that enhance latrine construction and utilization (USAID 2018). Financial constraints can lead to unsafe sanitation practices, as households may be unable to construct new latrines or maintain existing ones (Tyndale-Biscoe et al. 2013). Among impoverished households, the cost of materials serves as a significant barrier (De Buck et al. 2017). In Malawi, the high costs of cement in rural areas often compel communities to construct or rebuild mud-based toilets annually after rainy seasons, resulting in ODF slippage (Cole 2015). Devine (2010) reported that households meeting financial difficulties frequently undervalue sanitation and lack motivation to invest in larine facilities.

2.5.2.3 Environmental Determinants of Behaviour Change

Environmental conditions exert a significant influence on the construction and maintenance of latrines. Factors such as flooding, water availability, water table levels, soil profiles, rainfall, and cyclones are critical in this context (Ashenafi, Dadi & Gizaw 2018; Cagnet 2022). Hanchett et al. (2011), as referenced by Civill et al. (2015), indicated that natural disasters, including cyclones, floods, monsoon rains, and landslides, can jeopardize the stability of latrines if they are not designed appropriately and constructed using durable materials. The proximity of latrines to water

`

bodies such as ponds, lakes, streams, rivers, and dams can compromise the integrity of latrine pits, while flooding may lead to overflow. Furthermore, the leaching of contents from pit latrines in regions with elevated water table levels presents an additional challenge (Cole 2015). Soil conditions, whether loose or compact, influence the ease of latrine construction and their overall stability, often resulting in frequent collapses and rendering maintenance and reconstruction labor-intensive. These issues may lead to the instability of latrines, causing individuals to revert to open defecation practices (Cagnet 2022).

2.6 Behaviour Change Theories and Frameworks.

Human behaviour is inherently complex, necessitating the use of various theories to clarify its uniqueness. Behaviour changes theories provide researchers with insights into the key variables that influence behavioural modification and how these changes materialize across different contexts, populations, or situations (Sigler et al 2014). Within the framework of Community-Led Total Sanitation, such theories illustrate the effectiveness of the CLTS approach in achieving ODF status (Movik & Mehta, 2010; Kar & Milward, 2011; Kar 2012). Conceptual frameworks serve to clarify essential factors, concepts, and variables, as well as their interrelationships, facilitating the prioritization of interventions and the assessment of their effectiveness (Miles & Huberman 1994; Mosler 2012).

Prior to an examination of behaviour change models, it is imperative to understand the foundational elements of the CLTS approach. According to Karr (2012) and Mosler (2012), the sustainability of ODF initiatives relies upon the modification of behaviours related to latrine usage and HWWS following defecation within the community. Sustaining these practices subsequent to

`

ODF certification poses challenges attributed to personal, societal, technical, institutional, environmental, and cultural factors influencing human behaviour.

Theoretical frameworks underscore the most pertinent behaviour change variables and their interconnections. Interventions rooted in theory, such as CLTS, are generally more effective in promoting behavioural change than those which lack a theoretical foundation. Such frameworks assist in identifying paradigms that are causally related to behaviour and clarifying the mechanisms through which behaviour change occurs (Wilroy & Knowlden 2016). Employing theoretical frameworks aligns with evidence-based public health interventions, providing a structured approach to analyze specific challenges and evaluate the success or failure of interventions. Moreover, it can guide stakeholders in developing strategies to enhance the sustainability of interventions (Rimer & Glanz 2005). While numerous theories endeavor to describe human behaviour change, no singular theory has emerged as the definitive explanation. This study incorporates three behaviour change theories: the Sanitation Focus, Opportunity, Ability, Motivation, and Sustainability Model, the Socio-Ecological Model, and the Trans-Theoretical Model - Stages of Change, to identify the primary determinants of behaviour modification.

2.6.1 Sanitation Focus, Opportunity, Ability, Motivation and Sustainability Model (SaniFOAMS)

This study used the Sanitation Focus, Opportunity, Ability, Motivation, and Sustainability (Sani-FOAMS) model to examine the determinants of sustainable ODF status, with a particular focus on latrine utilization and HWWS after defecation. The Sani-FOAMS framework, developed by Devine in 2009, is designed to analyze sanitation behaviours and inform effective sanitation programs (Devine 2009). The acronym "FOAMS" represents four critical elements: Focus,

`

Opportunity, Ability, Motivation and Sustainability. This framework enhances the understanding of both the barriers and drivers of behaviour change in sanitation programs, analyzing the dynamics influencing long-term sustainability (Devine 2009). It integrates components from several psychological theories, including the Health Belief Model, Theory of Reasoned Action, Social Learning Theory, and Sanitation Marketing (O'Connell 2014; Rose 2022). (Figure 4)

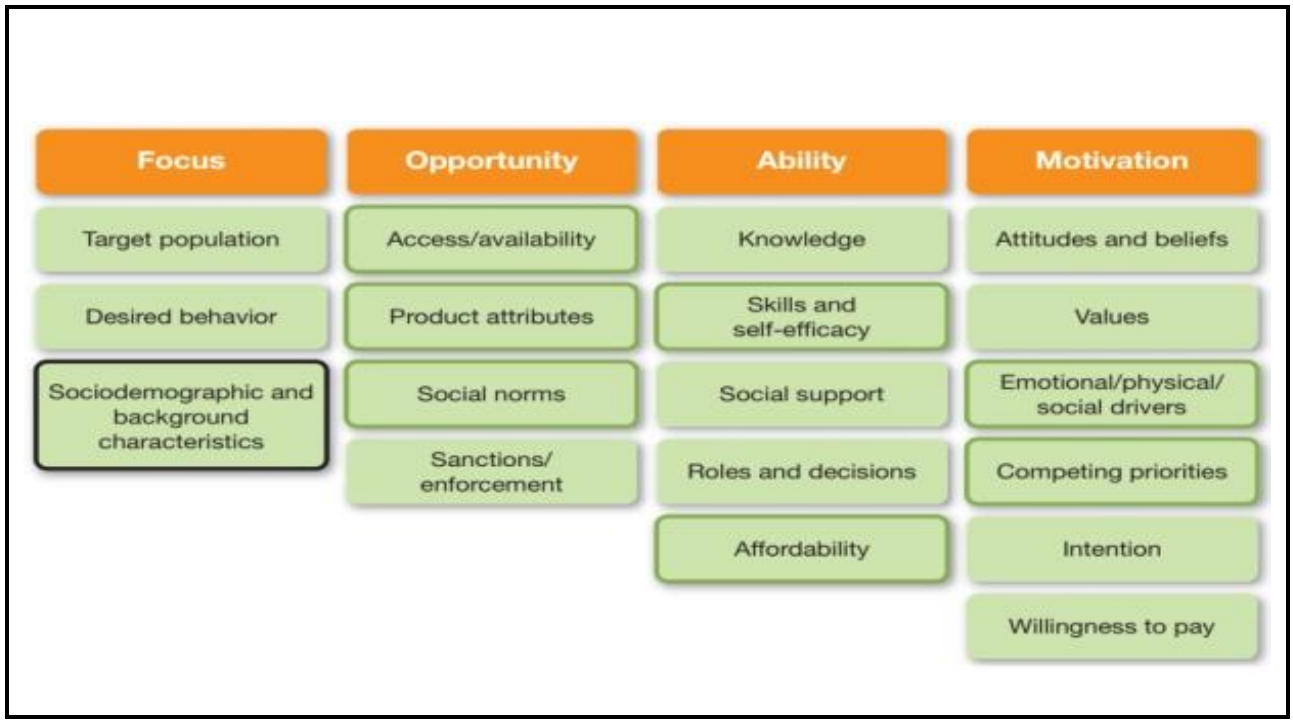


Figure 4 SaniFOAM Framework

(Source: O'Connell 2014)

Focus within the Sani-FOAMS model in the context of CLTS, identifies the target behaviour and population that require intervention (Devine 2009). It seeks to answer the questions: "What behaviour is subject to change, and who is the intended audience for this change?" For this study, the focus group comprises all communities and stakeholders engaged in CLTS in the selected

`

villages of Balaka, concentrating on the construction of latrines and HWFs, utilization of latrines and HWWS after defecation.

Opportunity element assesses whether individuals have the means to engage in the desired behaviours by considering institutional and structural factors (Devin 2009). It evaluates the availability and accessibility of sanitation and hygiene products, the influence of social norms, and the consequences associated with non-compliance. This aspect addresses the inquiry: "What is the likelihood that individuals will perform the recommended behaviour?" CLTS employs social mobilization techniques to transition communities from open defecation as a social norm to the use of latrines (Devine 2009).

The opportunity for HWWS is contingent upon the availability of hand-washing facilities, water, and soap. This availability may be influenced by costs, time constraints, and perceptions regarding the expenditure on soap for hand washing compared to other uses. For example, individuals may resort to defecating in natural settings if there is no water available for anal cleansing in latrines, or households may refrain from constructing latrines if masons are unavailable (Sara & Graham 2014). Perceived affordability can deviate from actual affordability, particularly when individuals or households are unaware of lower-cost options that may not be locally accessible (Sara & Graham 2014; O'Connell 2014). Such situations represent missed opportunities for intervention (Kar & Chambers 2008; Ngondi et al. 2010).

Findings from a study conducted in East Java highlight the influence of social norms on open defecation. For instance, in a study by O'Connell in 2014), one participant stated, "If I defecate in the river, I feel more comfortable. I do not have to smell my waste unlike when I am doing it in a

`

(closed) latrine." Another respondent noted, "Yes, I am embarrassed if people pass by, but I believe that everyone is accustomed to it; everyone does that"

Ability pertains to the requirements an individual must satisfy to perform the desired behaviour. It seeks to address the question: "Does the individual possess the ability to perform the behaviour or the capacity to engage in various sanitation practices?" This includes the necessary information, knowledge, and skills for constructing a latrine and an HWF. The knowledge component includes awareness of diseases associated with open defecation, various types of latrines, perceived social support, household roles, and decision-making regarding sanitation issues.

Furthermore, the skills component can be categorized into five determinants: (i*) Knowledge:* Awareness of sanitation services and the skills necessary for constructing and utilizing latrines and HWFs. (ii) *Social Support*: The physical and emotional encouragement provided by family and community members, facilitating the adoption of latrine and HWF construction and use. (iii) *Self-Efficacy:* The belief in one's ability to utilize a latrine and wash hands with soap after defecation. (iv) *Roles and Decisions:* Awareness of who typically makes sanitation-related decisions within a household or community. (v) *Affordability:* The financial resources available for procuring materials to construct latrines and HWFs, as well as hand-washing soap (Coombes & Devine 2010; Sara & Graham 2014).

Hand-washing with soap following defecation necessitates the availability of a HWF, soap, and water, as well as an understanding of the significance of hand hygiene and the necessity to wash both hands to prevent cross-contamination (O'Connell 2014). A study conducted by Sara and Graham (2014) in Tanzania identified that low adoption rates of latrines were correlated with insufficient knowledge regarding the health benefits associated with toilet use. Similarly, research

`

by Jenkins and Scott (2017) in rural Ghana highlighted major barriers to latrine access and adoption, including high costs, a shortage of construction expertise, and competing priorities.

Motivation is defined as the intrinsic desire of an individual to engage in a promoted behaviour, effectively answering the question: "Does the individual possess the motivation to perform this action?" Individuals must be motivated to cease open defecation, construct a toilet and HWF, utilize the toilets, and engage in hand-washing with soap. Factors that may influence motivation encompass: (i) *Attitudes and Beliefs*: Perspectives regarding health behaviours; (ii) *Values:* Collective community values pertaining to preferred sanitation practices; (iii) *Emotional, Physical, and Social Drivers*: Internal thoughts and emotions that encourage behaviour, such as the use of a latrine to preserve dignity; (iv) *Competing Priorities*: Household decisions regarding the allocation of funds for enhancing an old latrine versus other requirements; (v) *Intention:* The planning aspect integral in behaviour modification; and (vi) *Affordability and Willingness to Pay*: The extent to which individuals are prepared to invest in sanitation improvements (Mosler 2012; De Buck et al. 2017; Coombes & Devine, 2010; Sara & Graham 2014).

Sustainability pertains to the likelihood that a newly adopted positive behaviour will persist over time. This concept addresses the question: "Will the adoption of beneficial practices or the rejection of harmful ones endure?" The sustainability of improvements in hygiene behaviours often remains inadequately explored, particularly concerning CLTS. In this context, the sustainability of ODF status, the construction and maintenance of latrines and HWFs, as well as the utilization of latrines and HWWS post-defecation, requires further investigation (De Buck et al. 2017).

`

The SaniFOAMS framework serves as a tool for elucidating existing behaviours at the community, household, and individual levels, thereby facilitating the transition from unhealthy to healthy practices (O'Connell 2014). When a household possesses the opportunity, ability, and motivation to adopt a new behaviour, the likelihood of achieving sustainable behaviour change is enhanced. Nevertheless, barriers to these attributes may delay or completely obstruct the process of behaviour modification (Sara & Graham 2014; O'Connell 2014; The Decision Lab 2022).

According to Ngondi et al. (2010), as referenced by Stephen and Graham (2014), the FOAMS model indicates that the primary drivers for the adoption of latrines fall within the categories of opportunity and motivation. Factors such as social status, willingness to pay, cleanliness, prestige, safety, privacy, and convenience significantly influence latrine construction and usage. Conversely, latrine adoption barriers are generally found within the opportunity and ability categories. A study by Jenkins and Scott (2007) in Ghana found high costs, lack of construction expertise, limited savings, and competing priorities as the predominant obstacles to latrine access and adoption.

Practical gaps in the application of the SaniFOAMS model to promote sanitation behaviour change are evident, particularly in the disproportionate emphasis on individual behaviour while overlooking structural barriers. The model predominantly centers on individual decision-making and household-level factors; however, sanitation behaviour is significantly shaped by structural and policy constraints, including public investment and governance (Novotný 2018). Furthermore, the SaniFOAMS model lacks comprehensive mechanisms to address open defecation free slippage and to ensure long-term behaviour change. Numerous interventions employing the SaniFOAMS model concentrate on the initial adoption of sanitation practices but fail to incorporate sustainable strategies for long-term adherence. This often results in ODF slippage, attributed to inadequate

`

infrastructure maintenance, insufficient ongoing motivation, and financial limitations (Harter 2018; Crocker 2017).

The application of the SaniFOAMS model also encounters challenges related to knowledge gaps. Research on the effectiveness of each component remains limited. While the model identifies opportunity, ability, and motivation as critical drivers of behaviour change, empirical evidence outlining the relative importance of these factors across diverse contexts is negligible. Most studies do not assess the relative significance of these components, complicating the design of targeted interventions (Dreibelbis et al. 2015; Routray et al. 2015). Moreover, the model does not sufficiently integrate emotional and psychological drivers of behaviour. Although motivation is recognized as a key factor, emotional and psychological influences such as shame, social pressure, disgust, and fear are inadequately addressed. Programs utilizing the SaniFOAMS approach frequently underestimate the role of cultural and psychological variables in shaping sanitation decisions (Coffey 2017).

Additionally, SaniFOAMS-based sanitation interventions reveal policy deficiencies characterized by a primary focus on short-term behaviour change, alongside insufficient policies addressing infrastructure development and maintenance. Many sanitations policies leverage SaniFOAMS to advocate for latrine adoption without establishing frameworks for maintenance and upgrading. This lack of attention can result in latrine deterioration and abandonment due to maintenance costs and the absence of policies that accommodate family growth (Hueso 2013; Garn 2017). Although the SaniFOAMS strategy is aimed at facilitating individual behaviour change, it does not highlight the stage of behaviour change. The CLTS approach is inherently collective, as the ultimate decision regarding latrine usage and HWWS lies with individuals. The Trans-Theoretical Model (TTM)

`

indicates that interventions are more likely to succeed when strategies are aligned with the stages of behaviour change of individuals and/or communities (Soberey et al. 2014).

2.6.2 Trans-Theoretical Model (TTM) - Stages of Change (SoC)

The Trans-Theoretical Model (TTM), also referred to as the Stages of Change (SoC) model, was developed by Prochaska and colleagues in the 1970s to identify common elements of psychotherapy and behaviour change theories. This model is widely utilized in sanitation interventions to monitor and reinforce behaviour change (Clark & Janevic 2014). The TTM hypothesizes that individual's progress through various processes to shift from one behaviour stage to another until they attain the desired behaviour (Prochaska & Norcross 1994). It serves as an integrated model of behaviour change and is among the most frequently applied stage-related health behaviour change theories (Guess et al.2016; Manchaiah et al. 2015).

The TTM model explains how individuals modify problematic behaviours or adopt positive behaviours within a stage of change paradigm, which includes the temptation to make decisions (Prochaska & Veliger 1997). It emphasizes that behaviour change is an evolving process that develops over time (Callaghan et al. 2010). This process is described in five distinct stages: pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska & Veliger 1997; Fink-Barboza et al. 2013) (Figure 5) The TTM model facilitates cyclical movement through the stages of change, indicating that individuals may revert to earlier stages before advancing again. This process is not necessarily linear (Prochaska & Norcross 1994).

`

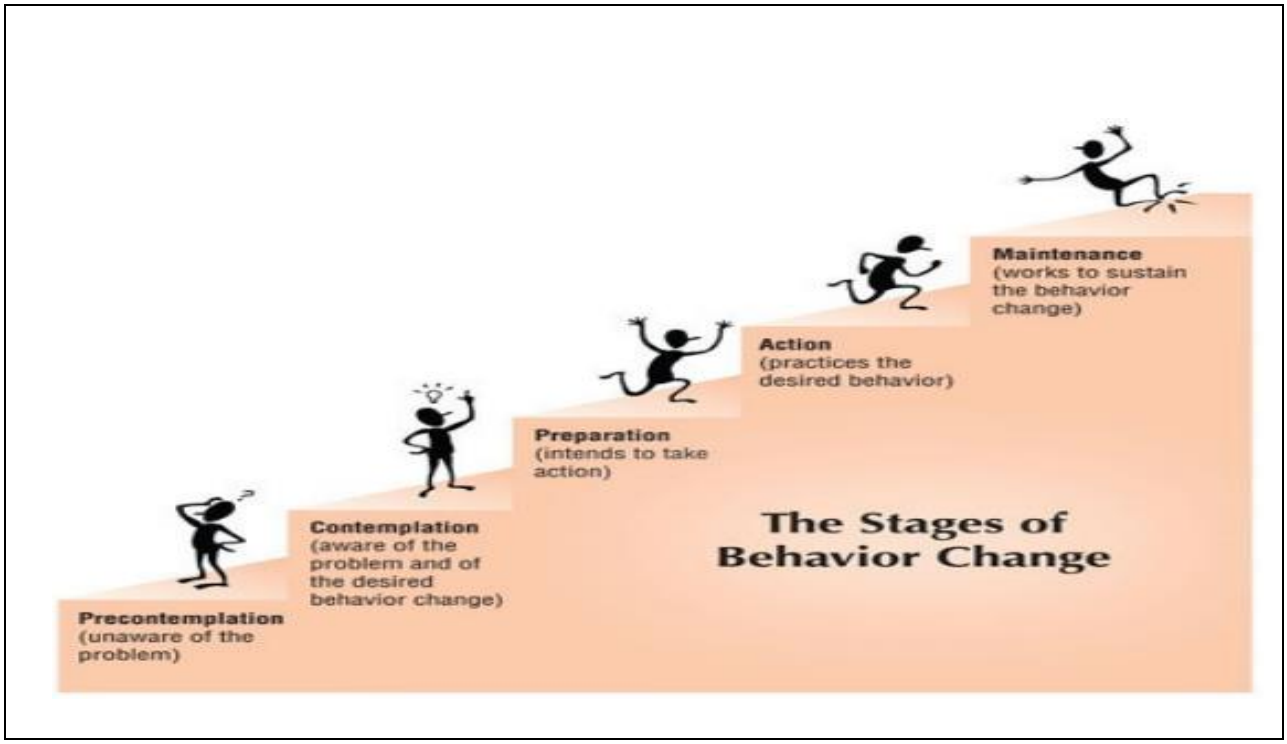


Figure 4 Trans-Theoretical Model - Stages of Change

(Source: Prochaska 1992)

In the pre-contemplation stage, an individual may not recognize the necessity to change a specific behaviour. The subsequent contemplation stage occurs as the individual weighs the pros and cons associated with making a change. Following the decision to change, the preparation stage involves formulating plans to implement that decision. During the action stage, the individual attempts to change their behaviour, although these changes may not be immediately apparent. The maintenance stage arises when consistent efforts are made to prevent relapse (Manchaiah et al. 2015; Soberay et al. 2014; Gordali et al. 2021; Siddharthans et al. 2021).

`

The TTM provides guidance regarding the stages of behaviour change following ODF certification. The CLTS triggering process aligns with the TTM stages of change, illustrating the transition from open defecation to open-defecation-free status and ultimately to sustained ODF status (Figure 6). An individual in the pre-contemplation stage may not recognize open defecation and the failure to practice HWWS as significant issues. They may exhibit no intention of using a latrine or engaging in HWWS thereafter (CLTS pre-triggering stage). A contemplator acknowledges the importance of stopping open defecation and HWWS after defecation; however, they have yet to start using a latrine or washing their hands (CLTS triggering stage). In the preparation stage, the individual is determined to construct a latrine and a hand-washing facility and to begin utilizing them (CLTS triggering stage). An individual in the action stage has begun using a latrine and HWWS after defecation. In the maintenance stage, the individual consistently uses a latrine and washes their hands with soap after defecation, thereby minimizing the risk of regression (CLTS post-triggering stage). The TTM emphasizes the significance of individual attitudes and the relationship between beliefs and behaviours related to stoppage of open defecation, utilization of latrines, and HWWS after defecation (Petit 2019).

`

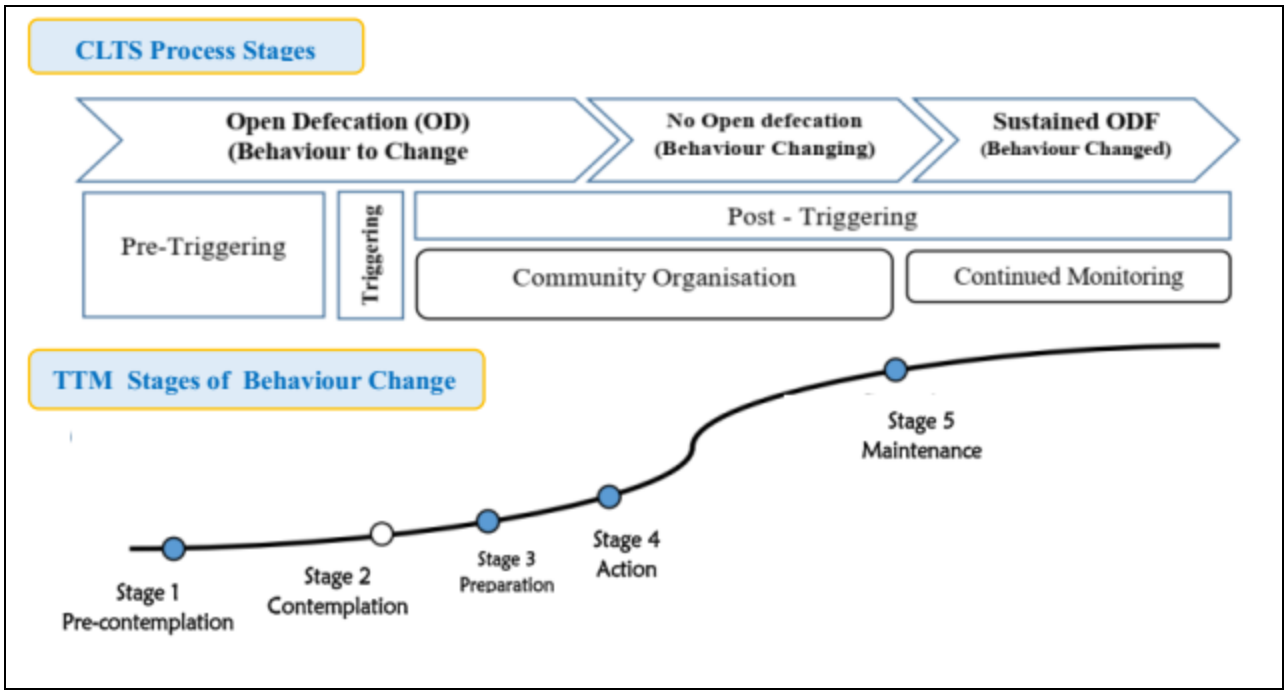


Figure 5 Community-Led Total Sanitation Process Stages and Trans Theoretical Model Stages of Behaviour Change

Despite the application of the TTM in sanitation interventions, notable gaps remain in its practical application, knowledge base, and integration into policy. One substantial gap is the TTM's primary focus on individual change, which tends to overlook social and environmental dynamics. Sanitation behaviour is frequently collective and subject to influence by social norms, infrastructure, and policy.

Community-level dynamics and peer influence play an essential role in the adoption and sustainability of latrine use within households (Dreibelbis et al. 2015). Although the TTM has been employed in sanitation interventions, notable deficiencies persist in its practical implementation, the knowledge base, and integration into policy frameworks. One significant limitation of the TTM is its predominant focus on individual behavioural change, which overlooks critical social and environmental factors. Sanitation behaviour tends to be a collective action influenced by social norms, infrastructure, and policy constructs.

`

Moreover, the transition between stages within the TTM often lacks robustness, resulting in high rates of relapse. Numerous sanitation programs operate under the assumption that once individuals reach the action or maintenance stage, they will invariably sustain their behaviours. However, research indicates that many communities revert to open defecation due to inadequate reinforcement, insufficient maintenance, and financial constraints (Harter 2018; Crocker 2017).

Knowledge gaps within the TTM framework are also evident, particularly in the absence of empirical evidence regarding stage-specific interventions. Comprehensive measurement of sanitation behaviour at each TTM stage is frequently lacking, and there is a limited understanding of the emotional and psychological barriers that influence these behaviours. The TTM suggests rational decision-making; however, sanitation behaviour is inseparably linked to emotions, social stigma, and cultural beliefs. Factors such as shame, disgust, and apprehension regarding pit toilets are insufficiently addressed (Dreibelbis et al. 2013).

Furthermore, TTM-based sanitation interventions encounter significant policy gaps. Many sanitation policies emphasize latrine construction and initial adoption while neglecting long-term maintenance, upgrades, and behavioural reinforcement. The maintenance stage explained by the TTM is often disregarded in sanitation policies, contributing to ODF slippage (Routray et al. 2015). Additionally, there exists an inadequate integration of economic and infrastructure policies, as many sanitation programs fail to account for affordability, land tenure, and access to infrastructure, which complicates sustained behaviour change (Novotny 2018).

`

2.6.3 Socio-Ecological Model (SEM)

The Socio-Ecological Model (SEM) effectively addresses the broader social and structural dimensions that serve either as enabling or constraining factors influencing behaviour, both directly and indirectly. This model functions as an analytical tool that describes various levels of influence and factors shaping individual behaviour. Comprising four nested circular layers, individual/intrapersonal, interpersonal, community/institutional, and societal, this framework facilitates a comprehensive understanding of the dynamics at play (Table 1).

The SEM incorporates a broad range of environmental and human factors (Stojanovic et al., 2016), necessitating multidisciplinary and interdisciplinary approaches to effectively address real-world challenges, thus giving rise to Sustainability Science (Kates et al. 2001; Turner et al. 2003). It is critical to emphasize that the elements driving behaviour change are socio-ecological.

Table 1 Description of Socio-Ecological Model Levels

Level	Description
Intrapersonal / Individual	Characteristics of an individual that influence behaviour, including knowledge, attitudes, gender, age, religious identity, racial/ethnic identity, economic status, financial resources, values, goals, expectations, literacy, stigma and hygiene habits.
Interpersonal	Formal and informal social networks and social support systems that can influence individual behaviour, including family, friends, peers, co-workers, religious networks, customs or traditions.
Community Institutional / Organizational	Relationships among organizations and informational networks within defined boundaries, including the built environment, local associations, community leaders, businesses, transportation, as well as social rules applying to the local community. Role of local institutions and NGOs, organizations with rules, procedures and regulations to structure everyday life, including for operations that affect how, or how well, for example cultural beliefs, traditional practices and leadership.
Societal	Local, state, national and global laws and policies affecting the issue of interest such as Government regulations, funding and monitoring systems either as the promoters or barriers to interventions and changes

Source: https://www.unicef.org/cbsc/files/Module_1_SEM-C4D.docx

`

The factors influencing behaviour transformation extend across various levels of the SEM individual, family, community, institutional, and societal ultimately inducing behavioural modifications (Petit 2019) (Figure. 7). In order for communities to successfully eradicate open defecation, cooperation and support must be established at all levels, from individuals to societal structures. Both public and private institutions must collaborate to promote sustained latrine utilization and HWWS after defecation.

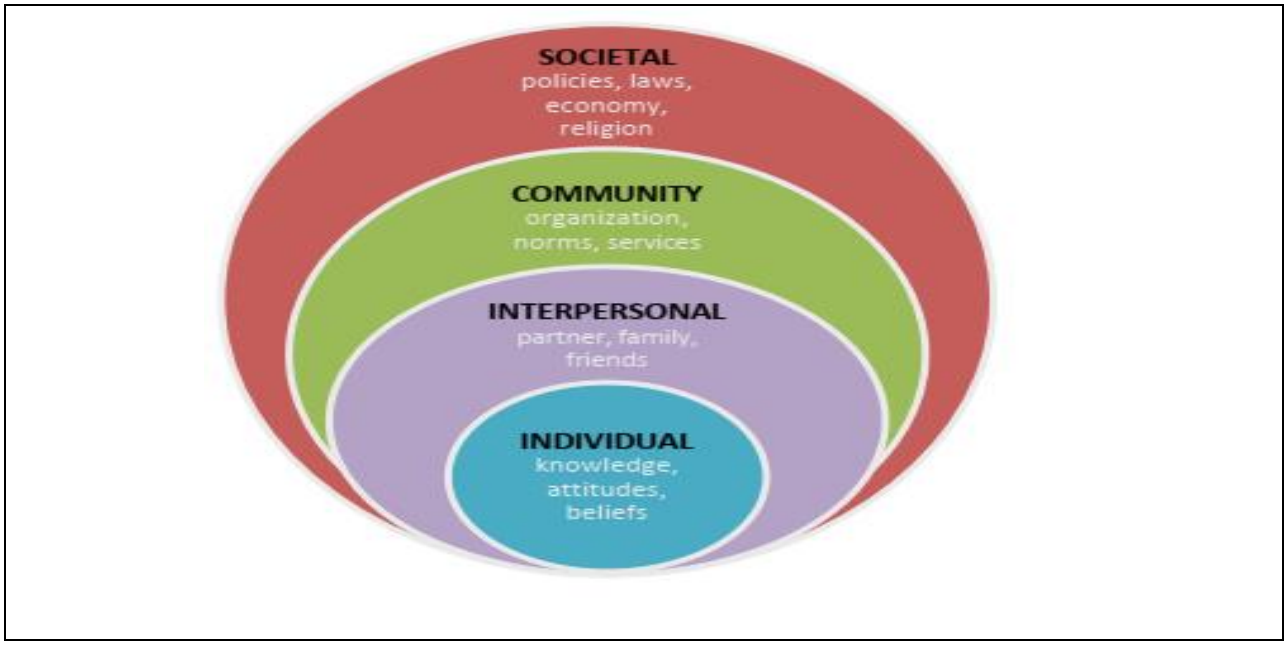


Figure 6 Socio-Ecological Model

Source: Schmied 2017

The SEM emphasizes that behavioural change extends beyond individual choice. To enhance the adoption of latrine usage among a broader population, it is essential to consider factors such as social norms, economic resources, the physical environment, and the availability of resources for latrine construction. When these conditions are favorable, the likelihood of adopting latrine use is heightened at both community and individual levels. Furthermore, the SEM suggests that

`

individuals shape the environments in which they reside, thereby influencing the ease or difficulty of adopting and maintaining new behaviours (Schmied 2017).

Despite the model's capacity to capture multilevel influence on individual behaviour, notable gaps persist in its application, particularly on practices, knowledge, and the integration of policies. Practical deficiencies of the SEM for sanitation behaviour change include an inadequate merger of structural and environmental factors (Schmidt & Dreibelbis 2012; Srinivasan & King 2015). Although the model highlights the necessity of support at both individual and community levels, its effectiveness within large-scale national programs remains underdeveloped, specifically in tackling broader systemic challenges such as funding and political commitment (WaterAid 2016).

Furthermore, knowledge gaps regarding the SEM's application to sanitation persist, including a lack of empirical evidence regarding the interactions between various levels of the model (Nguyen & Nguyen 2018) and limited research on non-health-related determinants influencing sanitation behaviour. Factors such as social status, economic conditions, and cultural values are frequently overlooked within sanitation behaviour change initiatives. Social pressures such as status and gender norms alongside economic constraints such as the affordability of latrines exert significant influence; however, these factors are inadequately represented within SEM applications (Coffey et al. 2017).

Additionally, SEM-based sanitation interventions encounter policy-related shortcomings, including insufficient alignment with national and local sanitation frameworks. While the model emphasizes individual and community behaviour change, it does not fully harness policy and governance structures that facilitate large-scale adoption (World Bank 2015). Recommendations

`

derived from the SEM often neglect to consider localized contexts, resulting in diminished efficacy in addressing the unique challenges faced within specific communities (Garn & Freeman 2017).

2.7 Conceptual Framework

Achieving sustainable sanitation in communities designated as Open Defecation Free requires a thorough understanding of the dynamics of behaviour change. A conceptual framework that addresses these dynamics should consider the origins of behaviour change theories, identify existing deficiencies, and emphasize contributions to knowledge, attitudes, practices, and the stages of behaviour change.

Behaviour changes theories have progressed to clarify how individuals and communities adopt and maintain new behaviours. This conceptual framework integrates established behaviour change models and identifies gaps pertinent to the study, thereby enhancing the understanding of knowledge, attitudes, and practices, stages of behaviour change, behaviour change dynamics, and determinants. The framework draws upon three theoretical models: the Social-Ecological Model, SaniFOAMS, and the Trans-Theoretical Model. While conventional models concentrate on individual elements, the pursuit of sustainable sanitation necessitates a broader perspective that encompasses social, technical, ecological, and personal dimensions (Devine 2009) (Figure 8)

The SEM presents a comprehensive approach that acknowledges the multiple levels of influence on individual behaviour, including individual, interpersonal, community, organizational, and policy factors. The SEM has been employed in various public health and sanitation behaviour change initiatives to explain how environmental and social factors affect behaviours such as latrine use or open defecation. The SaniFOAMS model focuses on sanitation behaviour change by

`

identifying Factors, Opportunities, Abilities, and Motivations as the key components essential for analyzing and influencing sanitation behaviours (Devine 2009). The TTM, also referred to as the Stages of Change Model, is utilized extensively in behaviour change research, including sanitation, and characterizes behaviour change as a process that unfolds in five stages: Pre-contemplation, Contemplation, Preparation, Action, and Maintenance.

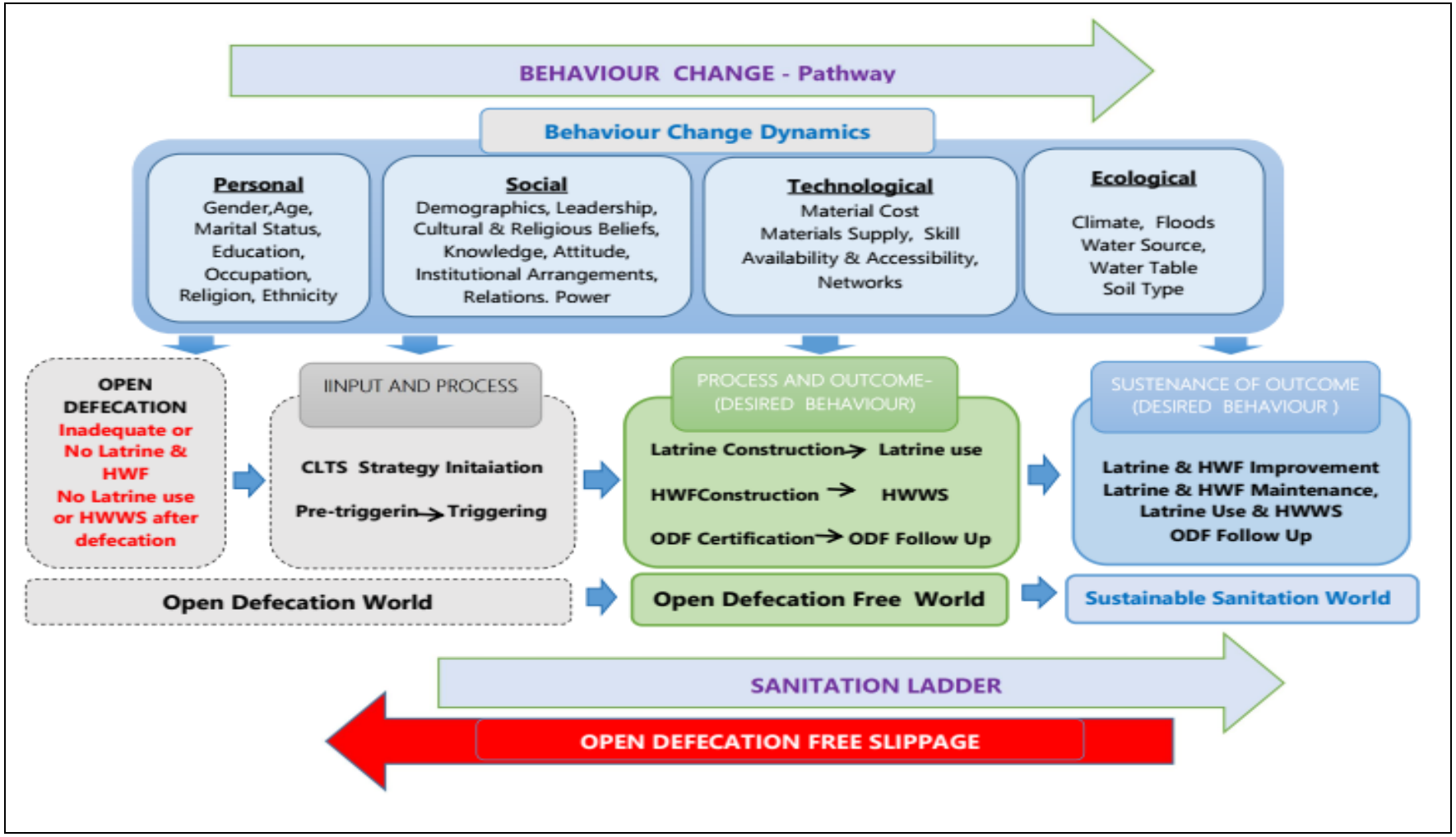


Figure 7 A Conceptual Framework on Behaviour Change beyond Open Defecation Free Status Certification.

(Source: Laston Kamwana 2024 (Author))

`

Although these models provide valuable insights, certain gaps persist concerning the sustainability of sanitation post-ODF. These deficiencies include: (i) *Post-Certification Sustainability:* Existing models often do not place sufficient emphasis on sustaining behaviours following initial adoption, which is critical for long-term sanitation advancements. (ii) *Ecological Considerations*: The influence of environmental factors on behaviour change is not comprehensively addressed. (iii) *Integration of Personal and Social Dynamics*: A holistic approach that merges individual motivations with community dynamics is essential for sustaining behaviour change.

The conceptual framework aims to: (i)- *Enhance Knowledge***:** By incorporating ongoing education and community engagement, the framework seeks to deepen the understanding of the health benefits associated with ODF status and improved sanitation. (ii) *Shift Attitudes*: By addressing cultural norms and individual beliefs, it fosters positive attitudes toward sanitation practices. (iii) *Transform Practices:* Through practical interventions and support, it facilitates the transition from the theoretical understanding of open defecation to the consistent construction, enhancement, and utilization of latrines and HWFs.

Post-ODF sustainability incorporates multiple dynamics. The framework (Figure 8) considers various factors that influence behaviour change, such as social, technical, ecological, and personal dynamics. This holistic approach addresses the complex factors that influence sanitation

`

behaviours, integrating knowledge, attitudes, and practices as defined by the SEM. It also identifies gaps in current post-ODF interventions and contributes to the understanding of long-term sanitation behaviour. This framework assesses the stage of behaviour change, readiness to change, and commitment to transitioning from open defecation to sustained sanitation (Dreibelbis et al. 2013; Chidziwisano et al. 2019).

The conceptual framework (Figure 8) defines the behaviour of communities with respect to open defecation prior to the implementation of CLTS. At this initial stage, individuals typically exist in the pre-contemplation phase, wherein a range of personal and social factors including educational background, gender, ethnicity, attitudes, beliefs, and skill affect their readiness to modify their behaviours associated with open defecation. The acceptance of the CLTS strategy is subject to the influence of social, technological, and ecological factors. Following the adoption of the CLTS strategy, communities experience a motivational shift, progressing from the pre-contemplation to the contemplation stage of behavioural change, ultimately transitioning toward an open defecation-free environment.

During and subsequent to the triggering of CLTS, individuals initiate the construction and utilization of latrines and HWF. At this stage, communities may be categorized within the open defecation-free paradigm. It is essential to recognize several dynamics of behaviour change aimed

`

at preventing individuals from reverting to open defecation, as well as facilitating their advancement from an ODF-certified status to a sustainable sanitation model. Diverse behaviours will propel individuals to construct, maintain, and improve their latrines and HWF, thereby ensuring continued utilization.

The conceptual framework (Figure 8) summarizes the various dimensions and levels of behavioural change and sanitation practices following the attainment of ODF status. It illustrates the path of communities from the world of open defecation to that of open defecation-free living, ultimately achieving sustained ODF status. The framework accentuates the dynamics and drivers of behaviour change, highlighting the necessity of these elements for communities aiming to progress along the sanitation ladder. This framework serves as a robust tool for researchers and policymakers to theorize and evaluate associations between differing behaviour change dynamics. For practitioners, it operates as a diagnostic resource to identify both the strengths and weaknesses of CLTS in promoting sanitation behaviour change, thereby assisting communities in their ascent along the sanitation ladder while averting regression to open defecation practices.

Existing literature shows significant progress in understanding the multidimensional factors knowledge, attitudes, and practices alongside social, cultural, institutional, and ecological influences that shape sanitation and hygiene behaviour change. In Malawi, Community-Led Total

`

Sanitation (CLTS) has effectively driven ODF achievements, with Balaka recognized as a model district. However, most interventions have treated ODF attainment as an endpoint, with limited focus on post-ODF ideological and behavioural reinforcement, leading to slippage such as repeated open defecation and inconsistent HWWS after defecating. This study addresses these gaps by analyzing the behavioural, social, and contextual factors influencing the sustainability of sanitation practices in Balaka. Drawing from the SaniFOAM, Social Ecological, and Transtheoretical frameworks, it introduces the Sustainable Sanitation Behaviour Transformation (SSBT) Model, a comprehensive approach that emphasizes continuous motivation, community ownership, contextual adaptation, and institutional support as key pathways to sustaining sanitation and hygiene behaviour change beyond ODF status attainment.

`

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The Community-Led Total Sanitation (CLTS) strategy seeks to influence transformative behavioural change within communities to eliminate open defecation. However, evidence indicates that such changes are often short-lived, with communities frequently reverting to open defecation and other unsanitary practices, a phenomenon known as slippage particularly during the post-triggering phase (Gebremariam et al. 2018; Pickering et al. 2015; Tesserae 2017; Venkataramanan et al. 2018; Njuguna 2019; Wijesekera & Thomas 2015). This challenge has prompted growing interest among researchers and practitioners in identifying strategies that sustain behavioural change throughout and beyond the CLTS process

This study investigates various dimensions of sanitation behaviour sustainability including community knowledge, attitudes and practices, stages of behaviour change, and the determinants that influence continued use of pit latrines and hand-washing facilities to address slippage. This chapter describes the study site, outlines the study design, target population, data collection methods and tools, sampling units, data analysis procedures, ethical considerations, underlying assumptions, and limitations, descriptive statistics of the variables analyzed, research limitations, and ethical considerations. Moreover, the chapter clarifies how these methodologies correlate with

`

the research objectives, thereby facilitating a stronger linkage between the collected data and the research questions to ensure consistency, validity and reliability of the findings.

3.2 Research Study Areas

3.2.1 Malawi as a Study Country

Malawi, recognized as one of the world's least developed and most densely populated nations, adopted the CLTS approach in 2008 with the ambition of achieving Open Defecation Free status by 2015 (GoM 2011; Maulit and Kang 2011; Sne l et al. 2014). Despite certain advancements, Malawi did not attain its ODF goal by the designated year; however, the percentage of the population engaging in open defecation reduced from 27.7% in 1992 to 5.9% in 2018 (NSO 2018). The challenge of securing adequate, consistent, and long-term investment in sanitation sustainability persists. In 2017, four districts Balaka, Dowa, Nkhotakota, and Ntchisi were certified as ODF. Notably, Balaka, recognized as a model ODF district, encountered a reversion to open defecation within one year (UNICEF 2019; GoM 2018 and Taulo et al. 2018).

Malawi's CLTS adoption context demands for examining the dynamics of behaviour change and sustainable sanitation, particularly given its significant challenges related to ODF slippage. The country's prioritization of sanitation enhancement and its significant progress toward achieving

`

ODF status render it an invaluable setting for investigating the factors that influence long-term behaviour change in sanitation practices. The occurrence of ODF slippage in Balaka underscores the urgent necessity to comprehend the behavioural and contextual factors that either facilitate or impede sustained sanitation practices. This positioning renders Malawi, particularly Balaka, an exemplary case study for exploring the complexities surrounding post-ODF sustainability and for generating insights that may inform national policies and program implementations aimed at achieving Sustainable Development Goal 6, which targets the cessation of open defecation by 2030, not only in Malawi but also in other developing nations meeting similar challenges.

3.2.2 Balaka as a Study District

This research was conducted in Balaka District, which is one of the thirteen districts located in the Southern Region of Malawi. Balaka, in conjunction with Dowa, Nkhotakota, and Ntchisi, was recognized as Open Defecation Free in 2017. It was selected as a model ODF district due to its achievements using the Community-Led Total Sanitation approach. However, within a year of receiving this certification, communities in Balaka reverted to open defecation, presenting a considerable challenge to the sustainability of ODF initiatives (UNICEF 2019; GoM 2018 and Taulo et al. 2018). Balaka was then purposively selected as the study site due to its ODF slippage

`

status despite being a model ODF District making it a suitable context for examining behaviour change dynamics beyond ODF certification.

Located 127 kilometers north of Blantyre, the commercial capital of Malawi, and 201 kilometers south of Lilongwe, the nation's capital, Balaka shares borders with Ntcheu to the northwest, Mangochi to the north, Machinga to the east, Zomba to the southeast, and Neno to the southwest (Mateauma 2017) (Fig 9). The district has a population of 464,103, comprising 221,648 males (47.8%) and 242,455 females (52.2%). The Yao ethnic group constitutes the predominant population at 37.2%, followed by the Lhomwe at 25.2%, and the Ngoni at 24.2%. Additionally, smaller populations of Chewa, Mang'anja, Sena, and Tumbuka are present. Balaka District encompasses 128,685 households, with an average household size of five. A substantial majority of the households (88.7%) are situated in rural areas (NSO 2018).

With a total area of 2,114.2 square kilometers, Balaka accounts for 2.4% of Malawi's total land area, making it the 20th largest District in the country and the 7th largest in the Southern Region. The geographic coordinates of Balaka are latitude 14°59'15.38" S and longitude 34°57'22.23" E. The District is primarily located in a rain shadow zone, yielding an average annual rainfall of approximately 800 millimeters, with a minimum of 700 millimeters and a maximum of 1,100 millimeters. Agriculture serves as the principal economic activity, with maize being the primary

`

food crop, typically cultivated in monoculture but also intercropped with legumes such as cowpeas, pigeon peas, and groundnuts. Other significant crops include tobacco, cassava, and cotton, which serves as a major cash crop (Makate and Mango 2017). (Fig 9)

The target population comprised households within selected Traditional Authorities and Group Village Head areas in Balaka District. Participants included household heads, and key community stakeholders involved in sanitation promotion and maintenance, such as Head of Departments Health Surveillance Assistants, community leaders, and sanitation committee members. This diverse population provided a comprehensive perspective on the knowledge, attitudes, practices, and determinants influencing sustained sanitation and hygiene behaviours within Balaka District.

3.2.3 Traditional Authorities as Study Areas

Balaka District is organized into seven designated Traditional Authorities (TAs). This study specifically concentrated on three of TAs: Kalembo, Sawali, and Nsamala (Figure 9). Traditional Authorities play a critical role in research due to their significant impact on local governance, community mobilization, and the preservation of cultural heritage. Acting as custodians of customary law, TAs serve as essential intermediaries between governmental bodies and local communities. Their compriesehensive understanding of local social norms, beliefs, and practices is instrumental in designing culturally appropriate interventions.

`

The influence exerted by TAs over local population's positions them as key stakeholders in development initiatives. Furthermore, the decentralized nature of program implementation in Malawi underlines the necessity for TA involvement in planning, execution, and monitoring, which is vital for the success and sustainability of ODF status. (Makate and Mango 2017).

In accordance with the National Open Defecation Free Malawi 2015 strategy, the criteria for ODF status certification primarily emphasize the achievement of 95% latrine availability at the Traditional Authority level. The Malawi National Sanitation and Hygiene Strategy (2018–2024) advocated for the formation of teams at the Traditional Authority level to identify and engage Natural Leaders, who would collaborate with district extension staff to certify Traditional Authorities. When all TAs within a district attain ODF certification, the entire District is awarded ODF status (GoM 2018).

Conducting research within TAs grants valuable insights into local perspectives, which are critical for identifying the behavioural changes necessary to sustain sanitation services and hygiene practices, particularly in the context of sustaining ODF certification.

`

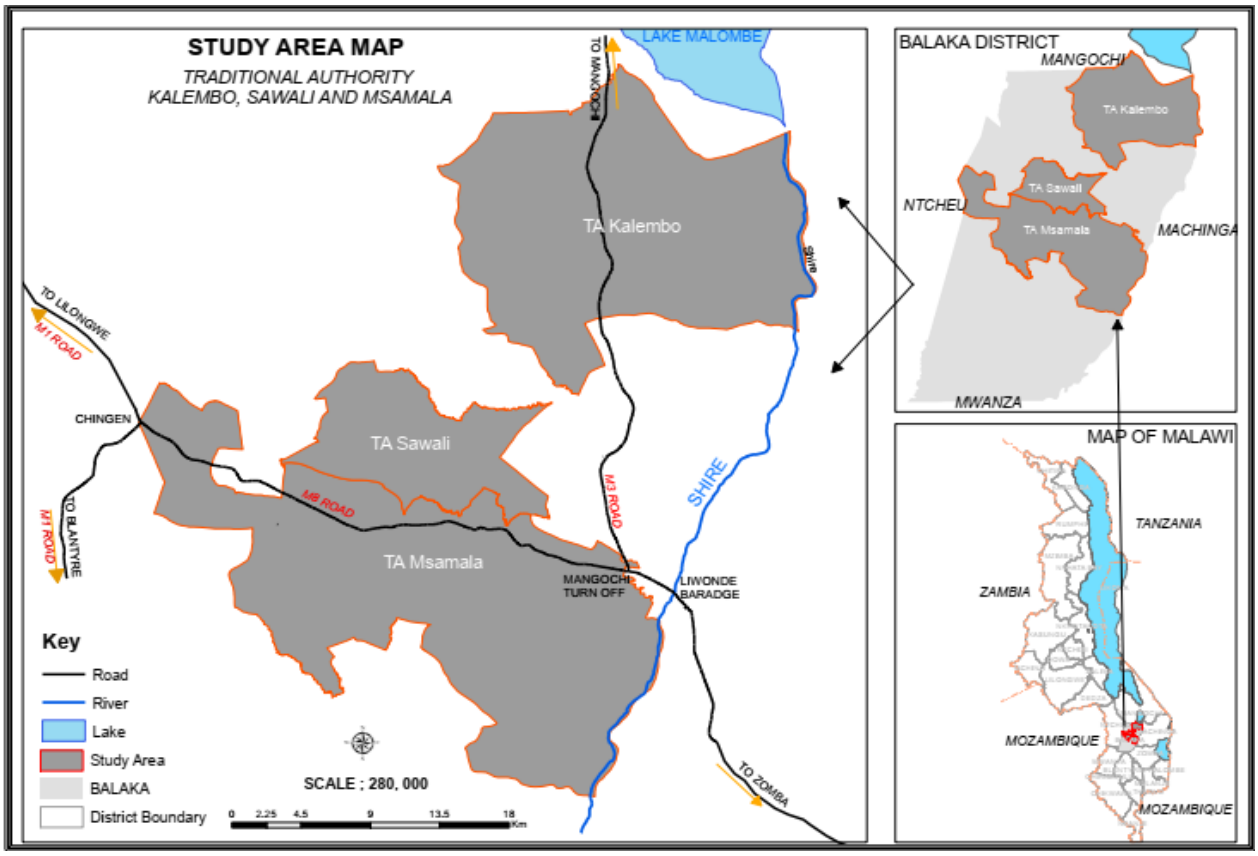


Figure 8 Map of Balaka District showing the study area.

3.3 Research design

This study used a cross-sectional mixed-methods design, integrating both qualitative and quantitative approaches. The mixed-methods approach facilitates the triangulation of findings, thereby providing a more comprehensive understanding of the research problem. This methodology also ensures that the findings possess sufficient validity and reliability to be generalized to a wider population (Creswell & Clark 2018). The cross-sectional design is particularly suitable for capturing a snapshot of sanitation practices and related behaviours at a

`

singular point in time across diverse community segments. As noted by Denscombe (2010), exploratory research allows for a meaningful evaluation of phenomena that are not well understood, yielding rich, grounded insights into local dynamics, such as behaviour change after achieving ODF status

The study enabled the researcher to gain insights into various dependent variables, including latrine use and HWWS with soap, alongside multiple independent variables, such as social, cultural, institutional, technical, and personal factors, as well as intervening elements like monitoring, enforcement, and incentives related to ODF sustainability. This comprehensive approach showed the barriers to maintaining ODF status and ultimately facilitated the development of a model aimed at promoting behaviour change to sustain ODF status and assist communities in their progression along the sanitation ladder.

Key methods utilized in this research included participant interviews, focus group discussions, key informant interviews, and observations, all directed at assessing the sustainability of ODF status. Subsequent sections will elaborate on the methods employed for each research question, the targeted data sources, and the techniques utilized to address these questions.

`

Research Design for Specific Objective i:

Research Question: What is the level of knowledge, attitudes, and practices within the community regarding sanitation and their stage of behaviour change after ODF status certification?

A cross-sectional research design was selected to evaluate community knowledge, attitudes, and practices related to sanitation at the time of this study. This design encompasses multiple segments of the study population, including household heads, local leaders, departmental heads, and extension workers. It constitutes a one-time survey aimed at capturing a snapshot of a particular group of households at a fixed point in time (Kish 1995). Specific Objective One utilizes the Socio-Ecological Model of Change in conjunction with the Trans Theoretical Model of Change. According to Valcourt et al. (2020), limited research has investigated the motivations underlying community choices regarding latrine usage and hand washing after defecation. This study focusses on identifying both facilitators and barriers that clarify the rationale behind behaviours and the contextual limitations affecting the usage of latrines and HWWS after defecation.

The Socio-Ecological Model of Change highlights knowledge and attitude factors such as cleanliness, prestige, safety, privacy, and convenience, which serve as social norms influencing the use of latrines and hand washing (Devine 2009; Yin 2009; Stephen & Graham 2014). The TTM model will facilitate the identification of the stage of behaviour change and sanitation practices,

`

determining whether communities are in the pre-contemplation, contemplation, planning, action, or maintenance stages. The pre-contemplation stage underscores the necessity of understanding the advantages and disadvantages of open defecation (Harter et al. 2020). During this stage, individuals begin to contemplate ceasing open defecation, constructing latrines and hand washing facilities, and utilizing these amenities. Awareness of the pros and cons associated with open defecation and hand washing represents an initial event within the socio-ecological model, corresponding to the nascent stages of the Community-Led Total Sanitation process: pre-triggering, triggering, and initial uptake (Delea et al. 2019; Harter et al. 2019a; Inauen et al 2020).

Data collection employed a mixed-methods approach to ensure triangulation and a comprehensive understanding of the results. Quantitative data pertaining to demographics, sanitation facilities, usage, and hygiene practices was collected through structured household surveys featuring primarily close-ended questions to describe sample characteristics and assess the prevalence of specific knowledge, attitudes, and practices related to sanitation. Furthermore, semi-structured key informant interviews were conducted with significant stakeholders, including Group Village Heads, Village Headmen, Government officials, extension workers, and religious leaders. Focus group discussions involved Village Development Committees (VDCs) and Village Health Committees (VHCs). Additionally, direct observations utilizing a structured checklist was

`

performed at each household to provide objective data regarding the availability, condition, and usage of sanitation facilities in Balaka.

Research Design for Specific Objective ii:

Research Question: What is the behaviour change determinants that facilitate sustainable sanitation following the attainment of open defecation-free status?

The research design pertaining to Specific Objective 2 used both quantitative and qualitative methodologies. Quantitative descriptive study designs were utilized to capture measurable patterns and establish associations among different variables (Salami & Omasta 2018). While quantitative data effectively documented community conditions prior to and following ODF certification, it was imperative to collect rich qualitative data to gain insights into the barriers and facilitators on the sustainability of ODF status (Mosler et al. 2018; Njuguna 2019). Qualitative methods enabled a comprehensive understanding of various study variables (Salami & Omasta 2018).

The qualitative component was structured to elicit insights regarding the triggers or obstacles influencing sanitation practices, including latrine and hand-washing facility construction, latrine utilization, and HWWS after defecation. Additional practices examined under Specific Objective

`

2 included community support in latrine construction, the organization of awareness meetings, and follow-up visits.

Furthermore, qualitative methods assisted in identifying behaviour change agents such as local leaders, religious leaders, extension workers, family members, and motivators such as dignity, convenience, beliefs, safety, and embarrassment (Njuguna 2019). A phenomenological approach was employed to provide elaborate descriptions of how respondents experience the phenomena under investigation (Patton 2002; Mack et al. 2005). This approach facilitated the exploration of respondents' thoughts and perceptions regarding the adoption and sustainability of ODF status post-certification in Balaka.

Specific Objective 2 also utilized the SaniFOAMS Model, which clarifies the barriers and drivers of behaviour change in sanitation practices (Devine 2009). This model outlines focused behaviours, such as latrine use and hand-washing, alongside opportunity elements, which include social norms concerning cleanliness, prestige, safety, privacy, and convenience, as well as access to resources that enable latrine and HWF facility construction and utilization (Devine 2009). The ability concept addresses factors such as costs, insufficient skills, lack of knowledge, and inadequate social support, which can impede latrine and HWF construction and usage (Stephen &

`

Graham 2014). Motivational elements include attitudes, beliefs, values, affordability, accessibility, willingness to pay, and competing priorities (Devine 2009).

3.4 Research variables

3.4.1 Independent variables

Social Factors: This category encompasses personal motivation, cultural norms and traditions, social influences, perceived social norms, behavioural intentions, institutional arrangements, peer pressure, community reinforcement, local leadership, and underlying beliefs.

Environmental/Ecological Factors: These include the availability of water sources, the water table, and soil type, occurrences of floods and regulatory frameworks.

Technological and Structural Factors: This encompasses the availability of materials, accessibility, affordability, supply networks, and the availability of requisite skills.

Intervention Strategies: This segment consists of health promotion campaigns, incentives, reinforcement mechanisms, and systems for monitoring and feedback

`

3.4.2 Dependent Variables

The dependent variables include the construction of latrines and hand-washing facilities, the sustained use of latrines and HWF, a reduction in the rates of open defecation, and the establishment of sustainable Open Defecation Free behaviour, which is measured by consistent usage of latrines, maintenance of sanitation facilities, and adherence to hygiene practices over time

3.4.3 Intervening Variables

Intervening variables include community monitoring, reinforcement of hygiene messages, the provision of incentives for sustained sanitation, the role of community-led initiatives, and participation in sanitation campaigns.

3.5 Sample Size and Sampling Framework

3.5.1 Sampling Framework

In view of the extensive and dispersed population in Balaka, a multistage sampling approach was used to select Traditional Authorities, Group Village Headmen, and villages. A comprehensive list of TAs within the district, alongside lists of GVHs in each TA and associated villages, was utilized. Simple random sampling was done to select three TAs, three GVHs (one from each TA), and six

`

villages (two from each GVH). The random sampling process involved recording the names of all seven TAs on pieces of paper, folding them, and placing them in a box. Three papers were randomly drawn to designate the TAs: Kalembo, Sawali, and Nsamala. An analogous procedure was applied for selecting the GVHs: Mpulula, Kadyalunda, and Nandumbo, one from each Traditional Authority. Six villages, Hanjahanja and Mbodzole from GVH Mpulula, Kadyalunda and Ziwoya from GVH Kadyalunda, and Nkota and Milala from GVH Nandumbo were also selected utilizing the same method. A household list in each village was used to ascertain the number of respondents

3.5.2 Sample Size

The study involved a total of 516 study units, which comprised 438 heads of households, 24 key informants, and 54 focus group discussion participants (Table 2). The household survey targeted heads of households, while key informant interviews included community leaders, heads of Government Departments, and extension workers engaged in the Community-Led Total Sanitation approach within Balaka. Focus group discussions included members from Village Health Committees, Village Development Committees, and Area Development Committees, all of whom were involved in CLTS initiatives in the selected villages. Eligibility criteria mandated that participants be aged 18 or older and stable residents who had participated in CLTS within the

`

community. Heads of departments, extension workers, and committee members were responsible for and engaged in CLTS activities. Gender representation was balanced, as both males and females play significant roles in sanitation decision-making.

Heads of households were surveyed to evaluate individual and community sanitation practices post-ODF certification, given their crucial role in household decision-making. Key informants provided valuable insights into institutional dynamics, inter-institutional interactions, political influences on decision-making, and enthusiasm for change at both individual and community levels.

Purposive and convenience sampling methodologies were used to select the 24 key informant interviewees, which included three Group Village Headmen, six Village Headmen, five heads of departments, one religious leader, and nine extension workers. For the focus group discussions, purposive sampling was employed to select members from the VHC and VDC.

The Yamane formula was utilized to determine the sample size, using a 95% confidence interval (CI) with a 0.05 precision level, ultimately estimating a total of 438 heads of household from three villages, utilizing a household list as the sampling frame. The sample size was calculated based on the number of households in each TA and the population of the village. According to Krejcie &

`

Morgan (1970), an effective sample size for large populations ranges between 10% and 30% to ensure proper representation of social issues.

$$\text{Study Sample size} = \frac{N}{1 + Ne2}$$

where: N = Target population size (Households)

e = 0.05 (Alpha level at 0.95 Confidence Interval)

$$\text{Study Sample size} = \frac{128{,}685}{1 + (128{,}685)(0.05 \times 0.05)} = 398$$

= 398 + 39 (10% non-response) = 437

The total estimated sample size was 437, but during actual data collection, a total of 438 heads of households participated in the survey (Table 2)

Heads of households were proportionately identified based on the number of households in each village (Kothari 2004). Systematic random sampling was utilized with an interval of three, achieved by dividing the total number of households by the desired sample size. The initial point of selection was the center of the village, from which the first household was identified. Every third subsequent household was selected until the required sample size of 438 respondents was achieved across the six villages. In instances where the head of the household was unavailable, a

`

senior adult family member was approached instead. Should a household not meet the selection criteria or if no individuals were present, the next household was selected

3.6 Data Collection

Data collection was conducted through a combination of household surveys, key informant interviews, focus group discussions, and observations (Appendices II-IV). Questionnaires for both surveys and interviews were uploaded onto Android devices utilizing Kobo Collect Software. Responses were directly recorded on the devices and subsequently uploaded to a designated website for processing and analysis using Excel and the Statistical Package for Social Sciences (SPSS) PASW 25. Secondary data were collected from policy documents, scholarly journals, articles, and reports from various development agencies and government departments.

Prior to the commencement of data collection, all enumerators underwent training on the established data collection protocol. A pre-test of the questionnaire was conducted in a village near Balaka District Headquarters to identify necessary revisions, assess the tool's suitability for collecting the required data, and gauge the appropriate duration for interviews. The questionnaire was modified following the pre-test to ensure alignment with the research objectives and to effectively address the study's research questions prior to the actual data collection phase.

`

3.6.1 Quantitative Research

3.6.1.1 Household Surveys

A total of 438 interviews were conducted with heads of households using questionnaires comprised of close-ended questions, which are effective for the collection of primary data. The household survey gathered critical information regarding the availability, usage, and maintenance of latrines and hand-washing facilities, in addition to community knowledge and perceptions. According to Combo and Tromp (2006), questionnaires represent one of the most effective data collection instruments for large samples, ensuring respondent confidentiality and consistency in inquiries, thereby facilitating equivalence. The questionnaires functioned as the primary research instruments due to their ease of use with a substantial number of subjects, allowing for the collection of extensive information within a relatively short time frame, as respondents could provide answers without necessitating lengthy explanations (Combo & Tromp 2006).

The first section of the questionnaire captured demographic and personal information about the respondents, including age, sex, religion, literacy levels, occupation, type of housing, and household items. The second section focused on community knowledge pertaining to Community-Led Total Sanitation, ODF status, and sanitation-related diseases. The third section evaluated community attitudes toward sanitation services and hygiene practices, encompassing latrine

`

construction, latrine usage, and HWWS after defecation. Attitudinal elements included safety, cleanliness, and privacy concerns regarding latrines. The fourth section collected data on community sanitation services and hygiene practices, detailing latrine and HWF coverage, latrine usage, HWWS after defecation, child feces disposal, and involvement in latrine construction. The final section gathered information on determinants affecting behaviour change necessary for the sustainability of ODF status, incorporating social, technical, ecological, and institutional factors. Additionally, this section assessed the community's readiness for change and commitment to actions aimed at constructing latrines and HWFs, utilizing latrines, and HWWS after defecation. The principal stages of behaviour change addressed included pre-contemplation, contemplation, action and maintenance.

3.6.1.2 Observation

Observation is characterized as "the systematic description of events, behaviours, and objects within the chosen social setting for study" (Marshall and Rossman 2014). This methodological approach empowers researchers to portray existing situations using their five senses, effectively crafting a "written photograph" of the environment under examination (Grandson 1993). As a technique for data collection, observation facilitates a comprehensive understanding of the activities of individuals and organizations in their natural contexts. It affords the opportunity to

`

gather firsthand information devoid of external filtering or exaggeration of facts (Marshall and Rossman 2014).

In this study, observations concentrated on the conditions of sanitation facilities, which included latrine usage, the overall state of latrines, compliance levels, and discrepancies between actual behaviours and self-reported behaviours. Assessments were conducted at each household to evaluate the availability, adequacy, and general sanitation conditions surrounding the home, as well as the utilization of toilets and hand-washing facilities. The observations covered evaluations of latrine design, construction materials, the physical environment, and the visible cleanliness of both the latrine and the surrounding area. Further assessments involved the examination of the presence and condition of latrines, including aspects such as roofs, doors, cleanliness, and the availability of soap, in addition to the condition of the drop whole cover.

Focus group discussions and observational notes were transcribed and categorized into themes that included perceptions of sanitation and hygiene, motivators and barriers to behaviour change, and available structures. According to Nowell et al. (2017), thematic analysis methodologies are instrumental in identifying, organizing, and reporting themes derived from the collected data. The data was grouped and sorted to clarify ideas within each theme, effectively capturing sub-themes that describe observed behavioural elements, knowledge, attitudes, and practices grounded in the

`

dynamics of behaviour change. Indicators of open defecation, such as the presence of feces inside and outside the latrine and within the vicinity of the household, were also documented, alongside the availability and condition of HWFs. Observations further included indicators of latrine and HWF usage, such as the presence of water in the HWF and the condition of the latrine foot path.

3.6.2 Qualitative Research.

3.6.2.1 Key Informant Interviews (KII)

A total of twenty-four KIIs were executed during the course of the study (Table 2). These interviews proved to be indispensable, as knowledgeable participants contributed valuable insights into the dynamics and determinants of behaviour change (Yin 2009). In-depth interviews were conducted with individuals influential in sanitation interventions, including Heads of Departments, extension workers in health, agriculture, education, and community development, as well as local leaders (Village Headmen, Group Village Headmen, and religious leaders).

The KIIs were designed to explore elements of the behaviour change process within CLTS, the roles of various actors in both triggering and post-triggering activities, key challenges associated with achieving ODF status, and other dynamics influencing ODF sustainability. The questions were formulated to elicit detailed responses, and the semi-structured format allowed for flexibility,

`

thereby enabling conversations to evolve in ways that generated richer data (Salami & Omasta, 2018). Topics addressed included successes and challenges linked to CLTS, stakeholder involvement, monitoring practices, and sanitation services and hygiene practices, as well as the accessibility of construction materials and stakeholder participation in sanitation and hygiene initiatives. These practices covered the construction of latrines and HWFs, toilet usage, and consistent HWWS after defecation.

3.6.2.2 Focus Group Discussion

Nine focus group discussions (FGDs) were conducted with Village Development Committees and Village Health Committees (Table 2). These FGDs are instrumental in acquiring insights into issues from the perspectives of the participants. They enable more authentic responses, as they replicate everyday social interactions compared to one-on-one interviews (Hennink 2007).

Each FGD comprised 5 to 8 members to maintain manageable group dynamics and encourage equal participation. Morgan (2019) suggests a group size of six to eight to enhance active engagement and interest in discussions, as larger groups may impede Meaningful contributions.

The interview guide had space for the interviewer's comments, observations, and reflective notes, which facilitated the categorization of themes (Salami & Omasta 2018). Each FGD lasted between

`

thirty minutes and one hour and was recorded in Android devices, in conjunction with note-taking. The recordings were translated from Chichewa to English, transcribed, and compiled.

Descriptive statistics, including gender, age, education, and household size, were employed to characterize the respondents. The qualitative component aimed to provide insights into the triggers and barriers of latrine HWFs, as well as to identify motivators and change agents for behaviour modification. Content analysis was utilized as a formal approach for analyzing qualitative data. All FGDs were recorded, and detailed notes concerning non-verbal cues and verbal responses were taken concurrently to identify and quantify recurring themes. Issues that emerged were summarized based on thematic categories for qualitative analysis and interpretation.

Table 2 Summary of Category of Respondents

			Study Units / Respondents							
	Study Area		**Focus Group Discussion**		**Head of H/H**	**Key informant interviewees**				
Traditional Authority	Group Village	Village	VDC	VHC		VH	GVH	RL	HoD	EW
Kalembo	Nandumbo	Nkota	7	6	71	1	1	0	5	9
		Milala		6	88	1				
Sawali	Kadyalunda	Kadyalunda	5	5	71	1	1	1		
		Ziwoya		8	66	1				
Nsamala	Mpulula	Hanjahanja	6	6	87	1	1	0		
		Mbodzole		5	55	1				
	Sub Total		18	36	438	6	3	1	5	9
TOTAL						516				

VDC: Village Development Committee; VHC: Village Health Committee; VH: Village Headman; GVH: Group Village Headman; RL: Religious Leader; HoD: Head of Dept; EW: Extension Worker

`

3.7 Data Analysis.

The analysis of survey data was conducted utilizing two statistical software programs: the Statistical Package for Social Sciences (SPSS) and Microsoft Excel. These tools enabled the aggregation of indicators, as well as the categorization and summarization of information. This process ended in the presentation of the most pertinent variables through tables, graphs, and charts.

In addition, notes from interviews, FGDs and observational data, set in themes were reviewed and transcribed. Thematic analysis techniques assist in identifying, organizing, and reporting themes within the collected data (Nowell et al.2017). I established connections among the items emerging from various subjects and locations by manually grouping, coding, and categorizing similar ideas within each theme, thereby capturing sub-themes in line with the observed behavioural elements, knowledge, attitudes, and practices in relation to behavioural change dynamics.

The data for this study was analyzed using both quantitative and qualitative methods. The quantitative analysis involved descriptive statistics (frequency and percentage) as well as inferential statistics (Chi-square, t-tests) and logistic regression using SPSS 25 software. The Chi-square tests and t-tests were utilized to assess significant relationships between the construction and use of latrines and HWWS in relation to household demographic, geographic, technical,

`

ecological, and cultural factors. Logistic regression was also applied to explore the determinants associated with sustainable sanitation practices. All tests were done at a significance level of 0.05.

Qualitative data gathered from FGDs and KIIs were coded, organized into categories, and analyzed in accordance with the framework established by Braun and Clarke in 2006. The editing process involved careful scrutiny of the data for errors and making necessary corrections. Emerging themes were categorized into main and sub-themes based on both similarities and differences, followed by interpretative conclusions.

To ensure accurate reflection of participant responses, the KII and FGD recordings were transcribed verbatim. Thematic analysis facilitated the identification of main themes, including the health benefits of latrine use and HWWS, social pressure, and structural barriers, along with corresponding sub-themes. Triangulation was used with household survey responses to enhance understanding of key factors influencing behavioural change that support ODF sustainability. Factors included the health significance of using latrines and HWWS, such as the reduction of diarrheal diseases and eye infections, the local availability of materials for latrine and HWF construction, as well as NGO support, cultural beliefs, and practices such as anal cleansing within Muslim communities. Furthermore, the data was linked to the conceptual framework, relevant policies, and guidelines alongside the roles and responsibilities of CLTS stakeholders

`

Quantitative data collected from household interviews and observations were entered into an Excel worksheet and subsequently exported to SPSS for coding and analysis. The household questionnaire survey data were analyzed via SPSS software, while Microsoft Excel was used to generate means, frequency distribution tables, charts, and graphs to illustrate the relationships between variables. The findings were then triangulated with qualitative data to yield a descriptive analysis and explore correlations between dependent variables (e.g. latrine use and HWWS) and independent variables (personal, technical, social, ecological).

Specific Objective One focused on assessing the community's knowledge, attitudes, and sanitation practices, in addition to their stage of behaviour change after ODF certification. Sanitation practices data qualitative data analysis used thematic content analysis and statistical measures such as means, standard deviations, frequencies, and percentages to evaluate the community's understanding of CLTS-ODF. Additionally, Chi-square tests and multivariate logistic regression were used to ascertain associations between socio-demographic characteristics and community sanitation practices, including latrine and HWF construction, latrine use, and HWWS after defecation. The Trans Theoretical Model was utilized to assess stages of behaviour change. Means, supported by Principal Component Analysis (PCA), were utilized to evaluate the community's readiness for change and commitment to action. PCA is particularly effective for interpreting large

`

datasets while minimizing information loss, enhancing the interpretability of the variables (Guerra-Urzola 2021; Jolliffe & Cadima 2016).

Specific Objective Two investigates the determinants of behaviour change in sanitation practices. The data analysis employed Chi-square tests and content analysis. Logistic regression was used for its effectiveness with binary variables and its intensive use in sanitation and hygiene studies (Crocker et al. 2017; Hathi et al. 2016). Content analysis was applied to qualitative data collected from KII interviews and FGDs. Multivariate logistic regression was deployed to analyze the relationships among personal, technical, ecological, socio-economic, and cultural factors in relation to latrine and HWFs construction, latrine use HWWS in Objective Two. Chi-square tests, accompanied by p-values, were used to evaluate the statistical significance of associations between independent and dependent variables, with p-value of less than 0.05 at 95% confidence interval

3.8 Operationalization of Variables

The operationalization of variables entails a detailed description of how key concepts will be measured and analyzed. This study examines the ideological dynamics of behaviour change that extend beyond ODF certification. The variables are categorized as follows: (i) Independent Variables: These include the knowledge, attitudes, and practices of the community, as well as the determinants of behaviour change, which comprise socio-cultural, economic, environmental, and

`

institutional factors. (ii) Dependent Variable: The primary dependent variable encompasses sustainable sanitation practices that extend beyond ODF certification, including the ongoing use of latrines, HWWS, and the avoidance of open defecation. (iii) Intervening Variables: These consist of policy interventions, monitoring mechanisms, and community participation, which exert influence on the relationship between determinants of behaviour change and sustained sanitation.

Table 3 presents a structured operationalization of variables, delineating their indicators, measurement scales, and data collection methods. This framework establishes a systematic approach to measuring crucial variables associated with behaviour change and the sustainability of sanitation practices. By employing both quantitative (surveys, observations) and qualitative (key informant interviews, focus group discussions) data collection methods, the study ensures the triangulation of findings, thereby enhancing the validity and reliability of its conclusions.

3.9 Ethical Consideration

Research necessitates a thorough consideration of the needs and rights of participants. It is imperative to uphold respect for human subjects, ensure the protection of information, promote justice, and minimize potential harms (Saldaña & Omasta 2018). Ethical practices widely adopted by researchers include obtaining informed consent and assuring confidentiality and anonymity for all participants (Saldaña & Omasta 2018).

`

Table 3 Operationalization of Variables.

Objective	Variable Type	Variable	Indicators	Measurement Scale	Data Collection Method
To assess knowledge, attitude, and practices of the community on sanitation and their stage of behaviour change after ODF certification	Independent	Knowledge of sanitation and hygiene	Awareness of health risks, CLTS principles, benefits of latrine use, and hand washing (Awareness of ODF status, sanitation related diseases, purpose of HWWS and actual HWWS)	Nominal (Aware/Not Aware)	Household surveys, Key Informant Interviews (KII) Focus Group Discussions (FGDs)
	Independent	Attitudes towards sanitation and hygiene	Perceived importance of latrine uses and hand washing with soap (cleanliness, prestige, safety, dignity, embarrassment privacy)	Likert Scale (Strongly Agree - Strongly Disagree)	Household surveys, FGDs
	Independent	Sanitation practices	Frequency of latrine use, hand washing, and disposal of fecal matter	Ordinal (Never, Sometimes, Always)	Household surveys, Observations
	Dependent	Stage of behaviour change	Pre-contemplation, contemplation, action, maintenance	Ordinal (Stages of Change - TTM Model)	Surveys, KIIs, FGDs
To analyze behaviour, change determinants that influence sustainable sanitation practices after attaining ODF status	Independent	Social and cultural factors	Traditional beliefs, gender roles, social norms, community enforcement	Nominal (Present/Not Present)	KIIs, FGDs
	Independent	Technical and economic factors	Availability of latrine construction materials, cost barriers, durability of latrines	Nominal (Available/Not Available)	Household surveys, Observations
	Independent	Environmental factors	Water access, soil type, seasonal effects on sanitation structures	Nominal (Favorable/Unfavorable)	Observations, KIIs
	Independent	Institutional and policy factors	Government monitoring, enforcement of sanitation policies, post-ODF support programs	Ordinal (Weak, Moderate, Strong)	KIIs, Document Review
To develop a community-led total sanitation post-ODF certification model for the sustainability of ODF status	Dependent	Sustained sanitation behaviour	Continued use of latrines, consistent hand washing, absence of open defecation	Ordinal (Sustained/Not Sustained)	Surveys, Observations
	Intervening	Post-ODF intervention mechanisms	Community monitoring, reinforcement of hygiene messages, incentives for sustained sanitation	Nominal (Implemented/Not Implemented)	KIIs, FGDs
	Intervening	Community participation in sanitation governance	Role of community-led initiatives, participation in sanitation campaigns	Ordinal (Low, Moderate, High)	FGDs, KIIs

`

This study was guided by strict adherence to ethical principles to ensure the protection, dignity, and rights of all participants. In this study, adherence to ethical research standards was confirmed through the clearance obtained from the Mzuzu University Research Ethics Committee (Ref. No: MZUNIREC/DPR/22/84) (Appendix VII). Government authorization was also secured from the Balaka District Council via the Balaka District Health Office. Informed consent was solicited from all study participants (Appendix VI). Each participant was briefed at the outset of the session regarding the purpose of the research, the topics to be discussed, their right to withdraw at any time, the confidentiality of the information shared, and the assurance of their anonymity. Participants were required to sign a Consent Form (Appendix 1). For those who were illiterate, a fingerprint was utilized as a mark on the questionnaires. Additionally, a health worker was engaged to interpret discussions and questions into Yao, which is the common language in Balaka.

The Consent Form detailed the participants' right to decline participation, to opt out of specific questions, or to withdraw from the study at any point. The actual names of participants and their witnesses were recorded exclusively on the consent forms. Throughout the study period, measures to prevent COVID-19 were rigorously implemented, including the use of face masks, maintaining a one-meter distance, and limiting the number of participants in focus group discussions.

`

3.10 Study Limitation

This study provides significant contributions to the understanding of sustained sanitation and hygiene behaviours following ODF certification; however, several limitations merit acknowledgment. First, the geographical scope of the research was confined to the Balaka District in Malawi. While the findings yield valuable insights, they may not be wholly applicable to other regions characterized by differing socio-cultural, environmental, or institutional contexts. Other districts that received certification alongside Balaka could have been included for multi-district or cross-country comparisons to enhance the applicability of the findings.

Second, the study relied on self-reported data on key behavioural outcomes such as latrine usage and HWWS after defecation. This reliance introduces the risk of social desirability bias, as respondents may have reported favorable behaviours in alignment with perceived expectations. For instance, the stated latrine coverage of 95.7% surpassed the observed coverage of 89%. Although efforts were made to triangulate responses with observational data, the accuracy of self-reports remains a potential limitation.

Third, despite employing a robust mixed-methods approach grounded in theoretical frameworks, the cross-sectional design restricts the ability to make causal inferences. The relationships observed between variables reflect associations rather than causative links. A longitudinal study

`

design would facilitate a more nuanced understanding of how sanitation behaviours evolve over time and in response to specific interventions.

Fourth, this study primarily engaged households and community-level actors, offering limited direct interaction with institutional stakeholders, including policymakers, health officials, and implementing partners. Incorporating these perspectives could have enriched the analysis of institutional and systemic barriers to sustained behavioural change.

Finally, while the proposed (SSBT) Model presents a novel framework that integrates key behavioural change theories and offers a solid conceptual foundation, its practical implementation and resultant impact were not empirically tested within the scope of this study. The SSBT Model and its practical applicability have yet to undergo empirical validation. Further piloting and validation of the model in diverse contexts are essential to assess its effectiveness in guiding real-world programming.

`

CHAPTER FOUR : RESULTS

4.1 Introduction

This chapter presents the findings in four sections organized around the study objectives and analytical frameworks guiding the research. The initial section provides demographic details about the study participants. The second section examines the knowledge, attitudes, and practices of communities and their stage of sanitation behaviour change, highlighting the extent to which sanitation and hygiene awareness translates into sustained behaviour. The third section explores the determinants of behaviour change, focusing on personal, social, cultural, technical, institutional, and ecological factors that influence post-ODF sanitation outcomes. The fourth section analyzes community behaviour change dynamics beyond ODF certification, addressing issues of motivation, ideology, and collective ownership that reinforce sustainability. The final section synthesizes these findings within the Sustainable Sanitation Behaviour Transformation (SSBT) Model**,** presenting an integrated framework that explains how behavioural**,** contextual, and institutional interactions shape long-term sanitation and hygiene sustainability in Balaka and similar rural settings in Malawi.

To enhance comprehension, the presentation employs graphical representations and frequency tables that illustrate the accompanying statistics.

`

4.2 Socio-Demographic Characteristics of Respondents

Table 4.1 indicates that a majority of the respondents were female (57.8%, *n* =253) and aged 45 years or older (33.3%, *n* =138). Most participants were married (79.0%, *n* =346), while widowed were 10.7% (*n* =47), and a small percentage had never been married (single) (4.3%, *n* =190). Christianity was the predominant religion (63.2%, *n* =277) and a mere 1% (*n* =4) with no religious affiliation. The Yao ethnic group were the majority (76.3%, *n* =331) while the Tumbuka community was a minority at only 0.2% (*n* =1). Regarding education, a notable portion of respondents had never attended school (21.9%, *n* =96), with the majority having only completed primary education (62.3%, *n* =277).

The primary occupation among respondents was farming (66%, *n* =289), followed by business (29.5%, *n* =129) with only 1.6% (*n* = 7) employed as civil servants. In terms of household size, most families had seven or more members (36.3%, *n* =146), suggesting a trend of large family sizes, with the majority having three to six children (58.0%, *n* =254).

`

Table 4 Socio-demographic characteristics of respondents and households.

Variable	Description	n	%
Gender	Male	185	42.2
	Female	253	57.8
Age	0-8	0	0
	Sep-17	2	0.5
	18-26	82	18.7
	27-35	109	24.9
	36-44	99	22.6
	45 above	146	33.3
Household Size	1 – 2	25	5.7
	3 – 4	124	28.3
	5 – 6	130	29.7
	7 and above	159	36.3
Marital status	Divorced	20	4.6
	Married	346	79
	Separated	6	1.4
	Single	19	4.3.
	Widowed	47	10.7
Religion	Christian	277	63.2
	Muslim	157	35.8
	None	4	1
Education level	Never attended school	96	21.9
	Primary	273	62.3
	Secondary	69	15.8
Type of House	Mud grass thatched	76	17.4
	Brick grass thatched	152	34.8
	Brick iron roof with cement	89	20.4
	Brick iron roof no cement	120	27.5
Occupation	Farming	289	66
	Business	129	29.5
	Civil servant	7	1.6
	Artisan	13	3
Ethnicity	Yao	334	76.3
	Chewa	61	13.9
	Lhomwe	42	9.6
	Tumbuka	1	0.2
No of Children	1-2	24	5.5
	3-4	127	28.9
	5-6	128	29.2
	7-8	107	24.2
	9-10	49	11.2
	11 & above	3	0.7
Household Assets (Bicycle, Motorcycle, Radio, Livestock, Garden, Oxcart)	0-2	236	53.9
	3	104	23.7
	04-May	98	22.4

`

4.3 Community's Knowledge, Attitude and Practices on Community Led Total Sanitation Strategy and Their Stage of Behaviour Change After Open Defecation Free Status Certification.

This section presents findings related to the community's understanding of the significance of CLTS, the criteria for achieving ODF status, and the community's perceptions regarding the ownership and utilization of latrines, as well as their safety, security, and cleanliness. It also discusses key CLTS practices following the attainment of ODF status, including the construction of latrines and HWF the actual use of latrines, and the practice of washing hands with soap after defecation. Lastly, this section addresses the community's stage of behavioural change, their willingness to adopt ODF sanitation practices, and their commitment to change after receiving ODF certification.

4.3.1 Knowledge of Community on Community Led Total Sanitation Strategy

The community's knowledge of CLTS was assessed through Mean scores across various sanitation-related variables. As illustrated in Table 5, the community exhibited a strong understanding of CLTS and ODF status, with Mean scores ranging from 3.65 to 3.80. The highest level of knowledge was indicated by a significant majority of respondents who knew that CLTS initiatives were

`

implemented in their locality (81.5%, *n* = 357) and that the use of latrines helps prevent diarrheal diseases (77.4%, *n* = 339) and worm infestations (75.3%, *n* = 330). Additionally, a considerable number of respondents strongly concurred that ODF encompasses not only the construction of latrines (72.0%, *n* = 314) and their usage (72.0%, *n* = 314) but also the importance of washing hands with soap after defecation (70.3%, *n* = 308) and the effectiveness of hand washing in eliminating germs (70.1%, *n* = 307). However, certain aspects of knowledge, such as the link between poor hygiene and infections (67.8%, *n* = 297) and the necessity of progressing up the sanitation ladder (65.5%, *n* = 287), received moderate levels of agreement, highlighting the need for enhanced health education on sanitation services and hygiene practices. Overall, the results indicate that the majority of respondents possess an understanding of sanitation, albeit with notable variations especially on movement along the sanitation ladder for improved sanitation (Table 5).

`

Table 5 Knowledge of Community on Community Led Total Sanitation and ODF status

	Variable	Participant Response 438(100%)				Mean	SD.	Knowledge
		Strongly Agree	**Agree**	**Disagree**	**Strongly Disagree**			
1.	CLTS was conducted in our area	357 (81.5%)	77(17.6%)	3(0.7%)	1(0.2%)	3.80	0.39	Good, Vary greatly
2.	CLTS strategy aims at communities attaining ODF status	310 (70.8%)	124 (28.3%)	3 (0.7%)	1(0.2%)	3.70	0.33	Good, Vary greatly
3.	CLTS is more about constructing a latrine	314 (72.0%)	117 (26.8%)	4(0.9%)	1 (0.2%)	3.69	0.34	Fair, Similar.
4.	CLTS is more about using a latrine	314 (72.0%)	117 (26.8%)	4(0.9%)	1 (0.2%)	3.69	0.34	Fair, Similar
5.	Use of latrine prevents diarrhea diseases	339 (77.4%)	97 (22.1%)	1 (0.2%)	1 (0.2%)	3.77	0.36	Good, Vary greatly
6.	Latrine use prevents spread of worm infestations	330 (75.3%)	105 (23.9%)	1 (0.2%)	1 (0.2%)	3.74	0.35	Good, Vary greatly
7.	ODF statues is all about washing hands after defecation	308 (70.3%)	128 (29.2%)	1 (0.2%)	1 (0.2%)	3.70	0.33	Fair, Similar
8.	After ODF status attainment communities have to move up the sanitation ladder	287 (65.5%)	149 (34.0%)	1 (0.2%)	1 (0.2%)	3.65	0.31	Fair, Similar.
9.	Hand washing with soap helps to kill germs in hands	307 (70.1%)	128 (29.2%)	2 (0.5%)	1 (0.2%)	3.69	0.33	Fair, Similar.
10.	Poor hygiene causes other diseases like eye infections	297 (67.8%)	138 (31.5%)	2 (0.5%)	1 (0.2%)	3.67	0.32	Fair, Similar
	Overall Mean Score					3.72	0.47	

CLTS: Community Let Total Sanitation; ODF: Open Defecation Free Likert Scale Scores Mean:3.72. SD: 0.47 Range: 3.65 to 3.80. Knowledge interpretation basing on the overall Score: >Mean → suggest Good and Excellent knowledge; <Mean → Fair and Poor knowledge. < SD → Most people have similar knowledge. > SD → Knowledge levels vary among people.

`

4.3.2 Community Attitudes Towards Community Let Total Sanitation

The community's attitudes regarding ODF status were predominantly positive, reflected in an average score of 3.56 (±0.62). The strongest consensus was noted on embarrassment associated with open defecation, with 81.7% (n = 358) of respondents acknowledging this social stigma. A significant majority expressed satisfaction with latrine use, with 72.4% (n = 317) appreciating the cleanliness and 76.5% (n = 335) valuing the safety it provides. However, discussions surrounding human waste (48.4%, n = 212) and privacy concerns (49.8%, n = 218) exhibited greater variability, suggesting a need for enhanced community dialogue and awareness on these subjects. (Table 6)

During focus group discussions, male participants expressed pride in showcasing their latrines and the cleanliness of their homes to extension workers and visitors. Different VDC members said this:

> *"We are now living in a healthy environment thanks to the knowledge gained from CLTS. It has transformed our lives, and we are reaping its benefits. Since our village achieved ODF status, cleanliness has improved significantly."* ***(VDC Male member)***

> *"We are not just building toilets; our homes are now clean."* ***(VDC Female member)***

`

"In addition to the cleanliness of the toilets, we feel secure using them. We experience happiness and comfort among ourselves, as the younger generation no longer witnesses open defecation as they did in the past" ***(VDC Female member)***

4.3.2.1 Association between Demographic Characteristics and Knowledge and Attitudes Regarding Community-Led Total Sanitation and Open Defecation Free Initiatives

In terms of knowledge about the status of CLTS and ODF initiatives, males exhibited significantly higher knowledge scores (Mean = 1.35, SD = 0.37) compared to females (Mean = 1.24, SD = 0.32. This indicates that males possess a greater understanding of CLTS-ODF initiatives. Gender had a statistical significance with Knowledge ($p = 0.001$). A notable difference ($p = 0.033$) was observed among ethnic groups, with Yao respondents achieving higher knowledge scores (Mean = 1.30, SD = ± 0.31) than Chewa respondents (Mean = 1.18, SD = ±0.45). Additionally, households with a greater number of assets (4-5 assets) had slightly elevated knowledge levels (Mean = 1.32, SD = ± 0.38) compared to those with fewer assets (Mean = 1.26, SD = ± 0.32). Economic status had a statistical significance with knowledge ($p = 0.048$) (Table 7)

`

Table 6 Community Attitude Towards Open Defecation Free Status (Latrine Construction and Use)

Variable	Participant Response 438(100%)				Attitude		
	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Std	Outcome
1. **It's shameful not having a latrine**	333 (76%)	103 (23.5%)	1 (0.2%)	1 (0.2%)	3.75	±0.45	Positive
2. **It's shameful and embarrassing seen defecating in the open**	358 (81.7%)	78 (17.8%)	1 (0.2%)	1 (0.2%)	3.81	±0.42	Positive
3. **It's shameful to use somebody's latrine**	280 (63.9%)	148 (33.8%)	9 (2.1%)	1 (0.2%)	3.61	±0.54	Positive
4. **It's shameful discussing human excreta issues**	212 (48.4%)	79 (18%)	120 (27.4%)	26 (5.9%)	3.08	±1.00	Neutral, Vary greatly
5. **I am pleased and happy when using a latrine**	317 (72.4%)	117(26.7%)	3 (3.7%)	1 (0.2%)	3.71	±SAG E0	Positive
6. The latrine is clean enough to use	317 (72.4%)	119 (27.2%)	1 (0.2%)	1 (0.2%)	3.72	±0.47	Positive
7. **Lack of privacy discourages latrine use**	218 (49.8%)	60 (13.7%)	115 (26.3%)	45 (10.3%)	3.03	±1.08	Neutral Vary greatly
8. **It is safe when you go and defecate in a latrine**	335 (76.5%)	100 (22.8%)	2 (0.5%)	1 (0.2%)	3.76	±0.46	Positive
Overall Mean Score					3.56	±0.62	Adequate

Likert scale Mean score attitude interpretation: 1.0-2.4 (Negative), 2.5-3.4 (Neutral), and 3.5-5.0 (Positive). A higher Mean → more positive attitudes. A high SD → attitudes vary greatly.

***Source**: (Wanjohi and Syokau 2020) and Survey data 2022`*

`

There were no statistically significant differences in knowledge regarding CLTS and ODF identified across various age groups, marital statuses, religious affiliations, educational attainment, or occupational categories ($p>0.05$). It is only age, ethnicity and economic status that has influence on knowledge ($p<0.05$). This suggests that knowledge levels remain relatively uniform across different demographic locations. (Table 7)

Regarding the community's attitude towards CLTS-ODF initiatives, significant differences were identified in relation to several demographic factors. Males exhibited notably more positive attitudes towards ODF (Mean = 1.57, SD = 0.51) compared to females (Mean = 1.34, SD = 0.41), Marital status and attitude towards ODF, widowed individuals having highest attitude scores towards ODF initiatives (Mean = 1.61, SD = 0.44). Civil servants (Mean = 1.61, SD = 0.59) and artisans (Mean = 1.74, SD = 0.44) showed more favourable attitudes towards ODF compared to farmers (Mean = 1.39, SD = 0.45) and business owners (Mean = 1.51, SD = 0.49). Additionally, Yao respondents (Mean = 1.47, SD = 0.44) and Lhomwe respondents (Mean = 1.48, SD = 0.431) showed higher positive attitude scores than Chewa respondents (Mean = 1.22, SD = 0.52). Furthermore, individuals with a greater number of assets (4-5) had a more favourable attitude towards ODF (Mean = 1.56, SD = 0.50). There was statistical significance between attitude and

`

gender, marital status, occupation and economic status (P>0.05). No statistically significant differences were found among various age groups, religions, and education levels ($p > 0.05$).

Overall, knowledge is influenced by gender, ethnicity and economic status while attitude is influenced by gender, marital status, occupation and economic status ($p<0.05$)

4.3.3 Community Practices Post-Open Defecation Free Certification.

This section examines the prevalence of latrines and HWFs, the condition of these facilities, essential sanitation services and hygiene practices, and behavioural changes post-ODF certification, as well as the distribution of latrines based on the respondents' location.

4.3.3.1 Latrine Construction and Usage

4.3.3.1.1 Latrine Coverage, Usage, Conditions, Structure and Design

The majority of respondents reported having latrines (94.1%, n = 412), predominantly consisting of grass-thatched simple pit latrines (85.1%, n = 351) (Fig 13) with a smaller proportion having slabs (13.3%, n = 55). During observation, 89% (n = 389) of the households had latrines, contrary to what was found from the respondents (94.1%, n = 412) (Table 8)

`

Table 7 Relationship Between Demographic Characteristics and Knowledge and attitude on Community-Led Total Sanitation and Open Defecation Free

Variable		N (%)	Knowledge on CLTS-ODF			Attitude Towards ODF		
			Mean (Sd)	Test Result	p-value	Mean (Sd)	Test Result	p-value
Sex	Male	185 (42,2)	1.35 (± 0.37)	3.27[b]	0.001	1.57 (±0.51)	5.17[b]	0.001
	Female	253 (57.8)	1.24 (± 0.32)			1.34 (±0.41)		
Age	18-26	82 (18.7)	1.31 (± 0.32)	1.317[a]	0.268	1.45 (±0.43)	2.481[a]	.061
	27-35	109 (24.9)	1.33 (± 0.42)			1.54 (±0.53)		
	36-44	99 (22.6)	1.27 (± 0.35)			1.38 (±0.45)		
	45 above	148 (33.8)	1.25 (± 0.29)			1.40 (±0.44)		
Marital Status	Divorced	20 (4.6)	1.30 (± 0.31)	2.122[a]	0.077	1.43 (±0.47)	4.310[a]	0.002
	Married	346 (79.0)	1.29 (± 0.35)			1.13 (±0.25)		
	Separated	6 (1.4)	1.20 (± 0.31)			1.31 (±0.49)		
	Single	19 (4.3)	1.08 (± 0.17)			1.56 (±0.41)		
	Widowed	47 (10.7)	1.34 (± 0.34)			1.61 (±0.44)		
Religion	Christian	281 (64.7)	1.27 (± 0.31)	-1.60[b]	0.110	1.44 (±0.49)	0.095[b]	.924
	Islam	157 (35.8)	1.32 (± 0.30)			1.43 (±0.41)		
Education Level	None	96 (22.0)	1.20 (± 0.31)	0.48[a]	0.617	1.35 (±0.40)	2.509[a]	.082
	Primary	273 (62.3)	1.30 (± 0.37)			1.46 (±0.48)		
	Secondary	69 (15.8)	1.28 (± 0.29)			1.48 (±0.49)		
Occupation	Farming	289 (66.0)	1.28 (± 0.35)	0.636[a]	0.592	1.39 (±0.45)	4.246[a]	0.006
	Business	129 (29.4)	1.29 (± 0.34)			1.51 (±0.49)		
	Civil servant	7 (1.6)	1.30 (± 0.37)			1.61 (±0.59)		
	Artisan	13 (3.0)	1.41 (± 0.28)			1.74 (±0.44)		
Ethnicity	Yao	334 (76.3)	1.30 (± 0.31)	2.934[a]	0.033	1.47 (±0.44)	5.909[a]	0.001
	Chewa	61 (13.9)	1.18 (± 0.45)			1.22 (±0.52)		
	Lhomwe	42 (9.6)	1.32 (± 0.42)			1.48 (±0.53)		
	Tumbuka	1 (0.2)	1.29 (± 0.30)			2.13 (-)		
Household Assets	0-2	132 (30.1)	1.26 (± 0.32)	-1.984[b]	0.048	1.33 (±0.41)		
	3	204(46.6)	1.28 (± 0.33)			1.33 (±0.41)		
	4-5	102 (23.3)	1.32 (± 0.38)			1.56 (±0.50)		

[a] F-values ANOVA [b] independent t-test: Survey data (2023) Scores Mean:1.29. SD: 0.47 Range: 1.00 to 2.00. Knowledge interpretation basing on the score: >Mean → suggest good knowledge; <Mean → suggest poor knowledge. < SD → Most people have similar knowledge. > SD → Knowledge levels vary among people s

,Likert scale Mean score attitude interpretation: 1.0-2.4 (Positive), 2.5-3.4 (Neutral attitude), and 3.5-5.0 (Negative). ***Source****: (Wanjohi and Syokau 2020) and: Survey Data 2022*

`

Most latrines were situated within 50 meters from the dwelling house (93.1%, *n* = 360). Among those without latrines (5.9%, *n* = 26), the majority had experienced latrine collapses (84.5%, *n* = 22), while a minority had never constructed a latrine (7.7%, *n* = 2) (Table 8). Latrine construction was primarily undertaken by husbands (57.5%, *n* = 252), with some assistance from others; however, most helpers did not receive any form of reward (71.9%, *n* = 315).

Approximately one-third of households with latrines at the time of the study (35%, *n* = 153) reported no maintenance activities, while a third made improvements. Among those whose latrines were in or had collapsed (27%, *n* = 119), 20.3% (*n* = 89) constructed new latrines, while a small number renovated (3.4%, *n* = 15) or took no action (3.4%, *n* = 15) (Table 8). A limited number of latrines had drop-hole covers (45.0%, *n* = 176), and even fewer were utilized to cover the drop holes (38.0%, *n* = 66). Most latrines lacked doors (80.0%, *n* = 312), sanitation plat foams (87%, *n* = 339), and roofs (31%, *n* = 120). In certain latrines, the presence of fecal matter was observed on the floor (42%, *n* = 163), on the interior walls (7.7%, *n* = 390), and outside the latrine (3.8%, *n* = 14). Additionally, feces were noted on the pathway leading to the latrine (1.4%, *n* = 7) and in the surrounding bushes (1.1%, *n* = 5). This indicates that the community in Balaka is failing to move up the ladder. They are not following ODF status requirements of ensuring latrine availability at a household. They are not tracing the initiative of maintaining and improving their latrines thereby affecting ODF sustainability. (Figure 11).

Regarding latrine usage, majority of respondents reported consistent use of latrines (95.7%, *n* = 419) and indicated that they utilize them whenever they need to defecate (70.8%, *n* = 310) (Table 8). Most respondents reported having well-maintained footpaths (62.3%, *n* = 242) and clean

`

pathways (40.5%, *n* = 157) leading to the latrine, contrary to what was observed where feces were observed on the footpaths to latrines (Figure 11).

Among mothers with children under five years old, a substantial proportion disposed of their children's feces in pit latrines (71.0%, *n* = 311), while some opted to discard them in the bushes. In households lacking latrines, the majority resorted to using others' latrines (70.6%, *n* = 12), with a smaller number still defecating in the bushes (29.5%, *n* = 5). Those who occasionally or completely refrain from using the latrine primarily include children (42.3%, *n* = 22), the ill (40.4%, *n* = 21), and a few elderly individuals (13.5%, *n* = 7). The predominant reasons cited for this behaviour were fear of falling into the latrine (40.4%, *n* = 21) and an inability to walk (30.8%, *n* = 16). (Table 8)

Following the certification of ODF status, open defecation is prohibited (99%, *n* = 437). A significant number of individuals found defecating in open areas face penalties (70.3%, *n* = 308), and at least a quarter are compelled to remove their feces (23.5%, *n* = 103).

Qualitative findings regarding latrine availability, derived from insights provided by key informants and focus group discussions, reveal that nearly all individuals constructed latrines to achieve ODF certification for their villages. It was noted that an International NGO, PCI, was instrumental in supplying communities with essential materials, including plastic sheets for latrine construction. One extension worker highlighted that latrines were often constructed hastily using substandard materials, as durable options were prohibitively expensive and poles were scarce and challenging to obtain within the villages. Members said this:

`

"There was an NGO named PCI that assisted us with sanitation platfoam and plastic sheets for roofing. After the NGO's left, households struggled to build toilet slabs. Consequently, when latrines collapse, families lose interest in constructing new ones, fearing they will also collapse soon" ***(Nsamala VDC Female member).***

Table 8 Latrine Availability and Latrine Usage

Latrine Availability		
Variable	**N**	**%**
Latrine Availability *(n* = 438)		
Yes	412	94.1
No	26	5.9
Reasons for not having a latrine *n* =26)		
Collapsed/fell down	22	84.5
Dilapidated	2	7.7
Never had one	2	7.7
Latrine available same one after certification *(n* = 412)		
Yes	115	27.9
No	297	72.1
What happened to latrine after ODF Certification (*n* =438)		
Nothing	166	38
Improved	153	35
Collapsed	109	25
Dilapidated	10	2
What was done if latrine collapsed/dilapidated(*n* =119)		
Nothing	15	3.4
Repaired	15	3.4
Built new one	89	20.3
Type of Latrine available (*n* = 412)		
Simple Pit Latrine	351	85.1
Simple Pit Latrine weth slab	55	13.3
Ventilated Improver Pit latrine	1	0.3
Septic tank Latrine	1	0.3
Composting Latrine	4	1
Those involved in latrine construction (*n* = 438)		
Husband	252	57.5
Wife	23	5.3
Brothers and Sisters	42	9.6
Children	65	14.8
Friends and Relatives	56	12.8
Anything given to latrine construction helpers (*n* =438)		
Never	315	71.9
Sometimes	67	15.3
Always	56	12.8

Latrine Use		
Variable	**n**	**%**
Use of latrine by Heads of households		
Never	16	3.7
Sometimes	3	0.7
Always	419	95.7
Do all household members use latrine (*n* = 438)		
Never	17	3.9
Sometimes	35	8
Always	386	88.1
Where those without latrine defecate (*n* = 17)		
Neighbours latrine	12	70.6
Bush	5	29.5
River/Stream	0	0
Household members who never/ sometimes use latrine *(n* =52)		
Elderly	7	13.5
Sick	21	40,4
Children	22	42.3
Disabled	2	3.8
What makes them fail to use the latrine(*n* = 52)		
Engaged	9	17.3
Negligence	6	11.5
No privacy	0	0
Can't walk	16	30.8
Afraid of falling in	21	40.4
What is done to open defecators (*n* = 438)		
Pays a fine	308	70.3
Forced to Remove	103	23.5
Is Wooed	27	6.2
Mothers' disposal of children excreta (*n* = 438)		
Bury in the soil	16	3.7
Dispose in pit-latrine	311	71
Throw in the bush	13	2.8
Don't know	98	22.4

`

"The community was indeed motivated and eager to build lasting latrines. However, the unavailability of robust and mature poles for pit covering and roofing posed a significant challenge. As a result, households resorted to constructing only temporary, basic pit latrines, often lacking a drop-hole cover and roof" ***(Health Surveillance Assistant).***

Two members voiced their concerns regarding the temporary construction of latrines with inadequate materials, which, due to high costs, led to their collapse during the rainy season.

"Latrines with temporary roofs were collapsing in the rainy season" ***(Nandumbo VDC Member).***

"Grass thatched roofs collapse due to termite damage, and walls also fall. The high cost and scarcity of durable construction materials, such as nails and corrugated iron for roofing, prevent poor households from building new latrines or maintaining those that have already collapsed" ***(Sawali VDC Member).***

A female member of the VDC from Nandumbo Group Village Head (GVH) expressed her concerns regarding the cessation of support from local leaders for the enforcement of by-laws aimed at ensuring that every household constructs a latrine. She remarked:

"The community established regulations mandating that each household build a latrine by a specific deadline, which was set for two weeks. This initiative was effective, as nearly every household complied. However, following the ODF status celebrations, the enforcement of these by-laws diminished, leading to a situation where those whose latrines were in disrepair neither maintained them nor replaced them" ***(GVH Nandumbo).***

`

Group Village Headman Sadyalunda acknowledged the positive impact of the CLTS program in enhancing latrine coverage, despite facing challenges such as the inability to compensate carpenters for constructing drop-hole covers. He noted that PCI had previously assisted them with sanitation platforms (Fig 20), but they were unable to manage these resources after the NGO's departure. He stated:

> "*In my area, nearly every household has built a latrine. The practice of using latrines has become deep-seated in our culture, and it is everyone's responsibility to utilize them. After the CLTS triggering, we allowed two weeks for those without latrines to use their neighbors' facilities while they constructed their own. However, maintaining latrines has become difficult due to a lack of poles. Some latrines lack drop-hole covers, as the cost of having carpenters make them is currently beyond the means of many households. While some families received sanitation platforms with support from PCI, that assistance ended when their program concluded. At present, people are unable to afford sanitation platforms. We are in need of further support*" ***(GVH Sadyalunda).***

Concerns were expressed on bye laws that permitted latrine sharing for only two weeks following the CLTS triggering. The community reached a consensus that individuals lacking latrines could temporarily share with others while they constructed their own facilities. Additionally, it was agreed that if a latrine became unusable or collapsed during the rainy season, households should utilize their neighbors' latrines. Two members from the Village Health Committee and one from the Village Development Committee voiced their concerns:

> *"Latrine sharing is not being promoted. During the triggering session, it was established that sharing would only be permitted for two weeks after CLTS initiation, with the*

`

expectation that those without latrines would build their own. This understanding prompted households to begin immediate construction and use of latrines." ***(Mpulula VDC member)***

"The CLTS triggering sessions clarified our perspectives and fostered a positive attitude towards toilet usage and latrine sharing. Those without latrines sought permission to use their friends' facilities, and we reached an agreement. This positive sentiment encouraged individuals to cease open defecation and share latrines with others. It did not take long for them to construct their own latrine and begin using it." ***(VHC Mbodzole)***

*"People have stopped defecating in the open, not merely due to the fear of fines, but because it has become embarrassing and shameful when children mock them. I have also observed a significant decrease in cholera cases and loss of life in my village." (****Nkota VHC Member)***

"The CLTS sessions have significantly enhanced the community's understanding of hygiene and sanitation, leading to social pressure or enforcement against open defecation. This shift has resulted in a marked decline in diseases such as diarrhea and cholera, which are no longer prevalent." ***(Hanjahanja VHC Member)***

4.3.3.1.2 Coverage and Utilization Rates of Latrines and Hand washing Facilities by ` Geographic Location

At the village level, Table 9 shows that Ziwoya village has the highest latrine coverage at 100% (*n* = 88), followed closely by Milala at 95.5% (*n* = 88) and Mbodzole at 93.1% (*n* = 81). Both Milala and Ziwoya villages also report the highest rates of latrine usage, with Milala at 100% (*n* = 88) and Ziwoya at 98% (*n* = 65). Conversely, Hanjahanja village exhibits the lowest latrine availability

`

at 89.1% (n = 49) and usage at 90.1% (n = 50), alongside a very low availability of HWF at 3.6% (n = 2) and a HWWS rate of 3.6% (n = 2). Nkota and Kadyalunda villages also demonstrate low HWWS rates, ranging from 28% to 31%, despite having latrines.

At the levels of Traditional Authority (TA) and Group Village Headman (GVH), Table 9 indicates that GVH Nandumbo in TA Kalembo, which includes Milala and Nkota villages, has high latrine coverage at 97.3% (n = 143) and latrine usage at 99.3% (n = 143), with moderate availability of HWF at 55.1% (n = 81) and a HWWS rate of 32.0% (n = 47). In contrast, Kadyalunda GVH in TA Sawali, encompassing Ziwoya and Kadyalunda villages, shows moderate latrine availability at 93.2% (n = 138) but slightly lower latrine usage at 92.3% (n = 141). Lastly, Mpulula GVH in TA Nsamala, which includes Mbodzole and Hanjahanja villages, reports the lowest latrine availability at 91.6% (n = 131) and latrine usage at 92.3% (n = 132), with a HWWS rate of 20.3% (n = 20).

4.3.3.1.3 Latrine Availability and Utilization Rates Across Socio-Demographic Groups

A logistic regression analysis and Chi square test were conducted to examine the impact of various socio-demographic factors on latrine availability and utilization, with results expressed as odds ratios (OR), confidence intervals (CI), and p-values. (Table 10)

`

Table 9 Geographical Latrine and HWF Availability, Latrine Use and HWWS Rates

Village	n(%)	Latrine Available		Latrine Usage		HWF Available		HWWS After Defecation	
		Yes	No	Yes	No	Yes	No	Yes	No
TA Kalembo GVH Nandumbo									
Milala	88(100%)	84(95.5%)	4(0.05%)	88(100%)	0(0%)	46(52.3%)	42(47.7%)	46(52.3%)	42(47.7%)
Nkota	71(100%)	64(90.16%)	7 (0.9%)	67(94.4%)	4(0.69%)	22(31.0%)	49(69.0%)	22(31.0%)	49(69.0%)
Total	147(100%)	143(97.3%)	4(2.7%)	146(99.3%)	1(0.7%)	81(55.1%)	66(44.9%)	47(32.0%)	100(68.0%)
TA Nsamala GVH Mpulula									
Mbodzole	87(100%)	81(93.1%)	6(6.9%)	81(93.1%)	6(6.9%)	32(42.5%)	55(57.5%)	31(35.6%)	56(64.4%)
Hanjahanja	55(100%)	49(89.1%)	6(10.9%)	50(90.1%)	5(9.9%)	2(3.6%)	53(96.4%)	2(3.6%)	53(96.4%)
Total	143(100%)	131(91.6%	12(8.4%)	132(92.3%	11(7.7%)	35(24.5%)	108(75.5%)	29(20.3%)	114(79.7%)
TA Sawali GVH Kadyalunda									
Ziwoya	66(100%)	65(98.4%)	1 (0.6%)	65(98.4%)	1 (0.6%)	38(55.9%)	28(.44.1%)	37(56.1%)	29(43.9%)
Kadyalunda	71(100%)	69(91.6%)	2(8.4%)	68(95.8%)	3(4.2%)	20(28.2%)	51(71.8%)	20(28.2%)	51(71.8%)
Total	148(100%)	138(93.2%)	10(6.8%)	141(95.3%)	7(4.7%)	44(29.7%)	104(61.3%)	44(29.7%)	104(61.3) %)
Overall	438(100%)	412(94.17%)	26(5.9%)	419(95.7%)	19(4.3%)	160(36.5%)	278(63.5%)	108(24.7%)	330(75.3%)

TA-Traditional Authority. GVH-Group Village Headman HWF-Hand washing Facility HWWS-Hand Washing with Soap

Majority of females reported having latrines (53.7%, n = 235) with a marginally higher likelihood of having a latrine although not statistically significant (OR = 0.747, CI = 0.42–1.34, p = 0.297). In terms of latrine usage, majority of females (54.8%, n = 240) also indicated utilizing a latrine (OR = 0.59, CI = 0.11–3.20, p = 0.558). Chi square test indicates no statistical significance with latrine availability (X^2 = 1.490, p = 0.222) and latrine use (X^2 = 0.925, p = 0.336). This suggest that sex did not significantly affect latrine availability and usage.

Respondents aged 45 years and older exhibited the highest rates of latrine availability (38.3%, n = 168) followed by 36-44 years age group. (23.1%, n = 101) with a higher likelihood of having a latrine though not significant. (OR = 0.621, CI = 0.28–1.35, p = 0.223) The highest rate of latrine

`

usage was observed in the 36-44 age group (23.5%, *n* = 102). Those aged 45 and above had a higher likelihood of using a latrine but was also not statistically significant (OR = 2.699, CI = 1.39–5.25, p = 0.587). Chi square test indicates no statistical significance with latrine availability ($X^2 = 6.2335$, p = 0.182) but significant with latrine use ($X^2 = 11.373$, p = 0.023). This suggest that age significantly affect latrine usage.

Majority of married individuals have latrines (74.9%, *n* = 328) and use (76.0%, *n* = 333) and markedly lower among those who are separated (1.4%, *n* = 6, 1.1%, *n* = 5). Chi square test indicates no statistical significance with latrine availability ($X^2 = 4.228$, p = 0.376) but significant with latrine use ($X^2 = 4.064$, p = 0.397). This suggest that marital status does not influence latrine availability and use.

In terms of religion, majority of Muslims had latrines 63.3%, *n* = 261). However, Christian respondents had higher latrine usage rates (60.5%, *n* = 265). However, Muslims are 2.205 times more likely to use a latrine though not significant (OR = 2.205, CI = 0.79–6.18, p = 0.488). Chi square test indicates no statistical significance with latrine availability ($X^2 = 1.277$, p = 0.528) and latrine use ($X^2 = 1.187$, p = 0.880). This suggest that religion does not influence latrine availability and use.

Most respondents with primary education had latrines (59.1%, *n* = 259) and also utilize them for defecation (59.6%, *n* = 261). Individuals with secondary education are 0.937 and 1.00 times more likely to construct and use a latrine though not significant. (p>0.05). Overall, education level did not significantly affect latrine availability ($X^2 = 1.277$, p = 0.528) and latrine usage ($X^2 = 1.187$, p = 0.880).

`

A significant proportion of farmers reported having a latrine (2.3% (n = 274) and 62.6% (n = 273) confirming their use. Farmers are 2.41 times more likely to construct a larine though not significant (OR = 2.41, p = 0.371). Chi Square test analysis revealed no statistically significant relationship between occupation and both latrine availability (X^2 = 6.404, p = 0.171) and latrine usage (χ^2 = 1.187, p = 0.880).

Among ethnic groups, the Yao indicated the highest latrine availability (70.3%, n = 308), and latrine usage (71.2% ,n = 312), Yaos are 1.409 times more likely to construct a larine (OR = 1.409, p = 0.0.619) and 3.344 times more likely to use it (OR = 3.344, p = 0.543) while the Chewa are 2.09 times likely to construct a latrine (OR = 2.09, p = 0.314). All these likelihood chances are not significant (OR = 2.41, p = 0.371). No significant correlation was found between ethnicity and latrine availability (X^2 = 1.512, p = 0.825) and latrine usage (X^2 = 1.729, p = 0.785)

Households with seven or more members had the highest latrine availability and usage rates 36.7% n = 151 and 35.4%, n = 155 respectively. Households with 7 or more are also 1.601 times and 7.492 likely to have a latrine (OR = 1,601, CI =0.05–56.3, p = 0.073) and use it. (OR = 7.492, CI = 0.64–87.5, p = 0.126). Households with 3-4 members are 2.596 and 2.843 times more likely to have a latrine (OR = 2.596, CI = 0.007–0.73, p = 0.051) and use it. (OR = 2.843, CI = 0.14–56.3, p = 0.557). A significant association was identified between household size and latrine availability (χ^2 = 13.304, p = 0.004) as well as usage (χ^2 = 12.254, p = 0.007). This indicates that household size influences latrine construction and latrine usage.

Households classified as having above-average economic status, possessing four or more assets had the highest rates of latrine availability (42.7%, n = 187) and usage (43.8%, n = 191). Chi Square analysis revealed no significant correlation between economic status and latrine availability

`

($\chi^2 = 1.631$, $p = 0.803$) or latrine usage ($\chi^2 = 4.897$, $p = 0.298$). This shows that economic status does not influence latrine availability and latrine use in Balaka.

In summary, latrine construction is influenced by household size while latrine use is influenced by household size and occupation ($p < 0.05$)

4.3.3.2 Hand Washing Facility Construction and Usage Post Open Defecation Free Certification

4.3.3.2.1 Status of Hand-Washing Facility and Hand Washing With Soap Post-ODF Certification.

The availability of HWFs was notably inadequate (35%, *n* =160). Most HWFs, 68.2% (*n* = 109), were situated within two meters of the latrine entrance (Fig 19). Just over one-third of participants, (36.9%, *n* = 162), reported washing their hands after defecation. Among the available HWFs, only 30.0% (*n* = 48) were equipped with soap. (Fig 11) Furthermore, merely a quarter of households practicing HWWS (24.7%, *n* = 108). The primary barriers to HWWS post-defecation included the lack of water at the HWF, (57.9%, *n* = 191) and the absence of soap (24.8%, *n* = 82) (Figure. 10).

`

Table 10 Latrine Availability and Utilization Rates Across Socio-Demographic Groups

Variable		Latrine Available						Latrine Use					
		Yes	No	OR	CI	p-value	X^2 (p-value)	Yes	No	OR	CI	p-value	X^2 (p-value)
Sex	Male	177(40.4%	8(1.8%)	0.747	0.42–1.34	0.297	1.490(0.222)	179(40.9%)	6(1.4%)				0.925(0.336)
	Female	235(53.7%)	18(4.1%)					240(54.8%)	13(3.0%)	0.59	0.11–3.20	0.558	
Age	18-26	62(14.2%)	7 (1.6%)	0.528		0.192	6.235(0.182)	85(14.8%)	4(0.9%)	0.613		0.355	11.373(0.023)
	27-35	81(18.5%)	8(1.8%)	0.513	0.20–1.28	0.119		80(18.3%)	9(2.1%)	0.206	0.01–4.10	0.704	
	36-44	101(23.1%)	3(0.7%)	0.621	0.28–1.35	0.223		103(23.5%)	1(0.2%)	2.235	0.43–11.63	0.138	
	45 above	168(38.3%)	8(1.8%)	0.566	0.27–1.18	0.127		171(29.1%)	5(1.1%)	2.699	1.39–5.25	0.587	
Marital Status	Married	328(74.9%)	18(4.1%)			0.451	4.228(0.376)	333(76.0%)	13(3.0%)			0.395	4.064(0.397)
	Single	18(4.1%)	1 (0.2%)	2.434	0.89–6.64)	0.063		18(4.1%)	1(0.2%)	3.959	1.38–11.4	0.307	
	Separated	6(1.4%)	0(0%)	2.418	0.43–5.54)	0.243		5(1.1%)	1(0.2%)	0.752	0.28–2.03	0.9	
	Divorced	17(3.9%)	3(0.7%)	1.459	0.38–5.61)	0.731		18(4.1%)	2(0.5%)	0.23	0.03–1.63	0.466	
	Widowed	43(9.8%)	4(0.9%)	1.542	0.60–3.95	0.541		45(10.3%)	2(0.5%)	0.286	0.03–2.54	0.448	
Religion	Christian	151(34.5%)	20(4.6%)			0.135	1.959(0.162)	265(60.5%)	16(3.7%)				3.474(0.062)
	Islam	261(63.3%)	6(1.4%)	0.515	0.21–1.28	0.135		154(35.2%)	3(0.7%)	2.205	0.79–6.18	0.488	
Education Level	None	90(20.5%)	6(1.4%)			0.584	1.277(0.528)	83(121.2%)	3(0.7%)			0.895	1.187(0.880)
	Primary	259(59.1%)	14(3.2%)	0.679	0.26–1.78	0.408		261(59.6%)	12(2.7%)	0.628	0.21–1.88	0.741	
	Secondary	63(14.4%)	6(1.4%)	0.937	0.31–2.81	0.858		65(14.8%)	4(0.9%)	1.007	0.25–4.08	0.995	
Occupation	Farming	273(62.3%)	13(3.0%)	2.41		0.371	6.404(0.171)	274(62.6%)	12(2.7%)			0.528	1.187(0.880)
	Business	116(26.5%)	13(3.0%)	1.455	0.47–4.48	0.709		123(28.1%)	6(1.4%)	1.19	0.48–2.94	0.999	
	Civil servant	7(1.6%)	0(0%)	0.405	0.04–4.13	0.559		7(1.6%)	0(0.0%)	0.65	0.09–4.98	0.092	
	Artisan	16(3.6%)	0(0%)	1.34		0.809		15(3.4%)	1(0.2%)	0.451	0.10–6.50	1	
Ethnicity	Yao	308(70.3%)	17(3.9%)	1.409		0.619	1.512(0.825)	312(71.2%)	13(3.0%)			0.543	1.729(0.785)
	Chewa	53(12.1%)	4(0.9%)	2.09	0.18–2.03	0.314		53(12.1%)	4(0.9%)	0	0.43–6.54)	0.998	
	Lhomwe	38(8.7%)	4(0.9%)	0.876	0.04–1.63	0.859		4-0(9.1%)	2(0.5%)	0	0.28–5.61)	0.801	
	Tumbuka	0(0%)	1(0.2%)	0	0.03–2.65	1		54(9.6%)	0(0.0%)	0	0.60–2.96	0.603	
Household Size	1 to 2	25(5.7%)	0(0%)			0.123	13.304(0.004)	128(29.2%)	1(0.2%)			0.097	12.254(0.007)
	3 to 4	109(24.9%)	15(3.4%)	2.596	0.007–0.73	0.051		112(25.6%)	12(2.7%)	2.843	0.14–56.3	0.557	
	5 to 6	127(29.0%)	3(0.7%)	2.657	0.007–0.73	0.017		128(29.2%)	2(0.5%)	0.396	0.05–3.34	0.357	
	7 and above	151(36.7%)	8(1.8%)	1.601	0.05–0.81	0.073		155(35.4%)	4(0.9%)	7.492	0.64–87.5	0.126	
Household Assets	≤ 2	127(28.8%)	6(1.4%)	0.694		4	1.631(0.803)	128(29.2%)	4(0.9%)	0		0.988	4.897(0.298)
	3	41(9.4%)	66(15.1%)	0.694	0.82－4.87	0.221		41(9.4%)	66(15.1%)	3.423	0.04–1.63	0.06	
	≥4	88(20.0%)	111(25.4%)	0.902	0.70－5.68	0.103		86(19.6%)	113(25.8)	1.789	0.18–2.03	0.369	

`

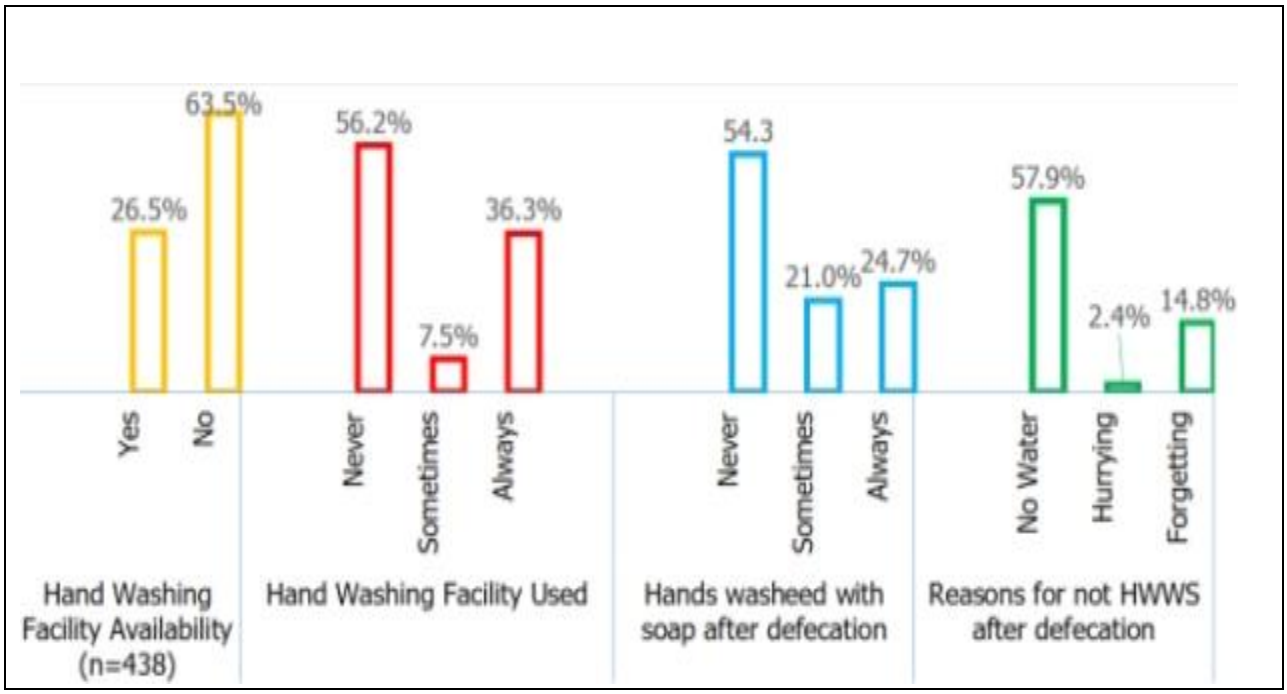


Figure 9 Hand washing facility availability and hand washing with soap coverage rates

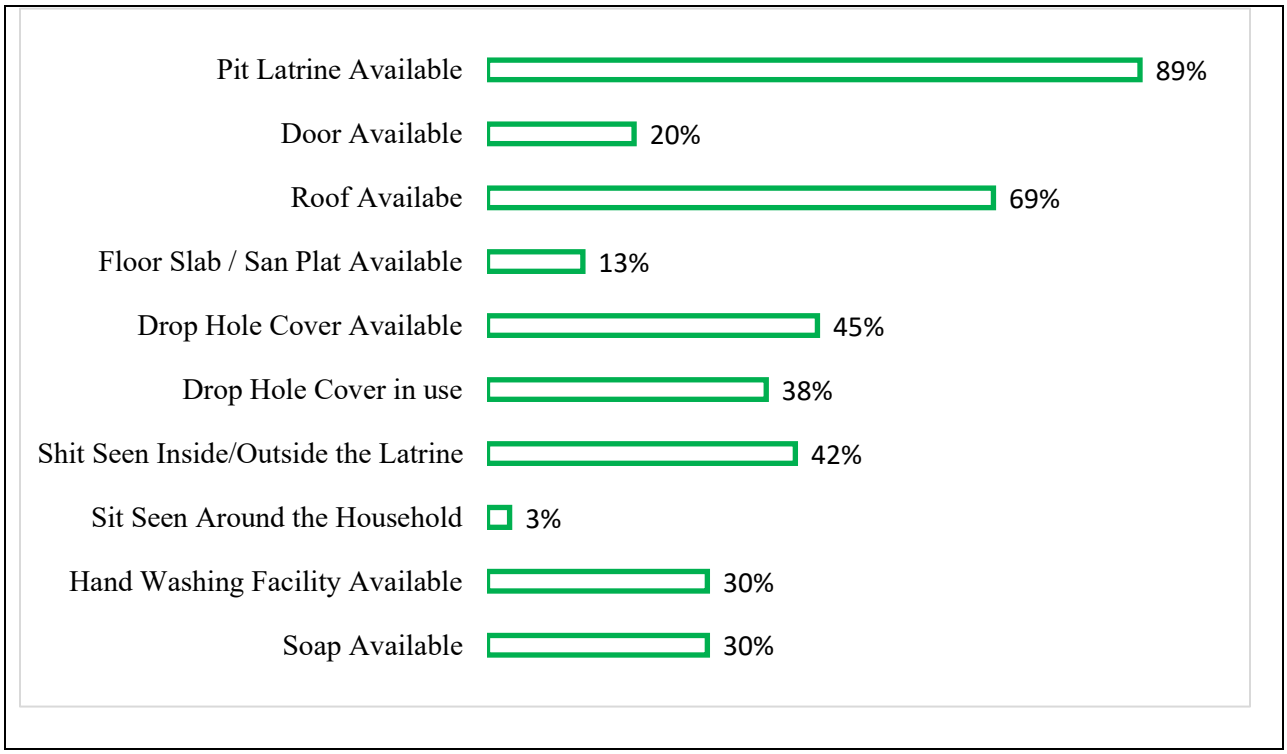


Figure 10 Status of Latrine and Hand-Washing Facilities

`

The qualitative data also highlighted similar reasons for the failure to wash hands post-defecation. It was noted that both children and some adults often neglect to wash their hands after using the toilet, sometimes without any specific reason, or due to the urgency of attending to other activities. Two participants from focus group discussions expressed the following:

> *"Children tend to rush out of the toilet to engage in other activities, like playing with friends, without washing their hands, while adults often leave even when a hand-washing facility is available."* ***(Kadyalunda VDC member)***

> *"We typically wash our hands before eating Nsima, but we often skip hand washing when consuming other foods, such as fruits. The thought of washing hands after using the toilet becomes unrealistic, especially when we are in a hurry to do other things."* ***(Nkota VHC member)***

Extension workers noted that hand washing facilities were only present while PCI was active, up until the villages achieved ODF status. Many HWFs were damaged by livestock, such as goats and pigs, and very few households took the initiative to maintain them. Even those with HWFs seldom washed their hands, often neglecting to use soap. This situation complicates efforts to prevent diarrheal diseases, as soap is essential for eliminating germs from hands.

During a focus group discussion, a male member of the VHC added:

> *"Most hand-washing facilities have been broken or vandalized by animals like goats and pigs, which are attracted to the water and soap. Consequently, people do not maintain these facilities or purchase soap for hand washing, especially given the recent rise in soap prices."* ***(Mbodzole VHC member)***

`

The construction of HWFs utilized small recycled plastic bottles. (Fig 19) One household representative described the improvements made to the HWF.

> "*We have transitioned to an improved version of the HWF. The initial design was inadequate, featuring two bottles: one for water storage and another for dispensing water. This setup allowed water to flow out for hand washing, but it posed a risk of contaminating the handle of the dispensing bottle, as we had to touch it before washing our hands. The new model, known as Mpondagiya, employs a foot pedal mechanism connected to a stick and string that lowers the neck of the storage bottle, enabling us to access water for hand washing without any physical contact." (Fig 19)* ***(Ziwoya VHC Member)***

4.3.3.2.2 Hand Washing Facility Availability and Utilization Rates Across Socio-Demographic Groups

The coverage of HWF was high with female respondents (20.5%, *n* = 90) as well as HWWS (15.8%, *n* =698) despite being not significant (p<0.05). The chi-square test revealed no significant association between gender and the availability of HWFs ($\chi^2 = 0.007$, p = 0.933) and HWWS after defecation ($\chi^2 = 2.205$, p = 0.138). Among respondents, a greater proportion aged 45 and above had HWF (14.4%, *n* = 63) and also were washing hands with soap after defecation (14.4%, *n* = 63) though not significant (p.0.05) Age did not significantly impact the availability of HWFs facilities ($\chi^2 = 0.371$, p = 0.985) or the practice of HWWS after defecation ($\chi^2 = 2.390$, p = 0.663).

The availability of HWFs was notably higher among married individuals (31.1%, *n* = 136) as well as HWWS after defecation (30.6%, *n* = 134) and lowest among the widowed, separated and single.

`

The single and separated are 2.4 times likely to have a latrine (OR = 2.434, p = 0.063) and (OR = 2.418, p = 0.243) respectively. For HWWS, the divorced are 3.957 times likely to HWWS after defecation though not significant. (OR = 3.957, CI = 0.01–4.58, p = 0.231). The Single are also 3.287 times more likely to HWWS after defecation and statistically significant (OR = 1.409, CI = 0.88–17.75, p = 0.034), suggesting that being single is a predictor of lower HWWS. In general, marital status has no influence of HWF availability (χ^2 = 0.371, p < 0.985) and HWWS after defecation χ^2 = 6.875, p = 0.143)

About education levels, those with Primary education were the highest proportions of respondents with HWF (24.2%, *n* = 108) and HWWS after defecation (23.7%, *n* = 104). Chi square test show that education is a significant predictor of HWWS after defecation (χ^2 = 9.436, p = 0.002) but not a predictor of HWF availability. Farmers demonstrated the highest rates of HWF availability (26.9%, *n* = 118) and HWWS (26.9%, *n* = 118), while business individuals reported lower HWFS availability (7.9%, *n* = 33). The occupation of farming had a significantly positive impact on both HWF availability (χ^2 = 12.487, p = 0.014) and HWWS (χ^2 = 21.046, p < 0.001), indicating that occupation is a crucial factor. (Table 11)

The Yao ethnic group exhibited the highest rates of HWF availability (30.6%, *n* = 134) and HWWS after defecation (30.4%, *n* = 133). Being part of the Yao group significantly increased the odds of HWF availability (OR = 1.409, CI = 1.12–3.04, p = 0.018) establishing it as a strong predictor of HWF availability. Ethnicity has a statistically significant relationship with the availability of HWFs availability (χ^2 = 12.249, p = 0.018) and not HWWS (χ^2 = 5.907, p = 0.206)

Table 11 indicates that a significant proportion of larger households, specifically those with 7 to 8 members had HWF (13.0%, *n* = 57) and wash hands with soap after defecation.(23.5%, *n* = 103)

`

Those that followed were households with 3-4 members and 5-6 members having a latrine (10.3%, *n* =45, OR=2.596, p=0.051) (11.0%, *n* =48, OR= 2.657, p=0.017) and HWWS after defecation (10.3%, *n* =45, OR=2.596, p=0.027) (10.7%, *n* =4, OR= 2.657, p=0.029) and were statistically significant. Despite these two significant relationships in the two household sizes, generally household size show no significant impact with HWF availability (χ^2 = 1.173, p = 0.982).and HWWS after defecation (χ^2 = 1.382, p = 0.710). Households whose economic status is above average are 3.423 times more likely to HWWS after defecation and is statistically significant (9.4%, *n* =41, OR= 3.423, p=0.06. Generally economic status is a significant predictor of availability of a HWF (χ^2 = 9.264, p = 0.001) and HWWS after defecation (χ^2 = 13.546, p = 0.009) (Table 11)

`

Table 11 Hand Washing Facility and Hand Washing With Soap After Defecation Coverage Rates Post-ODF Certification

Variable		HWF Available						HWWS After Defecation					
		Yes	No	OR	CI	p-value	X^2 (p-value)	Yes	No	OR	CI	p-value	X^2 (p-value)
Sex	Male	68(15.5%)	117(26.7%)	0.615		0.297	0.007(0.933)	39(8.9%)	146(33.3%)	0.46		0.142	2.205(0.138)
	Female	90(20.5%)	163(37.2%)	1. 12	0. 85 - 2. 12	0.297		69(15.8%)	184(42.0%)		0. 82 - 1. 79		
Age	18-26	26(5.9.8%)	43(9.8%)	0.528		0.192		26(5.9%)	43(9.8%)	0.677		1.266	
	27-35	30(6.8%)	59(13.5%)	0.513	0. 22 - 1. 17	0.119		30(6.8%)	59(13.5%)	0.684	0. 85 - 1. 95	0.82	
	36-44	39(8.91%)	65(14.8%)	0.621	0. 27 - 1. 44	0.223	0.371(0.985)	39(8.9%)	65(14.8%)	0.43	1. 01 - 2. 41	0.701	2.399(0.663)
	45 above	63(14.4%)	113(25.8%)	0.566	0. 25 - 1. 31	0.127		63(14.4%)	113(25.8%)	0.715	1. 08 - 2. 61	0.86	
Marital Status	Married	136(31.1%)	210(47.9%)			0.451		134(30.6%)	212(48.4%)			0.129	
	Single	3(0.7%)	16(3.7%)	2.434	0. 88 - 6. 73	0.063		3(0.7%)	16(3.7%)	3.287	0. 88 - 17. 75	0.034	
	Separated	2(0.5%)	4(0.9%)	2.418		0.243	0.371(0.985)	2(0.5%)	4(0.9%)	0.894		0.915	6.875(0.143)
	Divorced	5(1.1%)	15(3.4%)	1.459	0. 17 - 12. 45	0.731		5(1.1%)	15(3.4%)	3.957	0. 01 - 4. 58)	0.231	
	Widowed	14(3.2%)	33(7.5%)	1.542	0. 40 - 5. 95	0.541		14(3.2%)	33(7.9%)	1.278	0. 02 - 5. 08)	0.799	
Religion	Christian	74(16.9%)	207(47.3%)	0.515		0.135	6.770(0.149)	209(47.7%)	72(16.4%)	0.394		0.07	0.918(0.632)
	Muslim	88(19.6%)	71(16.2%)					86(19.6%)	71(16.2)				
Education Level	None	33(7.5%)	26(14.4%)	0.584				33(7.5)	63(14.4%)	0.927		0.199	
	Primary	108(24.2%)	167(38.1%)	0.408	0. 79 - 2. 97	0.679	1.920(0.383)	104(23.7%)	169(38.6%)	0.29	1. 11 - 2. 67	0.944	9.436(0.002)
	Secondary	21(4.8%)	48(11.0%)	0.858	0. 41 - 2. 18	0.937		48(11.0%)	21(4.8%)	0.349	1. 34 - 3. 51	0.028	
Occupation	Farming	118(26.9%)	168(38.4%)	2.41		0.371		118(26.9%)	168(38.4%)	0.927		0.017	
	Business	33(7.9%)	96(21.9%)	1.455	0. 94 - 2. 99	0.092		31(7.1%)	98(22.4%)	0.524	1. 87 - 4. 85	3.01	
	Civil servant	1(0.2)	6(1.4%)	0.405	0. 94 - 2. 99	0.092	12.487(0.014)	1(0.2%)	6(1.4%)	0.446	1. 87 - 4. 85	3.01	21.046(0.000)
	Artisan	8(1.9%)	8(1.9%)	1.34		0.809		8(1.8%)	9(1.9%)	0.848		0.999	
Ethnicity	Yao	134(30.6%)	191(43.60%)	1.409	1. 12 - 3. 04	0.018		133(30.4%)	192(43.8%)	5.449	1. 08 - 2. 95	0.021	
	Chewa	13(3.0%)	44(10.0%)	2.09		0.314		13(3.0%)	44(10.0%)	5.567		0.131	
	Lhomwe	10(2.3%)	32(7.3%)	0.876		0.859	12.249(0.018)	9(2.1%)	33(7.5)	2.405		0.143	5.907(0.206)
	Tumbuka	0(0.0%)	1(0.2%)	0		1				0		0.459	
Household Size	1 to 2	10(2.3%)	15(3.4%)			0.123		10(2.3%)	15(3.4%)			0.067	
	3 to 4	45(10.3%)	79(18.0%)	-2.596	0. 01 - 0. 99	0.051		45(10.3%)	79(18, 0%)	0.027	0. 06 - 1. 75)	0.034	
	5 to 6	48(11.0%)	82(18.7%)	-2.657	0. 01 - 0. 67	0.017	0.173(0.982)	47(10.7%)	83(18.9%)	0.029	0. 11 - 1. 45)	0.018	1.382(0.710)
	7 to 8	57(13.0%)	102(23.3%)	-1.601	0. 06 - 0. 69	0.073		103(23.5%)	56(12.8%)	0.196	0. 58 - 6. 38)	0.189	
Household Assets	≤ 2	31(7.1%)	101(23.1%)	-0.377		0.502		31(7.1%)	101(23.1%)	1.014		0.983	
	3	41(9.4%)	66(15.1%)	0.694	0. 82 - 4. 87	0.221	9.264(0.001)	41(9.4%)	66(15.1%)	3.423	1. 22 - 2. 87	0.06	13.546(0.009)
	≥4	88(20.0%)	111(25.4%)	0.902	0. 70 - 5. 68	0.103		86(19.6%)	113(25.8)	1.789	1. 73 - 4. 32	0.369	

`

4.4 Community Stages of Behaviour Change After Open Defecation-Free Status Certification

This section presents results on the stage of behaviour change together with the readiness to change and the commitment to change of Balaka community post-ODF. The key behaviours are construction of latrines and hand-washing facilities, use of the constructed latrines and washing hands with soap after using a latrine. The University of Rhode Island Change Assessment (URICA) 12-item version with pre-contemplation, contemplation, action, and maintenance stages was used to determine the stages of change, readiness to change and committed action to change.

As shown in Table 12, the internal consistency of the overall URICA 12-item questionnaire was found to be satisfactory, with a Cronbach's alpha of 0.81. The reliability coefficients for the individual sub-scales were 0.81 for Pre-contemplation, 0.76 for Contemplation, 0.86 for Action, and 0.79 for Maintenance, indicating a strong inter-correlation among the items within each stage and confirming that they measure the same underlying paradigm.

Table 12 Sanitation Services and Hygiene Practices Change Assessment Sub Scales Descriptive Statistics

URICA Scale	Dependent Variable								
		Toilet Construction		HWF Construction		Using a Toilet		HWWS after defecation	
	A	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Pre-contemplation	0.81	2.762	0.409	2.591	0.772	2.421	0.399	2.308	0.484
Contemplation	0.76	4.281	0.009	4.332	0.029	4.222	0.054	3.171	0.065
Action	0.86	4.308	0.003	4.349	0.076	4.335	0.156	3.116	0.088
Maintenance	0.79	3.513	0.870	3.564	0.939	3.413	0.865	2.681	0.583

A = Alpha, SD = Standard Deviation HWWS: Hand Washing With Soap; URICA: University of Rhodes Islands Change Assessment

`

4.4.1 Latrine Construction and Latrine Usage Stages of Behaviour Change

Table 13 shows that on latrine construction the community is at the Action Stage for stage of change (Mean = 4.308), at Contemplation (Middle) for readiness to change (Mean = 9.340) and least committed to action (Mean = 0.027). On latrine use, the community is at Action Stage of change (Mean = 4.335), at Contemplation (Middle) for readiness to use a latrine (Mean = 9.569) and Least Committed (Mean = 0.113) to use a latrine.

4.4.2 Hand Washing Facility Construction and Washing Hands With Soap After Defecation Stage of Behaviour Change

For hand washing facility construction, the community is at Action stage of change (Mean = 4.349), at Contemplation (middle) for readiness to change (Mean = 9.665) and Least Committed to action (Mean = 0.017). On HWWS after defecation, the community is at contemplation (Middle) Stage (Mean = 3.171) least ready (Mean = 6.660) and with Negative or no commitment to washing hands with soap after latrine use (Mean = - 0.055) (Table 13)

Table 13 Stages-of-change, Readiness to Change and Committed Action to Change

Stage	Mean Scores			
	Toilet Construction	HWF Construction	Using a Latrine	HWWS after using a latrine
Stage of Change (SoC) Scores				
Pre-contemplation (PC)	2.762	2.591	2.421	2.308
Contemplation (C)	4.281	4.332	4.222	3.171(C)
Action (A)	4.308 (A)	4.349 (A)	4.335 (A)	3.116
Maintenance (M)	3.513	3.564	3.413	2.681
Mean Score	3.716	3.709	3.598	2.819
Readiness to Change (RtC) Score (Readiness = C + A + M – PC)	9.340	9.665	9.549	6.660
Committed Action to change (CAtC) Score CA = A – C	0.027	0.017	0.113	-0.055

Score Interpretation

SOC: *Highest Mean score,* ***RtC*** *: ≤ 8 = Least; 8-10.999 = Intermediate; 11-14 =Most ready*

CAtC*: ≤ 8 = Least; 8-10.999 = Intermediate; 11-14 = Utmost*

`

4.5 Community Behaviour Change Determinants for Sustainable Sanitation Post Open Defecation-Free status Certification.

Factors affecting behaviour change encompass personal, technical, social, cultural, and ecological elements. This section presents findings related to these factors and their impact on the development and use of latrines and HWFs as well as the practice of HWWS after defecation.

4.5.1 Technological and Institutional Behaviour Change Determinants

4.5.1.1 Stakeholders Involvement in Planning and Supporting Sanitation and Hygiene Activities.

The majority of those involved in planning of community sanitation programs were local leaders (53.1%, *n* = 231) followed by Government extension workers (20.8%, *n* = 81). Local leaders had a greater influence on the coverage of latrines (49.41%, *n* = 216), use of latrines (50.1%, *n* =219), hand washing facility availability (17.6%, *n* = 77) and washing hands with soap after defecation (8.2%, *n* = 36). Government workers also played a moderate role in latrine construction (19.2%, *n* = 438) and usage (20.4%, *n* = 89). The contributions of women and government workers to HWF construction were minimal, with women at 5.7% (*n* = 25) and government workers at 5.9% (*n* = 28). Their influence on HWWS post-defecation was similarly low, with women at 5.0% (*n* = 22) and government workers at 5.3% (*n* = 23) (Table 14). A strong and statistically significant relationship was identified between stakeholder involvement in HWF construction ($\chi^2 = 70.308$, $p = 0.02941$ and HWWS after defecation ($\chi^2 = 117.785$, $p = 0.001$), while no significant relationship was observed for latrine construction and usage ($p < 0.05$) (Table 16).

Key informants and Focus group Discussion participants said this:

`

I, as a Group village Headman together with Village headmen and Health Surveillance Assistants were working hand in hand in planning after CLTS triggering to support the communities so that they can continue doing the work even after the NGOs leaves area" NGOs like PCI was only here for a short period and left soon after ODF certification. They were mostly working with Health Surveillance Assistants (HSAs), and VHC and mostly women who were also found during sanitation meetings ***(Nandumbo GVH)***

"CLTS needs to be integrated with other activities so that all extension workers from different departments like Community development and Social Welfare can support sanitation and hygiene services when doing their work instead of only a few Departments like Health and Agriculture" ***(Extension worker - Agriculture)***

"I am not conversant with CLTS and most of the time when I am in the field, communities and some local leaders ask for support in latrine construction materials like plastic sheets. I tell them that I will inform the health personnel, especially the HSA". ***(Community Development Assistant)***

4.5.1.2 Skills Availability and Sanitation Resources Availability, Accessibility and Affordability.

Economic and technical factors affecting the construction and maintenance of sanitation facilities reveal that many respondents identified the increasing cost of materials as a significant barrier to latrine availability (40.3%, n = 176), usage (38.4%, n = 438), HWF availability (26.3%, n = 438), and HWWS (41.4%, n = 168). Despite these rising costs, a substantial majority view the materials as affordable (80.8%, n = 438), with most individuals constructing (76.3%, n = 334) and using

`

latrines (77.9%, *n* = 341). However, material affordability has a lesser effect on HWF construction (23.1%, *n* = 101) and HWWS after defecation (13.9%, *n* = 61). Additionally, community skill deficits hinder latrine construction (38.4%, *n* = 168) and usage (38.4%, *n* = 168), while having a smaller impact on HWF availability (26.3%, *n* = 115) and HWWS (19.9%, *n* = 187) (Table 14).

Chi-square statistical test indicates a significant correlation between technical skills and HWF construction (χ^2 = 103.8, p = 0.001) as well as HWWS practices (χ^2 = 111.29, p = 0.028). Furthermore, material affordability is significantly associated with latrine usage (χ^2 = 83.464, p = 0.042) and HWWS after defecation (χ^2 = 82.173, p = 0.001) (Table 16).

During the focus group discussion, participants expressed concerns about their inability to construct latrines and practice HWWS, citing rising costs of essential materials like soap, cement, nails, and plastic sheets.

> *"My family has an Mpondagiya (Hand Washing Facility), but the water bottle is small, and we cannot afford soap. We wash our hands without it and only use soap for bathing."* ***(Sadyalunda VDC member)***

> *"The high cost of steel nails, iron sheets or plastic sheets, and cement prevent us from maintaining and improving our toilets, which remain basic with grass thatched roof and mud walls and floor"* ***(Mpulula VDC member)***

> *Communities lack skills in San plat casting. Few people were trained as masons and some are not present in the villages now. Some women stay alone and they cannot manage to construct a latrine as their children are away in town or got married somewhere"* ***(Health Surveillance Assistant)***

`

"Some construction materials like thatch grass, reeds, poles, bricks are locally available at no cost while plastic sheets are at affordable price within villages" ***(Hanjahanja VDC member)***

On availability of materials for latrines and HWF construction, the majority obtain them locally from traders within the villages (75.8%, n = 332) and almost a quarter get them from Balaka town (23.5%, n = 193). The majority of those who get materials locally have latrines (71.7%, n = 314) and defecate in latrines (72.8, n = 319) with very few having a HWF (32.2%, n = 141) and HWWS after defecation. This is the same with those who get materials from Balaka Town, most of them have latrines (21.7%, n = 95) and defecate in latrines with few having a HWF (4.1%, n = 18) and HWWS after defecation (2.3%, n = 10). Statistical test results show a significant relationship between the source of the materials and HWF availability ($\chi^2 = 21.194)$, $p= 0.001)$.and HWWS after defecation ($\chi^2 = 41.353$, $p= 0.047)$ (Table 16).

The focus group discussion revealed that while strings, grass, and plastic sheets are easily accessible in the villages, poles are notably lacking, which hampers residents' ability to repair or build new latrines. One participant noted that although vendors sell plastic sheets and strings for roofing, deforestation has led to a scarcity of trees, making it challenging to find poles.

"We struggle to find poles for both covering the pit and roofing. Consequently, we resort to molding bricks since water and soil are accessible, but poles remain elusive. Although purchasing them is an option, their scarcity is the issue. As a result, many of us are unable to repair our roofs or even install a roof on a new toilet" ***(Ziwoya VDC Member)***

`

4.5.1.3 Provision of Sanitation Information, Advice, and Support

In Balaka, the data indicates that the main sources of information, advice, and support for latrine construction, maintenance, and water sanitation and hygiene are Government and NGO extension workers (55.3%, *n* = 242) and local committees (32.0%, *n* = 142). The assistance from extension workers has a significant influence on latrine construction (62.3%, *n* = 272) and latrine (63.5%, *n* = 278). A chi-square test demonstrated a statistically significant relationship between the sources of sanitation and hygiene information and the construction of HWF ($\chi^2 = 79.513$, p= 0.042) as well as HWWS after defecation ($\chi^2 = 107.77$, p= 0.018). However, no significant association was found between latrine construction and usage (P-value > 0.005). (Table 16).

The main sources of support identified were extension workers (13.2%, *n* = 438), local committees (12.6%, *n* = 55), and local religious leaders (10.7%, *n* = 47). For HWWS after defecation, local religious leaders provided the most information (9.6%, *n* = 49), followed by extension workers (8.0%, *n* = 35) and local committees (7.1%, *n* = 31). A statistically significant relationship exists between community support for HWF construction, ($\chi^2 = 65.504$, p = 0.0141) and HWWS after defecation ($\chi^2 = 65.225$, p = 0.001). However, no significant relationship was found for latrine construction and usage (P > 0.005) (Table 16).

Qualitative results from focus group discussions indicated that PCI, an NGO in the area, along with Health Surveillance Assistants, Village Health Committees, and local artisans, played a crucial role in providing guidance.

> *"PCI workers were incredibly supportive, advising us on how to effectively dig and build a strong permanent pit latrine, ideally with a sanitation platform. They emphasized the*

`

importance of having a drop hole cover to prevent flies, a door for privacy and safety, and an HWF, not just the one used for anal cleansing" (***GVH Mpulula- Local leader)***

*"Health Surveillance Assistants continue to offer technical guidance on constructing a durable simple pit latrine and a Mpondagiya (hand washing facility) using local materials such as plastic water bottles and poles, which are easy for children to use. They regularly visit us to hold village meetings focused on personal hygiene, food hygiene, and sanitation." (**Ziwoya VHC Member)***

*"We had a local artisan skilled in masonry who collaborated closely with the Village Health Committee to provide technical advice on constructing sanitation platforms, but he stopped his support shortly after we achieved ODF Status." (**Hanjahanja VDC Member).***

*"One of the Church leaders most of the times preach in funerals that we should always wash hands after defecation to prevent the spread of cholera and diarrhea. I also always wash my hands and clean the anus as a requirement with advice from fellow Muslims like the Imam" (**Nandumbo VDC Member)***

On opportunities or chances available in the communities where respondents could access sanitation information and support, the majority of the community gets information and support through home visits by extension workers (65.8%, n = 188) and on a small scale through sanitation meetings (21.8%, n = 100). Home visits influenced the majority of respondents to construct latrines (62.3%, n = 273) and use them (63.5%, n = 278) while sanitation meetings influence respondents on a small scale to construct latrines (21.5%, n = 94) and use them (13.9%, n = 61).

`

On the other hand, home visits and sanitation meetings made very few respondents construct an HWF (13.7%*,* n = 438) and do HWWS after defecation (8.0%, n = 35)

In terms of accessing sanitation information and support, the primary source for respondents is home visits by extension workers, which account for 65.8% (n = 188). A smaller group, 21.8% (n = 100), receives information through sanitation meetings. Home visits have notably encouraged latrine construction, with 62.3% (n = 273) reporting building one and 63.5% (n = 278) indicating usage. In contrast, sanitation meetings have had limited effects, resulting in latrine construction by 21.5% (n = 94) and usage by 13.9% (n = 61). Both methods led to few respondents constructing HWF at 13.7% (n = 438) and practicing HWWS after defecation at 8.0% (n = 35).

Regarding follow-up visits to evaluate ODF status post-certification, most respondents reported occasional visits (63.5%, n = 278), while only a few indicated frequent follow-ups (15.5%, n = 66). These occasional visits positively influenced latrine construction (59.8%, n = 262), usage (60.5%, n = 265), HWF construction (13.9%, n = 61), and HWWS practices (8.7%, n = 38), as shown in Table 4.18. The Chi-Square test results show significant relationship between latrine construction ($\chi^2 = 0.629$, $p = 0.013$), latrine use ($\chi^2 = 5.724$, $p = 0.425$), ODF follow-ups and HWF construction ($\chi^2 = 40.39$, $p = 0.006$) and HWWS ($\chi^2 = 31.371$, $p = 0.001$) (Table 16)

Insights from focus group discussions highlighted the dynamics of support and follow-up in sanitation initiatives. It was observed that support meetings and supervisory visits were common right after the CLTS triggering phase but significantly decreased following ODF certification. The international NGOs involved, specifically PCI and World Vision, ended their participation shortly after the ODF certification due to the completion of their contracts.

`

"We received supervision during the CLTS triggering phase and shortly thereafter from PCI and World Vision International. However, after the ODF verification and celebrations, there has been a significant decline in supervision and follow-up in ODF-certified villages, as PCI and World Vision International left, halting all their support" ***(Health Surveillance Assistant)***

"Health Surveillance Assistants often visit us to evaluate our sanitation services and hygiene practices, especially regarding toilets, food, and water. They advise us to use a drop whole cover to reduce cholera risks and to have a HWF for hand washing. While we keep a pot of water in the bathroom for anal cleansing after defecation, in line with our customs, the HSAs also hold village meetings that provide us with valuable assistance, although attendance is mainly by women and children, with few men participating" ***(Nandumbo VDC- female member)***

`

Table 14 Latrine Coverage and Latrine Utilisation Rates Basing on Technological and Institutional Variables

Variable	Response	n (%)	Latrines Available n (%)		Latrines in Use n (%)			Hand Washing Facility Available n (%)		Hand Washing With Soap After Toilet Use n (%)		
			No	Yes	Always	Never	Sometimes	No	Yes	Always	Never	Sometimes
Those involved in planning community sanitation program	Village Health Committees	49(11.2)	1(0.2)	48(11.0)	49(11.2)	0(0)	0(0)	48(9.8)	6(1.4)	3(0.7)	28(5.9)	20(4.6
	Local Leaders	232(53.1)	16(3.7)	216(49.4)	219(50.1)	11(2.5)	2(0.5)	155(35.5)	77(17.6)	36(8.2)	146(33.4)	50(11.4)
	Religious Leaders	15(3.4)	1(0.2)	14(3.2)	14(3.2)	1(0.2)	0(0)	5(1.1)	10(2.3)	10(2.3)	2(0.5)	3(0.7)
	Government Workers	81(20.8)	7(1.6)	84(19.2)	89(20.4)	2(0.5)	0(0)	65(14.9)	28(5.9)	23(5.3)	59(13.5)	9(2.1)
	NGO Workers	21(4.8)	1(0.2)	20(4.6)	20(4.6)	1(0.2)	0(0)	5(1.1)	18(3.7)	13(3.0)	2(0.5)	6(1.4)
	Women	28(6.4)	0(0.0)	28(6.4)	26(5.9)	1(0.2)	0(0)	3(0.7)	25(5.7)	22(5.0)	2(0.5)	4(0.9)
	Men	1(0.2)	0(0.0)	1(0.2)	1(0.2)	0(0)	0(0)	1(0.2)	0(0.0)	1(0.2)	0(0.0)	0(0.0)
Technical conditions affecting sanitation facilities construction /repair	No Skills	180(41.2)	12(2.7)	168(38.4)	168(38.4)	9(2.0)	3(0.7)	65(14.9)	115(26.3)	87(19.9)	57(13.0)	38(8.2)
	Inadequate Space	5(1.1)	1(0.2)	4(0.9)	5(1.1)	0(0)	0(0)	3(0.7)	2(0.5)	1(0.2)	3(0.7)	1(0.2)
	Material Scarcity	69(15.8)	6(1.4)	63(14.4)	64(14.6)	5(1.1)	0(0)	63(14.4)	6(1.5)	3(0.7)	59(13.5)	7(1.6)
	Rising materials cost	183(41.9)	7(1.6)	176(40.3)	181(41.4)	2(0.5)	0(0)	147(33.6)	36(8.2)	16(3.7)	119(27.2)	48(11.0)
Affordability of materials	Yes	354(80.8)	20(4.5)	334(76.3)	341(77.9)	12(2.7)	1(0.2)	253(57.7)	101(23.1)	61(13.9)	226(51.6)	67(15.3)
	No	84(19.2)	2(0.3)	83(18.7)	77(17.6)	5(1.1)	2(0.5)	25(5.7)	59(13.5)	46(10.5)	13(3.0)	25(5.7)
Where communities get/buy construction materials	Local Traders	332(75.8)	18(4.1)	314(71.7)	319(72.8)	10(2.3)	3(0.7)	191(43.6)	141(32.2)	97(22.1)	152(37.4)	83(18.9)
	Balaka Town	103(23.5)	8(1.8)	95(21.7)	97(22.1)	6(1.4)	0(0)	85(19.4)	18(4.1)	10(2.3)	84(19.2)	9 (2.1)
	Outside Balaka	3(0.7)	0(0)	3(0.7)	3(0.7)	0(0)	0(0)	2(0.5)	1(0.2)	1(0.2)	2(0.5)	0(0.0)
Latrine construction, maintenance and WASH advice providers.	Got/NGO Extension workers	242(55.3)	11(2.5)	231(52.7)	223(53.0)	9(2.1)	1(0.2)	184(42.0)	58(13.2)	35(8.0)	157(35.8)	33(7.5)
	Local/Religious leaders	53(12.1)	6(1.4)	47(10.7)	48(11.0)	4(0.9)	1(0.2)	6(1.4)	47(10.7)	42(9.6)	3(0.7)	50(11.4)
	Local Committees	142(32)	9(2.1)	133(30.4)	138(31.5)	3(0.7)	1(0.2)	87(19.9)	55(12.6)	31(7.1)	78(17.8)	33(7.5)
	Mason & Volunteers	1(0.2)	0(0)	1(0.2)	1(0.2)	0(0.0)	0(0.0)	1(0.2)	0.(0.0)	1(0.2)	0(0.0)	0(0.0)
Information and support opportunities availability	Ext worker home Visits	288(65.8)	15(3.4)	273(62.3)	278(63.5)	9(2.1)	1(0.2)	228(52.1)	60(13.7)	35(8.0)	199(45.4)	54(12.3)
	Sanitation Meetings	100(22.8)	6(1.4)	94(21.5)	95(21.7)	4(0.9)	1(0.2)	39(8.9)	61(13.9)	38(8.7)	36(8.2)	26(5.9)
	Leaflets/Brochure	27(6.2)	3(0.7)	24(5.5)	23(5.3)	3(0.7)	1(0.2)	5(1.1)	22(5.0)	20(4.6)	1(0.2)	6(1.4)
	Awareness campaigns	10(2.3)	1(0.2)	9(2.1)	10(2.3)	0(0.0)	0(0.0)	0(0.0)	10(2.3)	8(1.8)	0(0.0)	2(0.5)
	Radio/Television	13(3.0)	1(0.2)	12(2.7)	13(3.0)	0(0.0)	0(0.0)	6(1.4)	7(1.6)	7(1.6)	2(0.5)	4(0.9)
ODF Certification follow-up visit done	No	94(21.5)	7(1.6)	87(19.9)	90(20.5)	4(0.9)	0(0.0)	85(19.4)	9(2.1)	3(0.7)	63(14.4)	28(6.4)
	Sometimes	278(63.5)	16(3.7)	262(59.8)	265(60.5)	11(2.5)	2(0.5)	150(34.2)	128(29.2)	85(9.4)	138(31.5)	55(12.6)
	Frequent	66(15.1)	3(0.7)	63(14.4)	64(14.6)	1(0.2)	1(0.2)	43(9.8)	23(5.3)	20(4.6)	37(8.4)	9(2.1)

Govt: Government, NGO: Non-Governmental Organization; ODF: Open Defecation Free, WASH: Water Sanitation and Hygiene

`

4.5.2 Social, Cultural and Ecological Determinates of Sanitation and Hygiene Behaviour Change.

4.5.2.1 Social Behaviour Change Determinants.

Most respondents identified spouses to highly influence both the construction of latrines (76.7%, n = 333) and usage (77.9%, n = 341) as well as HWF construction (33.8%, n = 148) and HWWS after defecation (23.3%, n = 102). Government workers played a crucial role in promoting the construction of latrines (38.4%, n = 168) and usage (39.3%, n-172). Chi-square tests revealed a significant relationship between construction responsibility and HWF construction ($\chi^2 = 26.168$, p = 0.001) and HWWS after defecation ($\chi^2 = 54.889$, p = 0.011), though no significant association was found for latrine construction and usage (p > 0.05) (Table 16).

Qualitative results from FGDs indicated that extension workers, along with family members such as spouses and children, often take on the responsibility for constructing latrines and HWF.

> *"Couples, husband and wife work together to construct a latrine and HWF. The wife goes to the woodland to cut grass while the husband digs the pit" (**Mbodzole VDC Member).***

> *"Biological children and other family members or relatives were helping their parents or grannies to construct a latrine and a HWF immediately after CLTS triggering because there were rules that were strongly followed by VHCs and chiefs. Some were using casual laborers to dig and build the latrine and construct HWF. But after ODF status certification, some latrines fell and HWF got broken down by goats and nobody is coming back to help. Currently, the local rules that were agreed upon by the community are no longer enforced" **(Nandumbo VDC Member)***

`

4.5.2.2 Cultural and Religious Beliefs Behaviour Change Determinants.

Table 15 shows that cultural beliefs notably affect behaviours such as latrine construction (51.4%, *n* = 225), latrine usage (53.0%, *n* = 232), HWF construction (11.2%, *n* = 193), and HWWS after latrine use (6.4%, *n* = 28). In contrast, religious beliefs have a limited effect on latrine construction (24.2%. *n* = 106) and latrine use (24.74%, *n* = 107)

Table 16 indicates a significant relationship between cultural beliefs and latrine usage ($\chi^2 = 9.195$, $p = 0.050$), HWF construction ($\chi^2 = 18.153$, $p = 0.001$), and HWWS after defecation ($\chi^2 = 207.709$, $p = 0.001$), and no significant relationship for latrine construction ($p > 0.05$)

Focus group discussions and key informant interviews also emphasized the role of cultural and religious beliefs in hygiene practices.

"A cultural practice among the Yao and Muslims involves using water containers for anal cleansing after defecation (Fig 14). They do not have a dedicated HWF and use the same pot, which diminishes the importance of proper hand washing" ***(Health Surveillance Assistant).***

"This area is mainly populated by the Yao, who, while not all are Muslims, practice anal cleansing with water. This cultural norm motivates them to construct latrines for their daughters and wives, similar to practices among Muslims" ***(GVH Mpulula- Local leader)***

Table 15 shows that most of the respondents (77.2%, *n* = 338) have latrines located at a distance of less than ten meters from the dwelling house which is the recommended distance. It also shows that a large number of toilets are easily accessible at night (96.8%, *n* = 423). Distance of latrine location from household affects the majority to construct a latrine (73.5%, *n* = 322) and use

`

(73.5%, *n* = 322). The distance has also a small effect on HWF construction (45.0%, *n* = 197) and on HWWS after defecation (24.4%, *n* = 107). Accessibility of latrines even at night influenced the majority of respondents to construct a latrine (92.9%, *n* = 406) and use latrines (93.8%, *n* = 410). On the other hand, this moderately influenced most of the respondents to construct a HWF (60.6%, *n* = 265), and almost one quarter to always HWWS after toilet use (24.7%, *n* = 108).

Chi-square test indicates a significant relationship between latrine distance from a dwelling house and latrine use ($\chi^2 = 1.603$, p= 0.043) and HWWS after defecation ($\chi^2 = 43.981$, p= 0.001). Fishers' Exact Test indicate significance between accessibility of a latrine at night and latrine use ($\chi^2 = 70.908$, p= 0.001), HWF availability ($\chi^2 = 3.107$, p= 0.001) and HWWS after latrine use ($\chi^2 = 6.532$, p= 0.038) not latrine construction and use (p>0.05) (Table 16)

4.5.2.3 Ecological Determinants of Sanitation Services and Hygiene Practices Post-Open Defecation Free Certification.

The key ecological determinants found were sandy soils (50.9%, *n* = 223) rocky soils (21.2%, *n* =123), and a bit of high-water table (12.3%, *n* = 54). The main water source found in the community was borehole (78.3%, *n* = 343) (Fig 15). The majority reported that water is scarce in the dry season only (100%, *n* = 438%) (Table 15)

Sandy soils affect the construction of latrines (47.9%, *n* = 210), latrine use (51.6%, *n* = 221), HWF construction (22.1%, *n* = 97) and HWWS after latrine use (17.1%, *n* = 75). Rocky soils and water table also affect latrine construction (21.2%, *n* = 92), (12.3%, *n* = 54) respectively. Water sources availability influenced the majority to construct latrines (74.4%, *n* = 328) and use them (74.95, *n*

`

= 328). On the other hand, only close to one-third had a HWF (31.5%, *n* = 137438) and only one quarter practiced HWWS after defecation (21.0%, *n* = 92) (Table 15)

Chi-square test results indicate a significant relationship between environmental conditions and latrine construction ($\chi^2 = 13.057$, p = 0.011), latrine use ($\chi^2 = 17.563$, p = 0.025), availability of HWFs ($\chi^2 = 21.278$, p = 0.001), and HWWS after defecation ($\chi^2 = 53.525$, p = 0.001). However, no significant correlation was found between water source availability and latrine use (p-value > 0.05), although a significant relationship was noted with latrine construction ($\chi^2 = 10.7$, p = 0.03) and HWF construction ($\chi^2 = 21.892$, p = 0.001) and HWWS after defecation ($\chi^2 = 31.941$, p= 0.007). (Table 16)

During focus group discussions, participants highlighted the difficulties of constructing latrines in sandy and rocky soils.

> "*The ground here is made up of soft sandy soils. This makes it easy for us to build the latrine. We easily dig our pits and soil to use for molding latrine walls with poles or molding bricks for walls. The only big problem is that most of the latrines with leaking roofs easily fall in the rainy season and becomes very difficult to maintain or build a new one until the dry season."* ***(Nandumbo VDC Member).***

Participants also indicated that water is readily available, eliminating excuses for not building latrines or washing hands after toilet use. They reported access to pipe and borehole water. Concerns were raised about the failure to wash hands after defecation, attributed to personal negligence and a lack of accountability in maintaining the HWF. A member from Nkota VDC

`

remarked on the sufficient water supply for brick molding and latrine construction, stating that boreholes ensure no water scarcity.

> *"Water is available most of the time and we can mold bricks and build latrine walls. There are adequate boreholes such that we do not have water availability problems"* ***(Nkota VDC Member)***

Furthermore, a female participant from Milala VDC stressed the importance of water for domestic tasks, asserting that women ensure its availability. She mentioned that while the village has daily access to water, neglecting to wash hands often results from not refilling the HWF. Another participant from Nandumbo GVH added that the responsibility for refilling the HWF typically falls on women, but husbands and children should also assist in this task

> *"A lot of domestic work uses water and as women, we make sure that there is water. We have boreholes in our village and we have water almost every day. We only fail to wash hands because of failure to refill the HWF" (****Milala VDC female member)***

> *"We fail to wash hands because of a lack of taking responsibility for putting water in the HWF. It is left to women only, but husbands and children can also fill the HWF with water when empty"* ***(Nandumbo GVH)***

`

Table 15 **Latrine and Hand-washing Facility Coverage, Latrine Usage and Hand Washing With Soap After Defecation Rates Basing on Social, Ccultural and Ecological variables.**

Variable	Response	n (%)	Latrine Available n (%)		Latrine Use n (%)			Hand Washing Facility Available n (%)		Hand Washing With Soap n (%)		
			No	Yes	Always	Never	Sometimes	No	Yes	Always	Never	Sometimes
Those responsible for pit latrine construction	Husband/Wife	354(80.8)	18(4.1)	333(76.7)	341(77.9)	10(2.3)	3(0.7)	206(47.0)	148(33.8)	102(23.3)	165(37.7)	87(19.9)
	Children	2(0.5)	0(0.0)	2(0.5)	2(0.5)	0(0.0)	0(0.0)	1(0.2)	1(0.2)	2(0.5)	0(0.0)	0(0.0)
	Leaders	7(1.6)	2(0.5)	5(1.1)	7(1.6)	0(0.0)	0(0.0)	4(0.9)	3(0.7)	1(0.2)	6(1,4)	0(0.0)
	Ext workers	75(17.1)	6(1.4)	69(15.8)	69(15.8)	6(1.4)	0(0.0)	67(15.3)	8(1.8)	3(0.7)	67(15.3)	5(1.1)
Those who influence latrine and HWF construction	Husband/Wife	113(25.8)	4(0.9)	109(24.9)	108(24.7)	4(0.9)	1(0.2)	52(11.9)	61(13.9)	38(8.7)	49(11.2)	26(5.9)
	Children	3(0.7)	0(0.0)	3(0.7)	3(0.7)	0(0.0)	0(0.0)	0(0.0)	3(0.7)	2(0.5)	0(0.0)	1(0.2)
	Community	84(19.2)	6(1.4)	78(17.9)	78(17.3)	4(0.9)	2(0.5)	52(11.9)	32(7.3)	24(5.5)	43(9.8)	17(3.9)
	Govt Workers	178(40.6)	10(2.3)	168(38.4)	172(39.3)	6(1.4)	0(0.0)	144(32.9)	34(7.8)	19(4.3)	119(27.2)	40(9.1)
	NGO staff	15(3.4)	2(0.5)	13(3.0)	14(3.2)	1(0.2)	0(0.0)	3(0.7)	12(2.7)	11(2.5)	3(0.7)	1(0.2)
	Religious leaders	8(1.8)	1(0.2)	7(1.6)	8(1.8)	0(0.0)	0(0.0)	2(0.5)	6(1.4)	6(1.4)	2(0.5)	0(0.0)
	Political Leaders	1(0.2)	0(0.0)	1(0.2)	1(0.2)	0(0.0)	0(0.0)	0(0.0)	1(0.2)	1(0.2)	0(0.0)	0(0.0)
	Community Volunteers	1(0.2)	0(0.0)	1(0.2)	1(0.2)	0(0.0)	0(0.0)	1(0.2)	0(0.0)	0(0.0)	1(0.2)	0(0.0)
	Local Leaders	35(8.0)	3(0.7)	32(7.3)	34(7.8)	1(0.2)	0(0.0)	24(5.5)	11(2.9)	7(1.6)	21(4.8)	7(1.6)
Latrine distance from dwelling house	<10 Meters	338(77.2)	18(3.7)	322(73.5)	322(77.2)	13(3.0)	3(0.7)	197(45.0)	141(32.2)	107(24.4)	159(36.3)	72(16.4)
	>10 Meters	10(22.8)	10(2.3)	90(20.5)	97(22.1)	3(0.7)	0(0.0)	81(18.5)	19(4.3)	1(0.2)	79(18.0)	20(4.6)
Latrine accessible even at night	No	14(3.2)	8(1.8)	6(1.4)	8(1.8)	691.4)	0(0.0)	12(2.7)	265(60.6)	0(0.0)	12(2.7)	2(0.5)
	Yes	423(96.8)	17(3.9)	406(92.9)	410(93.8)	10(2.3)	3(0.7)	2(0.5)	158(36.2)	108(24.7)	226 (51.5)	90(20.6)
Available environmental conditions	Sandy Soils	223(50.9)	13(3.0)	210(47.9)	226(51.6)	8(1.8)	3(0.7)	126(28.8)	97(22.1)	75(17.1)	92(21.0)	56(12.8)
	Rocky Soils	93(21.2)	1(0.2)	92(21.0)	69(15.8)	1(0.2)	0(0.0)	61(13.9)	32(7.3)	18(3.7)	66(15.1)	11(2,5)
	High water table	54(12.3)	7(1.6)	47(10.7)	39(8.9)	6(1.4)	0(0.0)	48(11.0)	6(1.7)	3(0.7)	46(10.5)	5(1.1)
	Flooding	40(9.1)	1(0.2)	39(8.9)	51(11.6)	0(0.0)	0(0.0)	23(5.3)	17(3.9)	11(2.5)	19(4.3)	10(2.3)
	Water Scarcity	28(6.4)	4(0.9)	24(5.5)	34(7.8)	1(0.2)	0(0.0)	20(4.6)	8(1.8)	3(0.7)	15(3.4)	10(2.3)
Available beliefs/taboos in communities	Cultural	242(55.3)	17(3.9)	225(51.4)	232(53.0)	9(2.1)	1(0.2)	193(44.1)	49(11.2)	28(6.4)	173(39.5)	41(9.4)
	Religious	108(24.7)	2(0.5)	106(24.2)	107(24.4)	1(0.2)	0(0.0)	72(16.4)	36(8.2)	9(2.1)	61(13.9)	38(8.7)
	Artistic	88(20.1)	7(1.6)	81(18.5)	80(18.3)	6(1.4)	2(0.5)	13(3.0)	75(17.1)	71(16,2)	4(0.9)	13(3.0)
Available water source	Borehole	343(78.3)	17(3.9)	326(74.4)	328(74.9)	10(2.3)	3(0.7)	74(16.9)	138(31.5)	92(21.0)	169(38.6)	80(18.3)
	Piped water	91(20.8)	9(2.1)	82(18.7)	86(19.6)	5(1.1)	0(0.0)	1(0.2)	17(3.9)	12(2.7)	68(15.5)	11(2.5)
	Shallow well	2(0.5)	0(0.0)	2(0.5)	1(0.2)	1(0,2)	0(0.0)	0(0.0)	1(0.2)	0(0.0)	1(0.2)	1(0.2)
	Stream	2(0.5)	0(0.0)	2(0.5)	4(1.0)	0(0.0)	0(0.0)	0(0.0)	2(0.5)	4(1.0)	0(0.0)	0(0.0)
Water scarcity	Not scarce	0(0%)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)
	Dry season	438(100)	26(5.9)	412(94.1)	419(95.7)	16(3.7)	3(0.7)	278(63.5)	160(36.5)	108(24.7)	239(54.3)	92(21.0)
	Wet Season	0(0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

:Ext: Extension HWF:Hand washing facility; Govt: Government, NGO: Non-Governmental Organization

`

`Table 16 Logistic Regression Analysis of Sanitation Services and Hygiene Practices with Behaviour Change Determinants

Independent Variable	Dependent Variables											
	Latrine Availability			Latrine Use			Hand Washing Facility Available			Hand Washing With Soap After Toilet Use		
	X^2	df	Sig	X^2	df	Sig	X^2	df	Sig	X^2	df	Sig
Technological and Institutional Determinants												
Those involved in planning community sanitation program	4.105	6	0.662	8.469	12	0.747	70.308	8	0.029	117.785	12	0.041
Technical conditions affecting sanitation facilities construction and repairing	10335	3	0.227	11.441	6	0.076	103.8	3	0.001	111.29	6	0.028
Affordability of materials	4.521	7	0.634	83.464	2	0.042	52.607	14	0.38	82.173	3	0.000
Where communities get/buy construction materials	2.965	2	0.617	2.807	4	0.591	21.194	2	0.001	41.353	4	0.047
Latrine construction, maintenance and WASH advice providers.	3.694	3	0.296	4.729	6	0.579	79.513	3	0.042	107.77	6	0.018
Social and Cultural Ecological determinants												
Information and support opportunities availability	1.936	4	0.747	9.961	8	0.268	99.017	4	0.001	111.173	8	0.001
ODF Certification follow up visit done	0.629	2	0.013	2.317	4	0.038	40.39	2	0.006	31.371	4	0.001
Those responsible for pit latrine construction	7.581	3	0.056	5.724	6	0.425	26.168	3	0.001	54.889	6	0.011
Those who influence latrine and HWF construction	0.252	8	0.834	6.607	16	0.98	63.504	8	0.014	65.225	16	0.001
Latrine distance from dwelling house?	3.833	1	0.048*	1.063	2	0.046	17.175	1	0.064 *	43.981	2	0.001
Latrine easily accessible even at night	70.908	1	0.001*	1.063	2	0.001	3.107	1	0.001*	6.532	2	0.038
Available beliefs/taboos in communities	4.382	2	0.112	9.195	4	0.036	18.153	2	0.001	207.709	4	0.001
Ecological determinants												
Available environmental conditions	13.057	4	0.011	17.563	8	0.025	21.278	4	0.001	53.525	8	0.001
Available water source	10.7	4	0.03	14.556	8	0.068	21.892	4	0.001	31.941	8	0.007

**Fisher's Exact Test, X^2 :Chi -Square Test, Sig: Significance, df: Degrees of Freedom*

`

4.6 Suggested Community-Led Total Sanitation Process Model for Sustained Open Defecation-Free Status in Balaka - The Sustainable Sanitation Behaviour Transformation (SSBT) Model

Following the attainment of Open Defecation Free status in Balaka, some communities experienced a relapse, marked by low latrine coverage and use, and a substantial reduction in hand washing facility availability and HWWS. This ODF slippage is attributed to several factors, including inadequate follow-up after ODF certification, limited stakeholder support, and insufficient availability of durable materials, poor technical skills in latrine and HWF construction and maintenance, and weak hygiene promotion (GoM 2018; UNICEF Malawi 2021).

To address these challenges and sustain sanitation gains, the Sustainable Sanitation Behaviour Transformation (SSBT) Model is proposed. This model integrates components from the SaniFOAMS framework (USAID/WSP 2010), the Social-Ecological Model (McLeroy et al., 1988), and the Trans Theoretical Model (Prochaska & DiClemente 1983), aiming to close existing gaps in sustained sanitation behaviour change. The Sustainable Sanitation Behaviour Transformation Model is a cost-effective, community-driven strategy that targets personal, social, technical, and environmental determinants of sanitation behaviour through multi-level interventions as outlines in Figure 12 Stage 7

The model aims to promote community ownership by transitioning from externally driven enforcement mechanisms to self-sustaining hygiene and sanitation habits. By addressing behavioural, financial, and technical barriers, the SSBT Model facilitates sustained latrine construction and use, as well as improved HWWS. It is aligned with Malawi's National Sanitation

`

and Hygiene Strategy (2018–2024), Sustainable Development Goal 6.2, the National Research Agenda II (2023–2030), and the Malawi 2063 MIP-1 agenda (GoM, 2023; NPC, 2020).

4.6.1 Key Components of Sustainable Sanitation Behaviour Transformation Model

4.6.1.1 Personalized Behavioural Reinforcement (Focus and Motivation-Individual Level)

Community-based actors such as local leaders, elders, religious figures, teachers, and sanitation volunteers will serve as "Sanitation Champions" to promote proper latrine use and HWWS through direct household engagement. Mobile-based monitoring and reminder systems will be employed to track sanitation practices and facility coverage at the household level

4.6.1.2 Community-Led Infrastructure Sustainability (Opportunity- Social Level)

Village Health Committees, Water Point Committees, and other local structures will be empowered to manage sanitation infrastructure using community scorecards. Community-led sanitation financing mechanisms such as Sanitation Saving Groups (SSG) modelled after Village Savings and Loan Associations (VSLA) will be introduced within Sanitation Marketing Approach. These savings groups will support latrine repair, upgrades, and reinvestment. (Figure 12)

Local entrepreneurs will be supported to provide affordable sanitation products including slabs and hand washing units, as previously demonstrated by PCI. Collaboration with NGOs and microfinance institutions will promote subsidized loan options for sanitation improvements through public-private partnerships. Youth and gender-focused engagement strategies will promote inclusive participation and responsibility.

`

4.6.1.3 Technical Innovation for Sustained Usage (Ability-Environmental & Technical Level)

Affordable, durable materials such as compressed mud bricks or rammed earth will be used to reduce dependence on costly cement-based structures. Locally made HWFs such as improved Tippy Taps using recycled plastic bottles will be scaled up. The model also promotes Ecological Sanitation (ECOSAN) and composting toilets, which allow safe reuse of human waste as organic fertilizer, fostering a circular sanitation economy. Masons will be trained to support local construction and maintenance, enhancing community technical capacity and reducing reliance on external contractors. (Figure 12)

4.6.1.4 Motivational Triggers and Social Reinforcement (Motivation - Multi-Level).

Behaviour change will be reinforced through awareness campaigns, peer education, and integration of sanitation messages into community events, songs, and religious gatherings. Public recognition and incentives such as “Cleanest Household” awards will motivate continued sanitation compliance. Collaboration with traditional and religious leaders will embed sanitation as a moral and cultural responsibility.

Child-led sanitation efforts in schools will promote peer-to-peer education through hygiene clubs, drama, and other activities. Sustainability will be ensured through structured follow-ups, including biannual re-verification, annual ODF recertification, and celebrations at the Traditional Authority level. These strategies aim to transition communities from open defecation to sustained ODF status and contribute toward achieving national sanitation goals. (Figure 12)

`

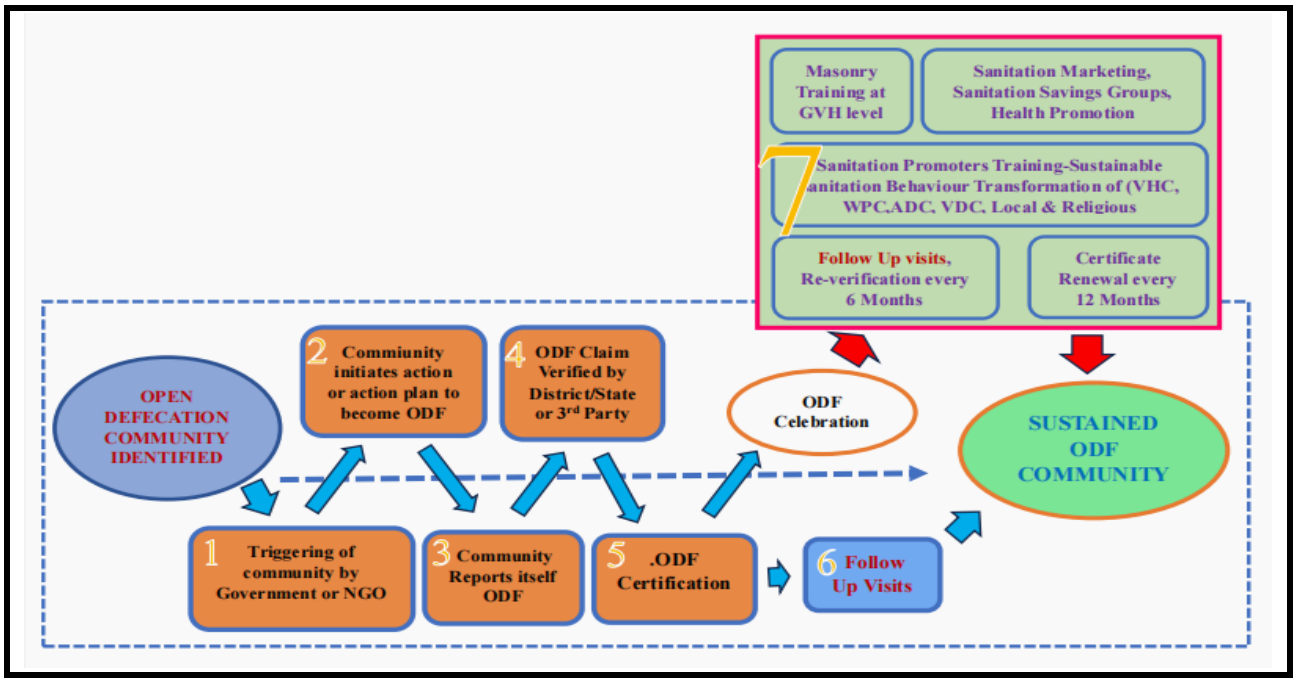


Figure 11 Proposed Post ODF Progression (Stage 7)

In summary, the results show that although Balaka District has insufficient sanitation progress post-ODF certification and remains challenging. While knowledge and attitudes toward sanitation are generally strong, consistent latrine use and HWWS after defecation have declined due to motivational fatigue, weak institutional follow-up, and environmental constraints. These findings highlight the complex interplay of personal, social, technical, and institutional factors influencing post-ODF behaviours. The study's integration of these determinants into the SSBT Model provides a framework for understanding post-ODF behavioural resilience and reinforcing these dynamics.

Chapter Five builds upon these findings to interpret the underlying dynamics influencing sustainable sanitation behaviour change. It discusses how demographic, social, cultural, ecological, and institutional factors intersect within the frameworks of SaniFOAM, the Social Ecological Model, and the Transtheoretical Model, positioning the SSBT Model as a pathway for achieving long-term sanitation sustainability in Balaka and similar rural settings in Malawi.

`

CHAPTER FIVE : DISCUSSION

5.1 Introduction

This chapter discusses the sustainability of sanitation and hygiene behaviours in Balaka District four years after ODF certification. Using SaniFOAM, TTM, and SEM, it examines how knowledge, attitudes, practices, and broader personal, social, and institutional factors influence the continuation or decline of key behaviours such as latrine use, maintenance, and handwashing with soap.

Emerging signs of ODF slippage are interpreted in relation to gaps in opportunity, ability, and motivation, as well as weak support systems. The discussion concludes by positioning the Sustainable Sanitation Behaviour Transformation (SSBT) Model as a framework for understanding these dynamics and guiding long-term community-driven sanitation sustainability insights beyond initial ODF certification for both the Malawian context and broader CLTS post-ODF programming in Balaka and similar rural contexts.

5.2 Community Knowledge, Attitude, Practices and Stages of Behaviour Change Four Years Post-ODF Certification

5.2.1 Community Knowledge on CLTS and ODF Four Years Post-ODF Certification

Community knowledge is a critical foundation for CLTS implementation and long-term ODF sustainability. In Balaka, knowledge of community of CLTS processes and ODF requirements was generally high (Mean = 3.7), with 81.5% reporting CLTS activities in their area and 98% aware of triggering events. Most households recognized the health benefits of latrine use (77.4%) and handwashing with soap (70.1%), consistent with Sigler et al. (2014). This demonstrates the

`

effectiveness of CLTS in raising initial awareness of sanitation and hygiene to prevent diseases such as cholera, dysentery and worm infections.

Despite households having strong baseline CLTS knowledge, only two thirds (65.5%) understood the importance of progressing up the sanitation ladder, revealing a critical gap in CLTS knowledge for long-term ODF status sustainability. Despite high initial latrine and HWF coverage, both infrastructure quality and usage declined over four years, reflecting the limits of knowledge alone in sustaining sanitation behaviour (Lopez et al. 2019; Bokeoo 2020). Regression analysis confirmed that knowledge had no significant effect on latrine construction ($p = 0.667$) or use ($p = 0.733$), diverging from evidence in Indonesia and the Philippines (Sayati 2018; Talinusa et al. 2017) and from Kenya and Ethiopia (Wasonga et al. 2014; Musyoki 2016), where improved sanitation knowledge influences latrine adoption.

However, knowledge played a more substantial role by significantly influencing both HWF construction ($p = 0.005$) and handwashing with soap after defecation ($p = 0.001$). Awareness that ODF involves moving up the sanitation ladder, that poor hygiene causes eye infections, and that handwashing kills germs motivated households to adopt these practices. While HWWS is still emerging across Malawi, the positive influence of knowledge on HWF construction aligns with findings from Amoah & Addoah (2021) and Wolde et al. (2022). In contrast, evidence from Zambia (Kagwa 2017) noted that sensitization alone did not translate into consistent handwashing behaviour, highlighting the need for ongoing reinforcement.

The SaniFOAM framework, frames knowledge as a key Ability determinant, while SEM situates it at the Individual level, interacting with household and community factors to support or hinder sustained behaviour (Devine, 2009; McLeroy et al., 1988). Within the SSBT Model, strong

`

knowledge supports motivation and adoption but requires enabling environments and reinforcement for sustained sanitation behaviour change.

Overall, while Balaka households had high knowledge of CLTS, ODF, and sanitation risks, this knowledge did not consistently translate into sustained practices as observed in similar post-ODF contexts across sub-Saharan Africa. Without reinforcing factors such as privacy, safety, motivation, durable infrastructure, communities risk reverting to open defecation despite understanding health benefits. Strengthening long-term engagement, continuous CLTS follow-up, and practical support for infrastructure improvement are essential to maintain ODF status and encourage progress up the sanitation ladder.

5.2.2 Community Attitude Towards ODF Status After Certification

Community attitudes were generally positive, shaped by experiences with latrine construction, use, and hygiene. Respondents expressed favourable perceptions of latrines for health, cleanliness, and dignity (Mean = 3.73), with 99% agreeing that owning a latrine should not be a source of shame. Nonetheless, neutral attitudes persisted among some respondents (Mean 2.5–3.4) due to concerns about privacy and cultural discomfort discussing human excreta. Qualitative findings highlighted public shaming for open defecation which is embarrassing, similar to a study in Nepal (Celia 2018) and Indonesia (Odagiri et al. 2017), where shame and ridicule discouraged open defecation. Fathers in Balaka reported discomfort sharing latrines with daughters, a pattern also observed in rural Eastern Zambia (Thys et al. 2015) and Kenya (Singh & Balfour 2015). Such social pressures, including shame and cultural discomfort, motivate households to construct and use private, well-enclosed latrines.

Privacy and structural adequacy emerged as central determinants of consistent use. Missing doors, weak superstructures, and poor maintenance contributed to an ODF slippage rate of 11%,

`

resonating with findings from Ethiopia, Kenya, as well as Malawi where inadequate facilities prompt a return to open defecation (Harvey 2011; Garn et al. 2017). Regression analysis showed that attitudes significantly influenced HWF construction ($p = 0.005$) and latrine cleanliness influenced use ($p = 0.012$), but overall attitudes had limited impact on latrine construction or HWWS ($p > 0.7$), highlighting the need for supportive physical environments and social norms.

According to the SaniFOAM framework, positive attitudes driven by perceived benefits such as privacy, safety, comfort, cleanliness, and dignity are critical Motivation determinants influencing latrine use and HWWS after defecation, while SEM puts them across interpersonal and community levels, influencing social reinforcement and perceived norms (Devine 2009; McLeroy et al. 1988). In Balaka most latrines do not meet ODF certification standards increasing the chances of Open defecation. This reflects slow behaviour change and limited appreciation of the sustained benefits of improved sanitation (Busienei et al. 2019). Favourable attitudes alone in Balaka were insufficient to maintain high-quality sanitation without durable infrastructure and continuous reinforcement, consistent with the proposed SSBT principles emphasizing multi-level, sustained support for long-term behaviour change.

Regression analysis reinforced these findings: overall attitude variables did not significantly influence latrine construction ($p = 0.773$) or use ($p = 0.707$), except for latrine cleanliness, which had a positive and significant effect on use ($p = 0.012$). Attitudes significantly influenced handwashing facility (HWF) construction ($p = 0.005$) but not handwashing with soap after defecation ($p = 0.707$). These patterns suggest that although community attitudes create a strong foundation for behaviour change, they must be supported by enabling physical environments and social norms to ensure sustainable ODF outcomes.

`

Best practices for sustaining attitudes include culturally sensitive latrine designs, peer-to-peer engagement, and community-led campaigns to normalize sanitation discussions (O'Connell 2014; Celia 2018). Without addressing privacy, structural inadequacies, and cultural discomfort, ODF sustainability remains vulnerable despite generally community having positive attitudes.

5.2.3 Community Sanitation Practices Four Years Post-ODF Certification

5.2.3.1 Latrine Availability and Use

Sustaining sanitation behaviour in Balaka requires examining both latrine availability and actual use. Although Balaka achieved over 95% latrine coverage at ODF certification, this declined to 89% four years later, despite high reported use (95.7%, n = 419). This slippage mirrors national and global trends where coverage gains become weak post-ODF. Larger households were more likely to maintain latrines, indicating that labour and resource availability influence sustainability.

Most latrines were simple pit structures with grass-thatched roofs (85.1%, n = 351), highly vulnerable to collapse from rains, termites and poor materials as 23% experienced frequent failure. Similar patterns in Malawi, Rwanda, and India show that low-cost structures rarely support long-term sanitation progress (Hinton et al. 2024). Only 13.3% (n = 55) had sanitation platforms or improved features, and many lacked doors, roofs, or drop-hole covers, undermining safety and privacy and prompting some households to revert to open defecation.

A notable gap existed between ownership and consistent use: while 95.7% reported using a latrine, only 70.8% used it every time. This discrepancy likely reflects social desirability bias, as reported in Indonesia and Kenya (O'Connell 2014; Busienei et al. 2019). Evidence across Asia and Africa further shows that ownership does not guarantee habitual use (Husna & Mailanie 2018; Junias et al. 2016).

`

Latrine proximity supported use, with 93.1% (n = 368) being within 50 meters aligning with findings that proximity benefits women and youths (Sherin et al. 2017). However, other studies show mixed effects (Maitabel et al. 221), indicating that quality, safety, and convenience matter more than distance alone.

Gender dynamics shaped construction: men built 57.5% of latrines, consistent with evidence from Odisha, India (Routray et al. 2015). Yet studies show sanitation outcomes improve when women and children participate in decision-making (Myers & Gnilo 2017). Community governance also played a role: initial CLTS discouraged sharing to promote ownership, and regulated sharing has been shown to reduce monitoring (Okullo et al. 2017).

Progression up the sanitation ladder was limited. Most households retained basic pit latrines, and improvements stagnated after withdrawal of NGO support (PCI). Similar stagnation after ODF attainment is reported in Zambia and India (Venkataraman & Shannon 2016; Lenai 2021).

Maintenance challenges latrine collapse, termite-damaged materials, unsafe pits, and poor cleanliness (faecal traces in 42% of latrines) reduced daily use. Studies highlight that safety, cleanliness, and comfort are critical motivators for sustained behaviour (Tyndale-Biscoe 2013; Cavill et al. 2015).

Vulnerable groups, including the elderly and physically challenged (4.39%), often avoided using latrines due to mobility limitations or fear of collapse issues also documented in Uganda and Zambia (Wilbur & Danquah 2015). Child faeces disposal remained unsafe, consistent with findings from Nepal and Indonesia (Odagiri et al. 2017; Celia 2018).

`

Demographic analysis showed that household size ($p = 0.008$), age ($p = 0.003$), and house type ($p < 0.001$) influenced consistent use, whereas construction was not significantly associated with demographics ($p = 0.477$). This indicates that sustained sanitation behaviour is shaped more by social and behavioural factors than by infrastructure alone.

Overall, Balaka's post-ODF trajectory reflects structural fragility, slow progression toward improved latrines, and persistent behavioural barriers. These findings underscore the need for targeted post-ODF support, technical reinforcement, and inclusive approaches that address vulnerable groups to reduce slippage and protect ODF gains.

5.2.3.2 Handwashing Facility Availability and Handwashing With Soap After Defecation

In Balaka, only 36.5% ($n = 160$) of households had a HWF, and a similar proportion 36.9% ($n = 162$**)** reported using them. Most facilities were improvised using recycled plastic bottles and were frequently damaged by animals such as goats, reducing their durability and functionality. The inadequate availability and fragility of HWFs undermined consistent HWWS, increasing vulnerability to sanitation-related infections. Comparable findings in Kenya show that low HWF availability contributes to increased OD even in ODF-certified communities (Maitabel et al. 2021).

Despite awareness of HWWS as a critical disease-prevention measure, only 24.7% ($n = 108$) of households consistently washed hands with soap after defecation. Key barriers included water scarcity in HWFs (24.8%, $n = 108$), cost of soap (24.8%, $n = 108$), and forgetfulness. The withdrawal of NGO support further reduced access to soap and maintenance of facilities, which affected sustenance of hygiene practices post-ODF without external reinforcement.

Regression analysis showed that marital status and religion significantly influenced HWF availability and HWWS ($p < 0.05$), while age, education, and ethnicity did not. ANOVA indicated

`

demographics significantly affected HWF availability (p = 0.005) but not consistent HWWS after defecation (p = 0.454). This suggests that while facility availability may be influenced by household characteristics, consistent HWWS is shaped more by socioeconomic factors, environmental constraints, and reinforcement mechanisms (Seksaria & Sheth 2014; Lawrence et al. 2016; Tessema 2017).

Nationally, reports indicate similar trends: 20% HWF coverage (MDHS 2016), 8% HWWS (UNICEF 2023), and 27% HWWS (Hinton et al. 2024). These figures highlight a negligible gap between sanitation facility availability and practice, reinforcing the need for durable HWF designs, affordable soap, water access, and consistent behaviour reinforcement, in line with SaniFOAM and SSBT determinants of Ability, Opportunity, and Motivation.

5.2.3.3 Influence of Knowledge and Attitude on Sanitation practices Four Years Post-ODF Certification

5.2.3.3.1 Knowledge and Practice: Latrine Construction and Use, HWF Construction and HWWS

Although knowledge of latrine construction, latrine use, HWF construction, and HWWS was high across households, this did not consistently translate into practice. While respondents clearly understood the health risks of open defecation, latrine reconstruction after collapse remained limited, primarily due to financial constraints, weak technical capacity, and competing household domestic priorities. Similarly, despite widespread awareness of HWWS, the low availability (36.5%) and poor functionality of HWFs restricted actual HWWS after defecation.

These patterns are consistent with findings from Kenya, Zambia, and Tanzania, where strong post-ODF knowledge does not guarantee sustained behaviour without enabling environments and

`

supportive social norms. In Balaka, persistent structural and economic barriers, combined with limited post-ODF institutional support, mean that knowledge alone, although necessary is insufficient to sustain sanitation and hygiene behaviour**.**

5.2.3.3.2 Attitude and Practice: Latrine Construction and Use, HWF Construction and HWWS

Communities in Balaka generally held positive attitudes toward latrine construction, latrine use, and hygiene practices, yet these attitudes did not consistently translate into sustained behaviour. Structural and economic constraints including recurrent pit collapse, limited materials, and competing household priorities led to delayed facility reconstruction and intermittent OD (Husna & Mailanie 2018; Junias et al. 2016). Poor-quality superstructures and inadequate privacy also affected use, particularly for fathers and daughters, further undermined latrine use in Kenya and Malawi (Routray et al. 2015; Hinton et al. 2024). From a SaniFOAM and SEM perspective, gaps in *opportunity*, *ability*, and social support limit sustained practice, while the SSBT Model emphasizes ongoing reinforcement and technical support post-ODF (Devine 2009)

Handwashing with soap demonstrated a similar disconnect between attitude and practice. Only 36.5% (n = 160) of households maintained functional HWFs, and just 24.7% (n = 108) consistently washed hands with soap after defecation (MDHS 2016; UNICEF 2023; Hinton et al. 2024). Barriers included broken facilities, water scarcity, and soap cost, highlighting that positive attitudes alone cannot sustain hygiene without consistent *opportunity* and *motivation*, key determinants in SaniFOAM (Seksaria & Sheth 2014; Lawrence et al. 2016; Devine 2009).

These findings align with evidence from Zambia, Kenya, and Tanzania, where favourable attitudes often fail to translate into practice when structural and economic barriers persist (Odagiri et al.

`

2017; Delea et al. 2019; Gebremariam et al. 2018). Overall, while attitudes in Balaka were encouraging, limited facility availability, poor durability, and weak post-ODF support constrained the translation of knowledge and attitude into consistent behaviour, reinforcing the need for sustained reinforcement strategies per the SSBT Model.

5.2.4 Community Stages of Behaviour Change Four Years After Open Defecation-Free Status Certification - The Transtheoretical Model, Stages of Change

Sustaining sanitation and hygiene behaviours after ODF certification requires understanding behavioural progression in the stages of behaviour change as conceptualized in the TTM. This section discusses the stage of behaviour change (Pre-contemplation, Contemplation, Preparation, Action, and Maintenance) readiness to change, and committed action to change., The TTM identifies five stages, through which communities adopt and sustain behaviours.

Integrating TTM with SaniFOAM, SEM, and the SSBT Model allows for a multi-level analysis of the drivers and barriers influencing adoption and long-term sustainability post-ODF behaviour in Balaka District. (Devine 2009, McLeroy et al. 1988)

5.2.4.1 Stages of Change in Latrine Construction and Use

Latrine construction in Balaka is predominantly in the Action Stage (Mean = 4.308), with most households constructing latrines following ODF certification. However, many latrines are basic and poorly maintained, reflecting partial progression toward the Maintenance Stage. Readiness to change is moderate (Mean = 9.340), and committed action is low (Mean = 0.027), indicating fragile adoption. SaniFOAM analysis suggests that while motivation is high, opportunity and ability are limited due to material scarcity and lack of technical support. SEM factors, including weak institutional follow-up and limited social reinforcement, further constrain long-term

`

adoption. Similar trends have been observed in Malawi and Tanzania, where initial CLTS interventions motivated construction, but long-term maintenance was hindered by economic and technical barriers (Chidziwisano et al. 2019; Odagiri et al. 2017). The SSBT Model emphasizes the importance of sustained technical support and community reinforcement to transition construction behaviours from Action to Maintenance.

Latrine use is also in the Action Stage (Mean = 4.335), with approximately 90% of households using latrines consistently. Readiness to change is high (Mean = 9.549), though committed action remains weak, suggesting that behaviours may regress without continued reinforcement. Positive social norms, accessibility of latrines, and household engagement contribute to sustained usage. Studies in Kenya and Ghana report similar findings, where strong community leadership and peer monitoring supported consistent latrine use post-ODF (Crocker et al. 2017; Kangwa 2017). SaniFOAM and SEM frameworks highlight that motivation, social opportunity, and interpersonal influence are key drivers, while SSBT strategies take stress continuous monitoring and personalized reinforcement to sustain behavioural adherence thereby positioning these behaviours within the Maintenance pathway.

5.2.4.2 Stages of Change in Handwashing Facility Construction and Handwashing with Soap After Defecation

Handwashing facility construction is in the Action Stage (Mean = 4.349), but coverage is limited (~36%), indicating partial adoption. Readiness to change is moderate, while committed action is low, reflecting that households construct HWFs inconsistently. SaniFOAM analysis shows motivation is present, but opportunity and ability are constrained by limited access to materials and weak prioritization. SEM highlights insufficient institutional support and weak coordination

`

across leadership structures. Similar patterns have been reported in Malawi and Tanzania, where temporary tippy taps were abandoned due to resource and monitoring limitations (Banda et al. 2022; Delea et al. 2019). The SSBT Model suggests that sustainable HWF adoption requires community-driven technical assistance, affordable durable materials, and social reinforcement mechanisms.

Handwashing with soap after defecation remains in the Pre-Contemplation Stage (Mean = 3.171). Despite high awareness (98%) of CLTS/ODF principles, only about 55% of households wash hands with soap consistently. Readiness to change is low (Mean = 6.660), and committed action is negative (Mean = -0.055), indicating minimal behavioural integration. Barriers include scarcity of functional HWFs, low prioritization of handwashing, and weak social norms. SaniFOAM highlights insufficient motivation, while SEM shows inadequate interpersonal and community influences to support habit formation. Similar findings in Ethiopia and Malawi reveal widespread knowledge of HWWS but limited practice due to weak reinforcement mechanisms (Gebremariam et al., 2018; Ng'ambi et al. 2020). The SSBT Model underscores the need for targeted interventions, including habit formation, environmental nudges (soap near latrines), leadership modelling, and community-led motivation to progress toward Action and Maintenance.

Overall, Balaka communities demonstrate strong initial adoption of latrine construction and usage but weak integration of HWWS indicating incomplete behaviour change. Latrine construction and use are predominantly in the Action Stage, with moderate to high readiness but weak committed action, highlighting the risk of regression without sustained support. The HWF construction is partially adopted, while HWWS remains in the Pre-Contemplation Stage, reflecting low readiness and negative committed action. Achieving long-term sanitation outcomes requires interventions extending beyond knowledge dissemination to habit formation, technical assistance, social and

`

institutional reinforcement, and ongoing community monitoring. Integrating TTM with SaniFOAM, SEM, and the SSBT Model provides a robust framework for understanding behaviour change pathways and designing sustainable post-ODF interventions.

5.3 Community Behaviour Change Determinants for Sustainable Sanitation After ODF Certification

The primary behaviours targeted by Community-Led Total Sanitation (CLTS) include cessation of OD and consistent HWWS after defecation. These practices are largely influenced by the availability and functionality of sanitation facilities, such as latrines and HWFs. This section examines the key determinants of community adoption and maintenance of CLTS-targeted behaviours, latrine and HWF construction, usage and handwashing with soap after defecation

5.3.1 Technological and Institutional Sanitation and Hygiene Behaviour Change Determinants

5.3.1.1 Stakeholder Involvement in Sanitation Programs

Stakeholder engagement in sanitation programming significantly influences latrine and HWF construction, latrine use, and HWWS after defecation. In Balaka, CLTS implementation involved community members, local and religious leaders, Government and NGO extension workers, and Village Health Committees. Local leaders exerted the strongest influence on behaviour, while extension workers and women contributed mainly to latrine construction and use. Planning meetings provided guidance and technical support, and statistical analysis confirmed a strong association between stakeholder involvement and HWF construction and HWWS ($p < 0.001$).

From the SaniFOAM perspective, stakeholders provide opportunity and motivation, enforcing social norms, offering reminders, and motivating communities to adopt and maintain sanitation

`

practices. At the SEM levels, traditional leaders enhance institutional and community support for sustained behaviour, as observed in Zambia (Kangwa 2017) and other studies (Tribbe et al. 2021). Reduced post-ODF monitoring by leaders diminishes these opportunities, underscoring the need for ongoing engagement to sustain HWF and handwashing practices.

5.3.1.2 Availability, Accessibility, and Affordability of Sanitation Facilities Construction Resources

The availability, accessibility, and affordability of materials are key determinants of latrine and HWF construction, toilet use, and HWWS ($p < 0.005$). In Balaka, materials such as soap, nails, and roofing plastic are locally available, but shortages of poles and rising costs hinder durable latrine and HWF construction. Statistical analysis showed that availability and affordability of resources strongly influenced HWF construction and HWWS ($p < 0.001$), but had less impact on latrine construction and use ($p > 0.05$). Similar constraints have been documented in India, Indonesia, Ethiopia, Rwanda, and Tanzania (O'Connell 2014; Routray 2017; Tameme 2021; Venkataramanan et al. 2018) According to SaniFOAM, availability, access to resources and their affordability represents an external opportunity factor, while self-efficacy shapes the ability to adopt promoted behaviours.

5.3.1.3 Information, Advice and Support Provision

Access to sanitation information and social support is critical for behaviour change. In Balaka, communities receive guidance from local and religious leaders, extension workers and masons. Channels include home visits, community meetings, awareness campaigns, leaflets, and media, providing technical knowledge on latrine and HWF construction and proper hygiene practices.

SaniFOAM identifies social support as an opportunity factor, while SEM situates information channels at the interpersonal, community, and institutional levels. Extension workers primarily

`

influence latrine and HWF construction, while religious leaders impact HWWS. Statistical analysis confirmed strong associations between information access and HWF construction/HWWS ($p < 0.001$). Personal follow-up (home visits, meetings, technical guidance) was more effective than mass campaigns, aligning with findings from Ghana and Malawi as well (Monney et al. 2015; WHO & UNICEF, 2017; Garn et al. 2016).

Post-ODF withdrawal of NGO support and inconsistent follow-up reduced reinforcement of latrine use and HWWS. Sustained behaviour requires continuous local forums, sensitization, and leadership to maintain ODF gains (Routray 2017; Harter & Mosler 2019).

5.3.1.4 Technical Skills

Household technical skills significantly influence sanitation behaviour. Many Balaka households construct latrines without skilled masons, leading to short-lived, poorly built latrines. Self-efficacy, emphasized in SaniFOAM, depends on access to technical skills and support (Devine 2009)

Regional evidence (India, Indonesia, Tanzania, Ethiopia) reflects Balaka's experience, where limited skills hinder durable sanitation infrastructure construction (O'Connell 2014; Routray 2017; Tameme 2021; Venkataramanan et al. 2018). Addressing provision of training, and enhancing local mason capacity are critical for sustaining sanitation behaviours and preventing ODF slippage.

In summary, sustaining sanitation and hygiene behaviours in Balaka depends on a combination of stakeholder involvement, resource availability and affordability, access to information, and technical skills. SaniFOAM highlights the importance of opportunity, motivation, and ability, while SEM situates these determinants at individual, interpersonal, community, and institutional levels. Weaknesses in material access, skills, economic capacity, and stakeholder follow-up limit HWF construction and HWWS, even when latrine coverage remains high. Long-term ODF

`

sustainability requires coordinated efforts addressing technical, economic, informational, and leadership gaps.

5.3.2 Social, Cultural, and Ecological Sanitation Behaviour Change Determinants

Human behaviour is strongly shaped by social and cultural environments, which are often spread across generations. Customs, practices, and traditions play a pivotal role in sustaining sanitation and hygiene practices after ODF certification. This section discusses social, cultural, and ecological determinants that influence sustained latrine and HWF construction, latrine use, and HWWS after toilet use. These determinants collectively shape the transition from OD to sustained sanitation, guiding communities up the sanitation ladder for long-term hygiene practices.

5.3.2.1 Social Determinants

In Balaka, social relationships and support networks strongly influence sanitation behaviours. Latrine and HWF construction were predominantly undertaken by couples, with Government extension workers providing motivational support rather than hands-on construction. Couples had a positive effect on latrine use and HWWS, emphasizing the importance of shared household responsibility. Statistical analyses revealed that taking responsibility and motivating others strongly correlated with HWF construction and HWWS ($p < 0.001$), though not with latrine construction or use ($p > 0.05$).

Family members, relatives, and friends initially supported households, particularly the elderly and physically challenged, during latrine and HWF construction for ODF certification. However, this support often ceased immediately after certification, contributing to slippage and reduced sustainability. This withdrawal is likely due to the initial pressure to achieve ODF targets and

`

discontinuation of local by-law enforcement post-ODF certification. Studies in Malawi and other contexts indicate that family and peer support can generate a "snowball effect," motivating wider community participation and consistent sanitation behaviour (Harter & Mosle 2019).

Other social factors, such as latrine proximity and accessibility, were critical. Most latrines (93.1%) were located within 10 meters of households and accessible at night. Proximity significantly influenced HWF construction ($p < 0.001$) and HWWS ($p = 0.034$). Larger households, however, faced challenges during peak usage times, sometimes reverting to OD (Asnake & Adane 2020; Osumanu et al. 2019). The presence of faeces within and around latrines (42%) further discouraged use, underscoring the importance of maintenance, social monitoring, and community-led reinforcement (Mirabel et al. 2021).

Community enforcement mechanisms such as CLTS triggering, public shaming, and local bylaws initially reinforced social norms for latrine and HWF adoption. Leadership from couples, extension workers, and local authorities played a crucial role ($p < 0.001$). Post-ODF, withdrawal of NGO and local support contributed to slippage, highlighting the need for sustained social reinforcement in line with the proposed SSBT Model, which emphasizes continuous motivation, peer support, and personalized behavioural reinforcement.

Overall, social determinants such as family support, peer encouragement, and leadership significantly influence HWF construction and HWWS, whereas latrine use is more strongly affected by beliefs and broader cultural norms. These observations align with SaniFOAM, which identifies social norms as key determinants of behaviour, and the SEM, emphasizing interpersonal and community-level influences.

`

5.3.2.2 Cultural Determinants

Cultural and religious beliefs in Balaka significantly shape sanitation behaviours. The influence of cultural norms (55.3%) exceeds that of religious beliefs (24.7%) on latrine construction (51.4%), latrine use (53.0%), HWF construction (44.1%), and HWWS (39.5%).

Religious practices, particularly among Muslim communities, often involve anal cleansing with water, which reduces perceived need for separate HWFs. This has resulted in lower HWF prevalence and HWWS (O'Connell 2014). Conversely, cultural norms have demonstrated a strong capacity to encourage sanitation behaviour, promoting latrine use and HWF construction when interventions are culturally adapted (Coffey et al. 2017).

From a SEM perspective, culturally sensitive interventions reinforce social norms and can operate at multiple levels, community, institutional, and national particularly when supported by faith-based organizations. Misconceptions about religious or cultural practices may inhibit safe sanitation behaviour, highlighting the need for context-sensitive interventions that align sanitation promotion with local beliefs (Avvannavar & Mani 2008; O'Reilly et al. 2017).

By integrating cultural and religious beliefs into sanitation programming, communities can enhance motivation, accessibility, and adherence to safe practices. This approach aligns with the proposed SSBT Model, which advocates personalized reinforcement and cultural alignment to maintain long-term sanitation behaviour beyond ODF certification.

`

5.3.2.3 Ecological Determinants

Ecological conditions, including soil type, water table, and water availability, strongly influence sanitation behaviours. In Balaka, sandy soils (50.9%) and rocky soils (21.2%) pose challenges to latrine construction, while high water tables increase the risk of pit collapse, particularly during the rainy season (O'Connell 2014). Boreholes were the primary water source, but availability declines in the dry season (5.9%), limiting HWWS and HWF maintenance.

Statistical analysis indicated that ecological conditions significantly influenced latrine and HWF construction and HWWS ($p < 0.001$), but had no significant effect on latrine use ($p > 0.05$). This suggests that environmental factors primarily impact infrastructure development and maintenance, rather than behaviour adoption per se. According to SaniFOAM, ecological factors represent external opportunity constraints, while the SEM situates them at the environmental level, interacting with household and community determinants to either facilitate or impede sanitation behaviour.

Water scarcity during dry periods (12.3%) constrains HWWS frequency as households prioritize water for drinking and cooking. Conversely, regions with reliable water access demonstrate higher HWWS compliance (Malawi National Sanitation Policy 2012; Cagnet et al. 2022). Technical assistance, durable construction materials, and consistent water availability are essential for sustaining sanitation infrastructure and behaviour, reflecting the integrated approach of the SSBT Model.

In summary, the findings from Balaka indicate that sustained sanitation behaviour is influenced by a complex interplay of social, cultural, and ecological determinants. Social support, family and

`

peer networks, and enforcement of local norms drive latrine use and HWWS, particularly when reinforced continuously. Cultural and religious beliefs shape perceptions, practices, and adoption of HWFs, requiring context-sensitive interventions. Ecological constraints, including soil type and water availability, determine the feasibility and durability of sanitation infrastructure.

The integration of SaniFOAM, SEM, and the SSBT Model highlights the necessity of multi-level, culturally adapted, and technically supported approaches to maintain sanitation and hygiene gains beyond ODF certification.

5.4 Community Behaviour Change Dynamics Beyond ODF Certification

The transition from ODF status to sustained practices requires more than infrastructure availability. It demands a shift in community ideology, motivation, and ownership. Evidence from Balaka indicates that while CLTS effectively mobilized collective action and social cohesion during ODF attainment phase, these dynamics gradually weakened once external facilitation and recognition diminished. As a result, the community's behavioural momentum slowed, leading to varying degrees of ODF slippage characterized by inconsistent latrine use and declining HWWS after defecation. Understanding these post-ODF behavioural trajectories requires an exploration of the deeper ideological shifts, motivational transformations, community ownership and sustainability pathways that reinforce long-term sanitation sustainability.

5.4.1 Ideological Shifts and Value Reorientation

Behaviour change beyond ODF involves an internalized transformation of values where sanitation practices become embedded within community identity, dignity, and self-respect. In Balaka, few households demonstrated this ideological reorientation by maintaining sanitation facilities without

`

external pressure, reflecting a transition from compliance-based behaviour to self-motivated hygiene consciousness. However, in most areas, sanitation behaviour remained externally driven and dependent on community enforcement structures established during CLTS triggering. This aligns with the SSBT Model's principle that sustainable sanitation emerges when behavioural compliance evolves into normative conviction where individuals perceive sanitation as a moral and social responsibility rather than a program requirement.

5.4.2 Motivational Dynamics and Habit Reinforcement

In Balaka, post-ODF motivation declined once community verification and external rewards diminished. Many households that had previously constructed latrines and HWFs did not maintain them, citing lack of follow-up or incentives. According to the TTM, this reflects a failure to progress from the *action* stage to the *maintenance* stage of behaviour change. The SSBT Model addresses this by emphasizing continuous motivational reinforcement through positive feedback circles, peer modeling, and locally embedded recognition systems. Sustained motivation is further enhanced when community members associate sanitation with tangible benefits such as reduced illness, social pride, thus converting extrinsic triggers into intrinsic drivers of behaviour.

5.4.3 Collective Efficacy and Community Ownership

Community ownership remains central to sustaining sanitation achievements. The findings show that active and motivated leadership demonstrated stronger sanitation outcomes. This underscores the importance of collective efficacy, where communities perceive their joint capacity to maintain sanitation standards as both attainable and socially valued. The SSBT Model situates community ownership within a participatory governance framework, linking local leadership, social norms, and institutional support as mutually reinforcing elements of sustainable sanitation behaviour.

`

5.4.4 Sanitation Sustainability Pathways and Policy Implications

Sustainable sanitation in Balaka is driven by the interaction of multiple pathways; behavioural, social, technical, institutional, and environmental that collectively reinforce long-term practices. The behavioural pathway highlights that knowledge and attitudes alone are insufficient without motivation and opportunity, while the social pathway emphasizes the role of community norms and peer influence in sustaining behaviours. Technical and environmental pathways show that durable facilities and adaptive infrastructure are critical for continued latrine use and handwashing, and institutional pathways underscore the need for consistent post-ODF support, supervision, and capacity building.

Overall, the findings indicate that weaknesses in any pathway can lead to slippage, whereas coordinated, multi-level interventions can reinforce sustainable sanitation. This integrated approach, captured in the SSBT Model, demonstrates how behavioural, social, technical, institutional, and environmental factors must work together to sustain sanitation and hygiene behaviours beyond initial ODF certification.

The post-ODF phase presents an opportunity to institutionalize sustainability through locally adapted mechanisms such as periodic community reviews, peer learning platforms, and integration of sanitation monitoring into existing governance systems. Balaka's experience demonstrates that without structured follow-up, ODF achievements risk regression. Hence, policy and programmatic focus should extend beyond ODF declaration to continuous capacity building, innovation support, and reinforcement of behavioural norms. Within the SSBT framework, this translates into a dynamic system of sustained engagement linking personal motivation, community solidarity, and institutional accountability to ensure long-term sanitation resilience.

`

5.5 Integrating Sustainability Within the SSBT Model: A Pathway to Long-Term Sanitation Behaviour Change

The Sustainability (S) element weaknesses identified in the SaniFOAMS framework became evident in Balaka, where sanitation behaviours declined sharply after ODF certification. The HWWS dropped from over 95% to 24.7%, and latrine use decreased by 11%, largely due to weak reinforcement, limited institutional follow-up, and persistent environmental challenges. The SSBT Model was developed to address these gaps by strengthening long-term behaviour maintenance. It enhances motivation through household feedback systems, recognition events, and behaviour commitment tools, supporting communities to move from the TTM Action to Maintenance stage. It also restores Opportunity by re-engaging local leaders, formalizing monitoring through community structures, and embedding sanitation into governance systems, aligning with SEM. To overcome technical and economic barriers, the SSB model promotes local mason training, durable construction options, and micro-financing. By institutionalizing multi-level reinforcement, continuous monitoring, and community ownership, the SSBT Model operationalizes the "S" in SaniFOAMS and provides a structured pathway for sustaining behaviour change in Balaka.

In summary, sustaining sanitation post-ODF is not a single milestone but an ongoing process of reinforcing motivations, strengthening collective norms, and continually adapting to emerging challenges. The SSBT Model comprehensively supports this progression, positioning sustainability as dynamic interactions between individual commitment, community governance structures, and supportive institutional systems. Long-term sanitation gains in Balaka depend not only on the availability of infrastructure but also on cultivating a deeply rooted, community-led culture of sanitation and hygiene that persists well beyond ODF certification.

`

CHAPTER SIX : CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Balaka district in Malawi achieved ODF certification, marking a significant milestone in its sanitation efforts. However, within two years, the district experienced ODF slippage, indicating that the necessary behavioural changes for sustainable sanitation practices were not firmly established. This study aimed to analyze the dynamics of behaviour change to maintain sanitation practices in Balaka after ODF certification, focusing on latrine construction and use, HWF construction and HWWS after defecation. To explore these dynamics, the study utilized the SaniFOAMS framework alongside the TTM and the SEM. Key objectives included assessing community knowledge, attitudes, and practices regarding ODF and community stages of behaviour change, understanding the factors influencing behaviour change, and developing a model for sustaining sanitation services and hygiene practices post-ODF certification.

6.1.1 Knowledge, Attitudes and Practices of community on Community-Led Total Sanitation and Stage of Behaviour Change after ODF Certification

The community showed high awareness of CLTS and ODF standards, with 98% recognizing the importance of latrines for disease prevention. However, there was a significant gap between this knowledge and the actual practice of these behaviours. Latrine coverage dropped from over 95% during certification to 89% post-ODF, and HWWS practices fell to 24.7%. While attitudes towards sanitation were generally positive, these alone were insufficient for sustaining behaviour, especially when latrine quality and comfort were compromised. Challenges in constructing and

`

using HWFs and adopting HWWS were influenced by factors such as gender, economic status, and ethnicity.

Despite reaching the TTM's "Action" stage for latrine use, households showed limited commitment to maintaining or improving latrine quality, particularly those built with substandard materials. Resource limitations and lack of motivation hindered HWWS practices, which remained at the "Contemplation" stage, highlighting a disconnect between knowledge and sustained behaviour.

6.1.2 Behaviour Change Dynamics and Pathway to Sustainable Sanitation

Sanitation and hygiene behaviours in Balaka are shaped by dynamic interactions between individual, social, technical, institutional, and environmental factors. The analysis using SaniFOAM, SEM, and TTM revealed that many behaviours remained stagnant in the "Action" or "Contemplation" stages, obstructing progress toward sustainable sanitation. Behavioural dynamics show that while knowledge of open defecation risks and handwashing benefits was high, handwashing with soap remained in the “Action” or “Contemplation” stages, reflecting gaps in motivation, habit formation, and opportunity. Cultural practices, facility durability, seasonal water shortages, and weak post-ODF support further influenced these dynamics, contributing to partial adoption and slippage.

The study demonstrates that multiple pathways mediate these dynamics. The behavioural pathway shaped readiness and commitment to maintain practices, while the social pathway reinforced behaviours through community norms and peer monitoring. The technical and environmental pathways affected feasibility and consistency, as broken latrines or water scarcity limited adherence. The institutional pathway highlighted the importance of continuous supervision,

`

follow-up, and capacity building to sustain behaviours. Together, these pathways explain the successes and gaps observed in Balaka, emphasizing that coordinated, multi-level interventions as captured in the SSBT Model are essential for long-term, community-driven sanitation and hygiene sustainability.

6.1.3 Development of the Sustainable Sanitation Behaviour Transformation (SSBT) Model

To address the gap in behavioural sustainability, the study developed the Sustainable Sanitation Behaviour Transformation (SSBT) Model, integrating SaniFOAM, TTM, and SEM. This model emphasizes five domains: targeting specific behaviours, creating access opportunities, enhancing capabilities, fostering motivation, and ensuring sustainability through structured follow-ups. The SSBT Model serves as a roadmap for practitioners and policymakers to change communities from temporary compliance to enduring sanitation practices, aligning with Malawi's national sanitation goals and global objectives. I.e. Malawi's Vision 2063 MIP-1, Sustainable Development Goal 6.2, which targets the eradication of open defecation by 2030.

6.2 Contribution of the Study

6.2.1 Contribution to Knowledge

The study highlights the importance of sustaining sanitation behaviours beyond achieving ODF status, providing localized evidence on the challenges and factors influencing rural sanitation in Balaka. It addresses a significant and underexplored gap in the existing literature by emphasizing not only the attainment of ODF status but also the long-term sustainability of sanitation and hygiene behaviours. It highlights the necessity of behavioural reinforcement, moving beyond the mere provision of infrastructure to ensure sustained community engagement. This research offers

`

new empirical insights into how personal, technical, social, ecological, and institutional elements influence the continuous use of latrines and HWWS. It enhances the understanding of the interplay between social norms, self-efficacy, and community support structures that affect HWWS and latrine utilization, thereby offering a pathway toward sustainable sanitation post-ODF in Balaka.

6.2.2 Contribution to Theory

The introduction of the SSBT Model offers a comprehensive framework for understanding and promoting sustained sanitation behaviours across multiple levels. It is an innovative framework that integrates the SaniFOAMS framework, the Trans theoretical Model, and the Social-Ecological Model. The model provides a comprehensive approach to understanding and fostering sustained sanitation behaviours across individual, household, community, and institutional levels. The study illustrates how various behaviour change theories can be combined, contextualized, and synergistically applied to address community challenges associated with CLTS that extend beyond the initial triggering phases.

6.2.3 Contribution to Practice

The findings provide actionable strategies for practitioners, emphasizing community-driven follow-up mechanisms and behaviour-centered approaches to reinforce hygiene practices. The study identifies key drivers and barriers for targeted community follow-up, including the use of hygiene champions, awareness campaigns, and refresher training sessions. The development and application of the SSBT Model equip practitioners with a functional framework to guide community-based interventions. This model emphasizes the importance of community-driven follow-up mechanisms, local innovations, and behaviour-centered approaches to reinforce hygiene

`

practices. Field workers, NGOs and Local Governments can utilize these findings to design follow-up strategies, such as promoting hygiene champions, conducting refresher CLTS sessions, and providing affordable hand-washing solutions that are tailored to local needs and conditions. The practical can be effectively implemented in real-world programming, highlighting critical leverage points such as reinforcing social norms, enhancing technical support all of which are essential for assigning post-ODF interventions that are attuned to local realities.

6.2.4 Contribution to Policy

The research provides timely input for improving Malawi's National Sanitation Policies. It advocates for comprehensive policies that support post-certification sustainability, emphasizing the need for integrated approaches across sectors to ensure ongoing post-ODF follow-up mechanisms, re-verification protocols, and local government empowerment. Support for sanitation initiatives the study also advocates for policy shifts from short-term project-based interventions to long-term sustainability-focused frameworks aligned with SDG 6.2 and Malawi 2063. It outlines the limitations of current ODF policies that do not include mechanisms for post-certification sustainability and advocates for comprehensive and continuous community support. The findings emphasize the necessity for policies that surpass infrastructure provision, encompassing behaviour change reinforcement, social accountability structures, and intersectional collaboration.

6.3 Recommendations

To enhance sustainable sanitation practices following ODF certification, a comprehensive approach is recommended, informed by the behaviour change dynamics articulated in the SaniFOAMS, TTM, and SEM frameworks.

`

Enhancement of Institutional Support: Encouraging HWWS is a deeply personal behaviour that necessitates intrinsic motivation, positive attitudes, and consistent practice. Therefore, Government agencies and Non-Governmental organizations must devise long-term, sustainable monitoring and support strategies to prevent the reversion of behaviours once external programs conclude. In addition, training local artisans and masons can facilitate the availability of affordable, high-quality construction and maintenance services for latrines and hand-washing facilities. Implementing biannual re-verification exercises and conducting annual ODF re-certification can further reinforce positive sanitation behaviours within communities.

Expansion of Community-Led Approaches: Empowering local leaders, including traditional and religious figures, as well as Village Health Committees and Water Point Committees, is essential for ongoing health promotion and the reinforcement of behavioural change post-ODF certification. Furthermore, integrating gender-sensitive sanitation programs will assist in addressing inequalities in household sanitation and promoting inclusive participation. To enhance access to sanitation resources, the introduction of microloans may improve the affordability of essential materials, such as latrine components and soap, thereby ensuring the continued latrine use and HWWS.

Addressing Social and Cultural Barriers: It is imperative to conduct culturally sensitive behaviour change campaigns that address traditional beliefs which inhibit proper sanitation practices. Engaging with religious sectors or faith-based communities can be instrumental in promoting HWWS and encouraging hygienic behaviours that align with community values. These culturally relevant approaches will enhance the significance and adoption of CLTS.

Advancement of Policy and Monitoring Mechanisms: There is an urgent need to strengthen post-ODF activities, which include consistent follow-ups, monitoring, supervision, re-verification,

`

and re-certification. This can be achieved by leveraging existing local structures, such as Area Development Committees, Village Development Committees, and Village Health Committees, Water Point Committees, and community volunteers. Sanitation policies should also be revised to extend the observation period prior to ODF certification. A more rigorous verification and re-verification process will ensure that declared ODF areas have genuinely sustained changes in sanitation behaviour. Additionally, increasing awareness and enforcing sanitation-related laws, by-laws, policies, and standards will help solidify progress and accountability.

Operationalization of the SSBT Model: To sustain long-term sanitation behaviour, the SSBT Model should be integrated into program design and implementation. This involves coordinated multi-level interventions targeting behavioural, social, technical, institutional, and environmental pathways. Programs should link individual knowledge and motivation with community norms, durable infrastructure, institutional support, and environmental adaptation. Operationalizing the model ensures that evidence-based insights guide practical, context-specific interventions that reinforce consistent latrine use, HWWS and broader sanitation behaviours post-ODF certification.

6.4 Areas for Further Research

Building upon the findings and limitations identified in this study, several avenues are suggested for future research to enhance the understanding and effectiveness of sustained sanitation and hygiene interventions aimed at promoting behaviour change. Despite the progress made in achieving Open Defecation Free status, certain areas remain underexplored and require further investigation. There exists a limited understanding of how sanitation infrastructure, specifically the construction of toilets and hand-washing facilities accommodates the needs of the elderly, individuals with disabilities, and those with chronic illnesses. These vulnerable groups often

`

confront unique barriers, necessitating additional research to evaluate their contributions and requirements within the context of CLTS and post-ODF sustainability. Such insights would facilitate the development of more inclusive and equitable interventions.

Further exploration is warranted to comprehend the influence of religious norms, particularly among Muslim communities, on hand washing with soap behaviours and anal cleansing practices. These norms may significantly affect the sustainability of ODF status and merit in-depth analysis to inform the design of culturally responsive interventions.

The integration of mobile technologies presents an innovative opportunity for real-time monitoring of ODF-certified areas. Future studies should evaluate the feasibility, effectiveness, and community acceptance of utilizing digital tools for tracking sanitation services and hygiene practices, particularly in rural settings. This would enable timely interventions and ensure ongoing accountability in maintaining sanitation advancements.

Future research should also employ longitudinal designs to monitor behavioural changes over time. Such an approach would yield deeper insights into the evolution of sanitation services and hygiene practices following ODF certification. Expanding research to incorporate the perspectives of local Government entities, implementing agencies, and policymakers would provide a more holistic understanding of systemic enablers and barriers to post-ODF sustainability, thereby reinforcing the institutional dimension of the Social-Ecological Model.

6.5 Summary

This study highlights that sustaining sanitation and hygiene behaviours after ODF certification in Balaka remains a complex challenge beyond the initial construction of latrines and HWFs. While

`

CLTS has driven positive change, lapses in latrine use especially HWWS after defecation reveal gaps in long-term adoption. Using the SaniFOAMS, TTM and SEM key factors such as knowledge, attitudes, motivation, norms, affordability, and policy enforcement were identified as critical to sustainability.

The findings emphasize the need for continuous support, community-led strategies, and stronger policy alignment with the NSHS, Malawi 2063, MIP-1, and SDG 6.2. Without sustained technical, social, and institutional reinforcement dynamics, progress may reverse. The proposed SSBT Model offers a multi-level, theory-driven framework to sustain improvements. Integrating this model into policy and practice is vital for lasting sanitation behaviour change beyond ODF certification in Balaka.

`

REFERENCES

Abebe, T. A & Tucho, GT 2020, 'Open defecation-free slippage and its associated factors in Ethiopia: A systematic review', *Systematic Reviews*, *9*(1), 252–267. https://doi.org/10.1186/s13643-020-01511-6

Abubakar, IR 2018. 'Exploring the determinants of open defecation in Nigeria using demographic and health survey data', *Science of the Total Environment*, 637-638, 1455– 465. https://doi.org/10.1016/j.scitotenv.2018.05.104

Alhassan, A & Anyarayor, BK 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. https://www.ajol.info/index.php/jdcs/article/view/174596\

Amoah, A & Addoah, T 2021, 'Does environmental knowledge drive pro-environmental behaviour in developing countries? Evidence from households in Ghana', *Environment, Development and Sustainability* 23 (2), 2719–2738.

Asfaw, B, Azage, M & Gebregergs, GB 2016,'Latrine access and utilization among people with limited mobility: A cross sectional study', *Archives of Public Health*, *74*. https://doi.org/10.1186/s13690-016-0120-5.

Ashenafi, T, Dadi, AF, & Gizaw, Z 2018, 'Latrine utilization and associated factors among Kebeles declared open defecation free in Wondo Genet district, South Ethiopia', *Journal of Health and Environmental Sciences*, 5(5), 43-51.

`

Asnake, D, Adane, M 2020, 'Household latrine utilization and associated factors in semi- urban areas of north eastern Ethiopia. *PloS one.* 2020; 15(11):e0241270. https://doi.org/10.1371/journal.pone.0241270

Astuti, DF 2013, 'Factors associated with the practice of open defecation in the Sukamaju Village Rancakalong Sub-District of Sumedang District' Thesis, Semarang: School of Public Health, Diponegoro University.

Avvannavar, S & Monto, M 2008, 'A conceptual model of people's approach to sanitation', T*he Science of the total environmen*t. 390. 1-12. 10.1016/j.scitotenv.2007.09.018.

Bandura, A 1977, '*Social Learning Theor',* Englewood Cliffs, NJ: Prentice-Hall

Bateman, M., & Engel, S. (018. To shame or not to shame—that is the sanitation question. Development Policy Review, 36(2), 155-173. 10.1111/dpr.12317

Bhatt, N, Budhathoki, SS, Lucero-Prisno, DE, Shrestha,G, Bhattachan,M, Thapa, J, Sunny, AK, Upadhyaya, P, Ghimire, A, & Pokharel, PK 2019, ' What motivates open defecation? A qualitative study from a rural setting in Nepal', *PLoS ONE*, *14*(7), 1– 15. https://doi.org/10.1371/journal.pone.021924

Boisson, S, Engels, D, Gordon, BA, Medlicott, KO, Neira, MP, Montresor, A, Solomon, Bokea, JO 2020, 'Implementation of Community Led Total Sanitation Program in Kajiado County, Kenya' http://ir-library.ku.ac.ke/handle/123456789/21245

`

Bongartz, P, Vernon, N, & Fox, J 2016, 'Sustainable Sanitation for All: Experiences, challenges, and innovations', Rugby, UK: *Practical Action Publishing,* http://dx.doi.org/10.3362/9781780449272>

Bramley, S & Breslin, E 2010, 'Sanitation as a Business: A new spin on the challenge of sanitation Operation and Maintenance', *Sustainable Sanitation Practice, 2*.

Busienei, PJ, Ogendi, GM, Mokua, MA 2019, 'Open Defecation Practices in Lodwar, Kenya A Mixed-Methods Research' , *Environmental Health Insights*. 2019;13. doi:10.1177/1178630219828370

Busienei, PJ, Ogendi, GM, & Mokua, MA 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. https://doi.org/10.1177/1178.630219887960

Busienei, PJ, Ogendi, GM, & Mokua, MA 2019, 'Open defecation practices in Lodwar, Kenya: a mixed-methods research. *Environmental health insights*, *13*, 1178630219828370.

Cagnet, DL, 2022, 'Facilitators to Becoming and Remaining Open Defecation Free in Uganda: Implications for Community-Led Total Sanitation Programming', Digital Commons @ ACU, Electronic Theses and Dissertations. Paper 447.

Cairncross S, Hunt, C, Boisson S, Bostoen K, Curtis V, Fung IC, Schmidt. WP 2010, 'Water, sanitation and hygiene for the prevention of diarrhoea', *Int J Epidemiol*. 2010 Apr; 39 Suppl 1(Suppl 1):i193-205. doi: 10.1093/ije/dyq035. PMID: 20348121; PMCID: PMC2845874.

`

Celestine, N 2021, '*What Is Behaviour Change in Psychology*? 5 Models and Theories, viewed 20 July 2020, https://positivepsychology.com/behaviour-change/#theories

Callaghan, P, Khalil, E, & Morres, I 2010, 'A prospective evaluation of the Transtheoretical Model of Change applied to exercise in young people', *International Journal of Nursing Studies*, Vol. 47 No. 1, pp. 3-12.

Cavill, S, Chambers, R & Vernon, N, 2015, 'Sustainability and CLTS: Taking stock', *Frontiers of CLTS: Innovations and Insights* 4, Institute of Development Studies, Brighton

Cole, B 2013, '*Participatory design development for sanitation'*, *Frontiers of CLTS:Innovations and Insights* 1, Institute of Development Studies, Brighton.

Cole, B 2015, *'Going beyond ODF: Combining sanitation marketing with participatory approaches to sustain ODF communities in Malawi'*, Eastern and Southern Africa Sanitation and Hygiene Learning Series, UNICEF New York NY, www.communityledtotalsanitation.org/sites/communityledtotalsanitation.

Conner, M & Norman,P 2007, *'Predicting health behaviour : research and practice with social cognition models (*2nd ed.)', Open University Press.

Contzen, N, & Mosler, H-J 2015, '*The RANAS approach to systematic behaviour change. Methodological Fact Sheet 1*', Dübendorf, Switzerland: Eawag, Swiss Federal Institute of Aquatic Science and Technology.

Coombes, Y, Devine, J 2010, '*Introducing FOAM: A Framework to Analyse Handwashing Behaviours to Design Effective Handwashing Programs',* The World Bank, Water and Sanitation Program, Washington DC.

Crocker J, Rowe, R 2015, '*Community-led Total Sanitation in Ethiopia: Findings from a Situational Assessment' , viewed 20 July 2020,* http://waterinstitute.unc.edu/files/2015/03/situational-.assessment-ethiopia-2015-02.pdf

Crocker J, Saywell, D, Bartram, J 2017, 'Sustainability of community-led total sanitation outcomes: Evidence from Ethiopia and Ghana', *Int. J. Hyg. Environ. Health* 2017, *220*, 551–557. https://doi.org/10.1016/j.ijheh.2017.02.011 PMID: 28522255

Curtis, V, & Cairncross, S 2013, 'Effect of washing hands with soap on diarrhoea risk in the community: a systematic review', *Lancet Infect Dis* 3(5):275-81

Davis, A, Javernick-Will, A & Cook, SM 2019, 'The use of qualitative comparative analysis to identify pathways to successful and failed sanitation systems', *Sci. Total Environ*. 2019, 663, 507–517. [CrossRef] [PubMed]

De Buck, E, Van Remoortel, H, Hannes, K, Govender, T, Naidoo, S, Avau B, et al. 2017, 'Approaches to promote hand-washing and sanitation behaviour change in low- and middle-income countries: A mixed method systematic review', *Campbell Systematic Reviews*. 2017;13: 1–447 Designs and Plan International, www.communityledtotalsanitation.org/resource/odf-sustainability-study-plan

`

Devine, J 2009, '*Introducing SaniFOAMS: A framework to analyse sanitation behaviour s to design effective sanitation programs',* Global scaling up sanitation project. World Bank, Water and Sanitation Program (WSP), USA. viewed 20 July 2020http://www.wsp.org/sites/wsp.org/files/publications/GSP_SaniFOAMS.pdf

Di Noia. J, Prochaska. JO 2010, ' Mediating Variables in a Transtheoretical Model Dietary Intervention Program', *Health Education & Behaviour*. 2010;37(5):753-762. doi:10.1177/1090198109334897

Dozois, DJA & Dobson, KS. (Eds.) 2004, 'The prevention of anxiety and depression: Theory, research, and practice*",* American Psychological Association. viewed 20 July 2020 https://doi.org/10.1037/10722-000

Dreibelbis, R, PJ, Winch, E, Leontsini, KRS Hulland, PK. Ram, LU,,Unicomb & SP,Luby 2013, 'The Integrated Behavioural Model for Water, Sanitation, and Hygiene: A Systematic Review of Behavioural Models and a Framework for Designing and Evaluating Behaviour Change Interventions in Infrastructure-restricted Settings' *BMC Public Health* 13: 1015. http:// www.biomedcentral.com/1471-2458/13/1015

Dubik, SD, Addo, HO, Luke, O, Eugenia, A, Amshawu, A & Kwasi, NA 2018, 'Food Hygiene Awareness and Environmental Practices among Food Vendors in Basic Schools at Kintampo Township, Ghana' , *Food and Public Health, 8, 13-20.*

Ejemot-Nwadiaro, RI, Ehiri, JE, Arikpo D, Meremikwu, MM, Critchley, JA 2021, 'Hand-washing promotion for preventing diarrhoea', *Cochrane Database of Systematic Reviews 2021,* Issue 1. Art. No.: CD004265. DOI: 10.1002/14651858.CD004265.pub4.

`

Elisabeth-Ingo, K. Jonas, B, Andersson, G, Lunner, T & Laplante-Lévesque, A 2016, 'Measuring motivation using the transtheoretical (stagesof change) model: A follow-up study of people who failed an online hearing screening', *International Journal of Audiology,* 55:sup3, S52-S58, DOI:0.1080/14992027.2016.1182650

Esrey, SA 1996, 'Water, Waste, and Well-Being: A Multicountry Study' *American Journal of Epidemiology.;*143(6):608–23. pmid:8610678

Evans, BE, Colin, C, Jones, H et al. 2009, 'Sustainability and equity aspects of total sanitation programmes - A study of recent WaterAid-supported programmes in three countries: global synthesis report', Report. WaterAid , London.

Ficek, F, and J. Novotný 2019, 'Comprehending ractitioners'Assessments of Community-led Total Sanitation', *HealthPromotion International34 (6): e129–e138. doi:10.1093/heapro/day070*

Finck-Barboza, C, Monteiro, SM, Barradas, SC, Sarmiento, OL, Rios, P, Ramirez, A, Mahecha, MP & Pratt, M 2013*,* "Physical activity, nutrition and behaviour change in Latin America: a systematic review*', Global health promotion,* Vol. 20, 4_suppl, pp. 65-81.

Finck, C & Monteiro, Sarojini & Barradas, Susana & Sarmiento, Olga & Rios, Paola & Ramirez, Andrea & Mahecha, Maria & Pratt, Michael 2015, Finck Physical activity, nutrition and behaviour change in Latin America a systematic review.

Fleming,W, King, B, Robinson, K, Wade, E, Erickson B, Delie J, et al. 2022, ' Is there no "I" in team? Potential bias in key informant interviews when asking individuals to represent a collective perspective', *PLoS ONE* 17(1): e0261452. https://doi.org/10.1371/journal.pone.0261452

`

Garn, JV, Sclar, GD, Freeman, MC, Penakalapati, G, Alexander, KT, Brooks, P, Rehfuess, EA, Boisson, S, Medlicott, KO, Clasen, TF 2017, 'The impact of interventions on latrine coverage and latrine use: A systematic review and meta-analysis'. *Int. J. Hyg. Environ. Health*, *220*, 329–340. doi: 10.1016/J.IJHEH.2016.10.001

Gebremariam TB, Kalayu, BM and Neway,TK 2018, '*Substance Abuse Treatment, Prevention, and Policy* 13:13', https://doi.org/10.1186/s13011-018-0150-

Gebremariam, B, Asmelash, B & Tetemke, D 2019, 'Determinants of sanitary status among food establishments in urban setup in Adwa town, Tigray, Ethiopia: a cross-sectional study', *BMC Res Notes* 12, 399 . https://doi.org/10.1186/s13104-019-4435-5

Gensch, R & Tillett, W 2019, 'Strengthening sanitation and hygiene in the wash systems conceptual framework. Considerations for evolution of wash systems, concepts and frameworks, and examples of systems strengthening', Discussion Paper, viewed 20 July 2020, https://www.aguaconsult.co.uk/wp-content/uploads/ssi_SH-discussion-paper_final-1.pdf

Gizaw, Z & Addisu, A 2020, 'Evidence of Households' Water, Sanitation, and Hygiene (WASH) Performance Improvement Following a WASH Education Program in Rural Dembiya, Northwest Ethiopia', *Environmental health insights*, *14*, 1178630220903100. https://doi.org/10.1177/1178630220903100

Gordali,M, Bazhan, M, Ghaffari, M, Omidvar, N & Rashidkhani, B 2021, 'The effect of TTM-based nutrition education on decisional balance, self-efficacy and processes of change for fat intake*',* DOI 10.1108/HE-10-2020-0095 Accessed at .:https://www.emerald.com/insight/0965-4283.htm

`

Government of Malawi 2011, '*Open Defecation Free Strategy, Ministry of Agriculture, Irrigation and Water Development, Lilongwe*, http://www. sanitationmonitoringtoolkit.com/images/SMTdocuments/12_ODF%20 Malawi%20Strategy%20_2011_2015.pdf

Government of Malawi Ministry of Health, 2018, *'National Sanitation and Hygiene Strategy 2018 – 2024',* Ministry of Health, Malawi

Government of Malawi , Ministry of Health 2014*, 'Evaluation of the WASH Sector Strategy',* FINAL VERSION March_2014. pdf, (accessed 25 February 2021)

Government of Malawi 2021, 'Malawi 2063 First 10-Year Implementation Plan (MIP-1)', *National Planning Commission*, Lilongwe, Malawi

Government of Malawi 2023, '*National Water Policy 2023-2028'*

Greenhalgh, T, Wherton, J, Papoutsi, C, Lynch, J, Hughes, G, Hinder, S, Fahy, N, Procter, R, & Shaw, S 2017, 'Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies', *Journal of Medical Internet Research*, *19*(11). https://doi.org/10.2196/jmir.8775

`

Guerra-Urzola, R, Van Deun, K, Vera, JC. *et al*. 2021, 'A Guide for Sparse PCA: Model Comparison and Applications', *Psychometrika* 86, 893–919 (2021). https://doi.org/10.1007/s11336-021-09773-2

Harter M, Mosch, S, & Mosler, HJ 2018, 'How does Community-Led Total Sanitation (CLTS) affect latrine ownership? A quantitative case study from Mozambique', *BMC Public Health*. 2018 Mar 21;18(1):387. doi: 10.1186/s12889-018-5287-y. PMID: 29562899; PMCID: PMC5861600.

Harvey, P 2011, ' Community-led total sanitation, Zambia: stick, carrot or balloon?', *Waterlines, 30(2), 95-105.*

Hathi, P, Spears, D, & Coffey, D 2016, 'Can collective action strategies motivate behaviour change to reduce open defecation in rural India?', *Waterlines.* 35. 118-135. 10.3362/1756-3488.2016.011.

Heather, N, & Hönekopp, J 2007, *'Readiness to Change Questionnaire—Treatment Version* (RCQ) APA PsycTests. https://doi.org/10.1037/t01789-000

Hinton R G K, Lévesque, L C T,Macleod,C. Troldborg, M, Modesta Kanjaye,M.and Kalin R/. 2042 Progress and slippage of sanitation and hygiene targets in Malawi: is SDG6.2 achievable?. Journal of Water, Sanitation and Hygiene for Development 1 August 2024; 14 (8): 633–644. doi: https://doi.org/10.2166/washdev.2024.263

House,S, Ferron, S & Cavill, S 2017, '*Scoping and diagnosis of the Global Sanitation Funds'*

Huber, AC & Mosler, H 2012, 'Determining behavioural factors for interventions to increase safe water consumption: a cross-sectional field study in rural Ethiopia', *International Journal of Environmental Health Research*, DOI:10.1080/09603123.2012.699032

Jain , A, Wagner, A, Snell-Rood C, & Ray, I. 2020, 'Understanding open defecation in the age of Swachh Bharat abhiyan: Agency, accountability, and anger in rural Bihar', *International Journal of Environmental Research and Public Health*. 2020;17(4):1384. doi: 10.3390/ijerph17041384. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Jenkins, MW & Scott, B 2007, 'Behavioural indicators of household decision-making and demand for sanitation and potential gains from social marketing in Ghana', *Social Science & Medicine* 64, 2427–42 http://dx.doi.org/10.1016/j.socscimed.2007.03.010.

Jensen,,L, Rautanen, S &White, P 2015, 'Strengthening behaviour change communication in western Nepal: how can we do better?', *Practical Action Publishing* http://dx.doi.org/10.3362/1756-3488.2015.030, ISSN: 0262-8104 (print) 1756-3488

Jepkorir, BP, 2019. 'Factors associated with the practice of open defecati on inLodwar,Kenya: a mixed method research

Jerneck, M, Voorden, C & Rudholm, C 2016, 'S*anitation and Hygiene Behaviour Change at Scale: Understanding Slippage'*

Joint Monitoring Progfram (JMP) 2020, '*Open defecation* | Joint Monitoring Plan (washdata.org)

Jolliffe, IT, & Cadima, J 2016, 'Principal component analysis: a review and recent developments*,' Philosophical transactions. Series A*, Mathematical, physical, and engineering sciences, 374(2065), 20150202. https://doi.org/10.1098/rsta.2015.0202

`

Junias, MS, Muono, J, Purnomo, W 2016, 'Factors of Knowledge and Toilet Availability in Affecting Behaviour of Open Defecation', *International Journal of Scientific and Research Publications,* Volume 6, Issue 5, May 2016 ISSN 2250-3153

Kagwa, G 2017, 'Factors influencing open defecation free status in areas practicing community led total sanitation: the case of Chiwala and Nkambo chiefdoms of Masaiti District'

Kapatuka, D 2013, '*Natural leaders energising change in villages to attain and sustain open defecation free status: a case study of Plan Malawi impact areas– Mulanje and Lilongwe districts (traditional authorities Juma and Njewa)',* In IRC Symposium.KNBS. (2009); Kenya Demographic and Health Survey, Nairobi, Kenya.

Kar,K 2012, 'Why not Basics for All? Scopes and Challenges of Community-led Total Sanitation', *IDS Bulletin,* 43, 93-96

Kar, K & Milward, K 2011, 'Digging in, spreading out and Growing up: Introducing CLTS in Africa. *IDS Practice Papers*

Kar, K & Chambers R 2008, *'Handbook on Community-Led Total Sanitation'*, Plan Iternational*:* Brighton, UK, Volume 44

Kazembe, LN 2022, ' Social Vulnerability and Childhood Health: Bayesian Spatial Models to Assess Risks from Multiple Stressors on Childhood Diarrhoea in Malawi', *Spat Demogr* 10, 209–227 (2022). https://doi.org/10.1007/s40980-021-00101-x

`

Krebs, PJC, Nicholson, JM, Prochaska, JO 2018, ' Stages of change and psychotherapy outcomes: A review and meta-analysis', *J Clin Psychol. 2*018 Nov;74(11):1964-1979. [PubMed]

Krejcie, V, Morgan, W 1970, 'Determining sample size for research activities. Educational & psychological measurements', *Canada: Captus Press.*

Lawrence, JJ, Yeboah-Antwi, K, Biemba, G, Ram, PK, Osbert N, Sabin, LL & Hamer DH 2016, 'Beliefs, behaviours, and perceptions of community-led total sanitation and their relation to improved sanitation in rural Zambia', *Am J Trop Med Hyg* 94: 553–562

Linggar, F, Rantetampang AL, Tingginehe,R & Anwar Mallongi, A 2019, 'The factors influencing defecation behaviour in toilet Pasca community led total sanitation at Wamesa sub district Manokwari Selatan district", *International Journal of Science & Healthcare Research*.; 4(1): 88-99.

Mack, N, Woodsong, C, Macqueen, K, Guest, G & Namey, E 2005, '*Qualitative Research Methods: A Data Collector's Field Guide"*

Maitabel, AO, Okiror,S, Owuor,K, Enock W, Stephen,L, Mabonga, L & Mateyo, C 2021 *Evaluation of factors contributing to sustainability of open defecation free status of communities 'in Butere Sub-county,Kakamega county, Kenya'*

Makate,C & Mango, N 2017, 'Diversity amongst farm households and achievements from multi-stakeholder innovation platform approach: lessons from Balaka Malawi', *Agric & Food Secur* DOI 10.1186/s40066-017-0115-7

Mateauma, R 2017, *'Balaka District Socio -Economic Profile (2017-2022)'*

Mathew,DJ, Kumar S, Jaiswal K, Bajpai PK, Singh N & Ali N 2020, 'Awareness and practices of sanitary latrine usage and environmental cleanliness in rural Etawah, Uttar Pradesh' *J. Evolution Med. Dent. Sci.* 2020;9(18): 1490-1493, DOI: 10.14260/jemds/2020/325

Maulit, JA & Kang, M 2011, 'Effects of program and institutional design on district-level CLTS management in Malawi' *IN: Shaw, R.J. (ed)*. The future of water, sanitation and hygiene in low-income countries - Innovation, adaptation and engagement in a changing world: Proceedings of the 35th WEDC International Conference, Loughborough, UK, 6-8 July 2011,4p.

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly, 15*(4), 351–377.

McMichael,C. Robinson,P. 2016, 'Drivers of sustained hygiene behaviour change A case study from mid-western Nepal', *Social Science & Medicine,*Volume 163,2016,Pages 28-36, ISSN02779536,https://doi.org/10.1016/j.socscimed.2016.06.051.

Mehta, L & Movik,S. 201, 'Shit Matters: The Potential of Community Led Total Sanitation', *Practical Action Publishing, Rugby.*

Merga, N & Alemayehu, T 2015, 'Knowledge, perception, and management skills of mothers with under-five children about analysedl disease in indigenous and resettlement communities in Assosa District, Western Ethiopia', *Journal of health, population, and nutrition,* 33(1), 20

Miles, MB, & Huberman, MA 1994, 'Qualitative data analysis: An Expanded Sourcebook (2nd ed.)', Beverley Hills: *Sage*

`

Mir, RA, Gangwar, R & Gangwar, AK 2018, 'Rural sanitation and 'open defecation free'environment', *Ensure healthy lives and promote well-being for all, p.105.*

Mosler H-J, Mosch S & Harter M 2018, 'Is Community-Led Total Sanitation connected to the rebuilding of latrines? Quantitative evidence from Mozambique', *PLoS ONE* 13(5): e0197483. https://doi.org/10.1371/journal.pone.0197483

Mosler H-J. 2012, 'A systematic approach to behaviour change interventions for the water and sanitation sector in developing countries: a conceptual model, a review, and a guideline' , *Int J Environ Health Res*. 22:431-449.

Movik, S & Mehta, L 2010, 'The Dynamics and Sustainability of Community-led Total Sanitation (CLTS): Mapping Challenges and Pathways', *STEPS* Working Paper 37, Brighton: STEPS Centre

Mukherjee & Nilanjana 2011, *'Factors Associated with Achieving and Sustaining Open Defecation Free Communities: Learning from East Java, Jakarta'*

Musyoki, S 2016, 'Roles and responsibilities for post-ODF engagement: building an enabling institutional environment for CLTS sustainability. Sustainable Sanitation for All: Experiences, Challenges, and Innovations', *Practical Action Publishing*, Rugby

Myers J & Gnilo M 2017, *'Supporting the poorest and most vulnerable in CLTSprogrammes'*

National Planning Commission (NPC). (2020). Malawi 2063: Vision for Inclusive Wealth Creation and Self-Reliance

National Statistical Office (NSO) Malawi and ICF 2018, 'Malawi Demographic and HealthSurvey 2015-16' Zomba and Rockville.

Ngondi, J, Teferi, T, Gebre,T, Shargie, EB, Zerihun, M,Ayele, B,Adamu, L,King, JD,Cromwell, EA & Emerson, P.M *2010,* 'Effect of a community intervention with pit latrines in five districts of Amhara, Ethiopia', *Trop. Med. Int. Health* 2010, *15*, 592–599

Njuguna, J 2016' , Effect of eliminating open defecation on analysedl morbidity: an ecological study of Nyando and Nambale sub-counties, Kenya' , *BMC public health*, *15*, 712. https://doi.org/10.1186/s12889-016-3421-2

Njuguna, J 2019' , Progress in sanitation among poor households in Kenya: evidence from demographic and health surveys', *BMC public health*, *19*(1), 135. https://doi.org/10.1186/s12889-019-6459-0

Norcross, JC, Krebs, PM & Prochaska, JO 2011, 'Stages of change' , *Journal of Clinical Psychology* 67(2), 143–154. https://doi.org/10.1002/jclp.20758 [CrossRef], [Google Scholar].

Novotný, J, Kolomazníková, J, & Humňalová, H 2017, 'The role of perceived social Ethiopia', *International Journal of Environmental Research and Public Health,* 14, 794.

Noy, E & Kelly, M 2009, 'CTLS: Lessons Learnt From a Pilot Project in Timor Leste' Paper presented at the *34th WEDC International Conference*, Addis Ababa, Ethiopia

O'Connell, K 2014, '*What Influences Open Defecation and Latrine Ownership in Rural Households?'*

`

Odagiri, M, Muhammad, Z, Cronin, A, Gnilo, M, Mardikanto, A, Umam, K & Asamou,Y 2017, 'Enabling Factors for Sustaining Open Defecation-Free Communities in Rural Indonesia: A Cross-Sectional Study', *International Journal of Environmental Research and Public Health* 14 1572 Online: http://dx.doi.org/10.3390/ijerph14121572'

Odongo, NO. et al. 'Knowledge and practices of food hygiene and safety among camel milk handlers in the pastoral camel value chain in Kenya', *African Journal of Food, .Agriculture, Nutrition and Development* 17.1 (2017): 1180311821

Ogendo, KN, Kihara, AB, Kosgei, RJ, Tweya,H, Kizito,W, Murkomen,B & Ogutu O 2016, 'Assessment of community led total sanitation uptake in rural Kenya', E*ast African.Medical Journal Vol: 93 No. 10 (Supplement)*

Okolimong, CD, Ndejjo, R, Mugambe, RK, & Halage, AA 2020, 'Effect of a Community-Led Total Sanitation Intervention on Sanitation and Hygiene in Pallisa District, Uganda' *The American journal of tropical medicine and hygiene*, *103*(4), 1735–. 1741. https://doi.org/10.4269/ajtmh.19-0911

Okullo, JO, Moturi, WN & Ogendi, GM 2017, 'Open Defaecation and Its Effects on the Bacteriological Quality of Drinking Water Sources in Isiolo County, Kenya', *Environmental Health Insights*, *11*, 1–8. https://doi.org/10.1177/1178630217735539

Orgill-Meyer, J., Pattanayak, S. K., Chindarkar, N., Dickinson, K. L., Panda, U., Rai, S., Sahoo…, & Jeuland, M. 2019. Long-term impact of a community-led sanitation campaign in India, 2005–2016. *Bulletin of the World Health Organization, 97*(8), 523. 10.2471/BLT.18.221572

`

Osumanu, IK, Kosoe, EA, 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;2019. https://doi.org/10.1155/2019/3075840

Pantalon, Michael, Nich, Charla, Frankforter, Tami, Carroll & Kathleen 2002, 'The URICA as a measure of motivation to change among treatment-seeking individuals with concurrent alcohol and cocaine problems. Psychology of addictive behaviours', *Journal of the Society of Psychologists in Addictive Behaviours* 16. 299-307. 10.1037//0893-164X.16.4.299.

Patkar, Archana 2016, '*CHAPTER 16: Leave no one behind: equality and nondiscrimination in sanitation and hygiene.* http://dx.doi.org/10.3362/9781780449272.

Patton. MQ 2002, '*Qualitative research and evaluation methods (3rd ed.*).Thousand Oaks, CA: Sage Publications.

Pasteur, K 2017, ' Keeping Track: CLTS Monitoring, Certification and Verification', *CLTS Knowledge Hub Learning Brief 2,* Brighton: IDS

Petit, V. 2019 The Behavioural Drivers Model: A Conceptual Framework for Social and Behaviour Change Programming. UNICEF.

Petrocelli, JV 2002, 'Processes and stages of change: counseling with the Transtheoretical model of change', *J. Couns. Dev*., 80 (1) (2002), pp. 22-30

Phiri, GC, Kalulu, K, Kumwenda, S, Chidziwisano, K & Kalumbi, L 2014, '*Attainment of Open Defecation Free Status Among Villages of Nthondo Area in Ntchisi District,* Malawi' *Standard*

`

Research Journal, 2(13), 743–748, viewed 20 July 2020, http://www.standresjournals.org/journals/SSRE/Pdf/2014/december_special_issue/Phiri%20et%20al.pdf

Plan Malawi, 2012, *'Malawi- Situational analysis on CLTS/SLTS/ULTS*

Prochaska, J O & Diclemente, CC 1983, 'Stages and processes of self-change of smoking: Toward an integrative model of change' , *Journal of Consulting and Clinical Psychology* 51(3), 390–395. https://doi.org/10.1037/0022-006X.51.3.390 [CrossRef], [Google Scholar].

Prochaska, J.O & Velicer, WF1997, ' The Transtheoretical Model of health behaviour change', *American Journal of Health Promotion*, 12, 38-48.

Prochaska, JO, DiClemente, CC & Norcross, JC 1992, 'In search of how people change: Applications to addictive behaviour' *American Psychologist*, 47, 1102-1114. Doi:10.1037/0003-

Prochaska, JO, & Norcross, JC 1994, 'Systems of Pscyhotherapy A Transtheoretical Analysis 3rd edition' *Pacific Grove*, CA: Brooks/Cole

Reiner, RC, Wiens, KE, Deshpande, A Baumann, MM, Lindstedt, PA, Lacker,BF, '2020 -Income and middle-income countries, 2000-17: analysis for the Global Burden of Disease Study 2017, *Lancet*, 395 (2020), pp. 1779-1801

Rieiro, M. 2019, *'Jirani sanitation groups: sustaining open defecation free status in Tanzania'*, SNV Tanzania'

`

Rimer, B & Glanz, K 2005, ' *Theory at a Glance, a Guide for Health Promotion Practice'* National Institute of Health, Bethesda, MD

Robinson, A, Gnilo, M 2016, 'Beyond ODF: a phased approach to rural sanitation development. Sustainable Sanitation for All: Experiences, challenges, and innovations'

Robinson, Andy & Gnilo, M 2016, 'Beyond ODF a Phased Approach to Rural Sanitation Development." In Sustainable Sanitation for All, edited by Petra Bongartz, Naomi Vernon, and John Fox, 153–66. *Practical Action Publishing*.https://doi.org/10.3362/9781780449272.009.

Routray, P, Schmidt, W, Boisson, S, Clasen, T & Jenkins MW 2015, 'Socio-cultural and behavioural factors constraining latrine adoption in rural coastal Odisha: an exploratory qualitative study', DOI 10.1186/s12889-015-2206-3

Saleem, Mahrukh & Burdett, Teresa & Heaslip, Vanessa 2019, 'Health and social impacts of open defecation on women: A systematic review', *BMC Public Health*. 19.10.1186/s12889-019-6423-z.

Sara, S, Graham, J 2014, 'Ending Open Defecation in Rural Tanzania: Which Factors FacilitateLatrine Adoption? ' *International Journal of Environmental Research and Public Health*. 11(9):9854-9870.https://doi.org/10.3390/ijerph110909854

Shaheen, Musarrat & Pradhan, Sudeepta & Ranajee, Ranajee 2019, '*Sampling in Qualitative Research*' 10.4018/978-1-5225-5366-3.ch002.

Siddharthan, S & N, Nyi & Ramakrishnappa, Sowmya & Bhaskar Raj, Naresh & Zahoor Ul Huqh, Mohamed 2021, 'Transtheoretical Model of Behavioural Change' 13. 344-347. 10.31838/ijpr/2021.13.02.081.

`

Sigler, Rachel & Mahmoudi, Lyana & Graham, Jay P. 2014. *Analysis of behavioural change techniques in community-led total sanitation programs.* Health Promotion International. 30. 1-13. 10.1093/heapro/dau073.

Sijbesma, C 2010' '*Coming into its own: Hygiene promotion for development'*, RC International Water and Sanitation Centre, The Hague, the Netherlands

Silva, L, Marta, R & Panggabean, H 2019, 'Sanitation Behaviour and Risk of Stunting: Understanding the Discourse of a Public Service Announcement', *Jurnal The Messenger.* 11. 168. 10.26623/themessenger.v11i2.1317.

Singh S, Balfour, N 2015*, ' Sustainability of ODF practices in Kenya',* www.unicef.org

Soberay, AD, Grimsley, P, Faragher, JM, Barbash, M, & Berger, B 2014, 'Stages of change, clinical presentation, retention and treatment outcomes in treatment-seeking out patient problem gambling clients' Psychology of Addictive Behaviours, 28, 414-419

Spears, D, Ghosh, A, Cumming, O 2013, 'Open defecation and childhood stunting in India: an ecological analysis of data from 112 districts" *PLoS ONE*. 2013; 8(9):e73784. doi:10.1371/journal.pone.0073784.[PMC free article] [PubMed] [Cross Ref]

Stephen Sara. S. and Graham, J. 2014 Ending Open Defecation in Rural Tanzania: Which Factors Facilitate Latrine Adoption? *Int. J. Environ. Res. Public Health* 2014, *11*, 9854-. 9870; doi:10.3390/ijerph110909854

Tamene,A & Afework, A 2021, ‘ Exploring barriers to the adoption and utilization of improved latrine facilities in rural Ethiopia: An Integrated Behavioural Model for Water, Sanitation and Hygiene (IBM-WASH) approach’, .*PLoS ONE* 16(1): e0245289. https://doi.org/10.1371/journal.pone.0245289

Tamene, A 2021, ‘Prevalence and Associated Factors of Tunga penetrans Infestation among 5-14-Year-Olds in Rural Ethiopia’ *PLOS ONE*, 16, e0259411. https://doi.org/10.1371/journal.pone.0259411

Taulo, S, Kambala, C, Kumwenda, S, Morse, T 2018, ‘*Review Report of the National Open Defecation Free (ODF) and Hand Washing with Soap (HWWS) Strategies*. (Accessed 08th October, 2020)

Tessema, RA 2017, ‘Assessment of the implementation of community-led total sanitation, hygiene, and associated factors in Diretiyara District, Eastern Ethiopia” *PLoS ONE* 12(4): e0175233. https://doi.org/10.1371/journal.pone.0175233

Thomas, A 2016, ‘Strengthening post-ODF programming: reviewing lessons from sub-S.Saharan Africa. Sustainable Sanitation for All: Experiences, challenges, and innovations”

Thomas, A & Bevan, J 2013, ‘*Developing and Monitoring Protocol for the elimination of Open Defecation in sub-Saharan Africa, ODF Protocol’*, UNICEF*, viewed 20 July 2020,* http://www.communityledtotalsanitation.org/sites/communityledtotalsanitation.org/files/Thomas_and_Bevan_Elimination_of_open_defecation_SSA.pdf

`

Thomas, A & Bevan, J 2013, 'Developing and Monitoring Protocol for the Elimination of Open Defecation in Sub-Saharan Africa', In *Monitoring Sustainable WASH Service Delivery Symposium.*

Thys, S, Mwape, KE, Lefèvre, P, Dorny, P, Marcotty, T, Phiri, AM & Gabriël, S 2015, 'Why latrines are not used: communities perceptions and practices regardinglatrines in a Taenia solium endemic rural area in Eastern Zambia". *PLoS neglected tropical diseases,* 9(3), e0003570.

Tribble, J, Zain, V, Delaire, C, Khush, R, & Peltz, R 2021, 'How Do Rural Communities Sustain Sanitation Gains? Qualitative Comparative Analyses of Community-Led Approaches in Cambodia and Ghana', Sustainability, 13, 5440.

Tyndale-Biscoe, P, Bond, M & Kidd, R 2013, '*ODF Sustainability Study',* FH Designs and Plan International, viewed20 July, www.communityledtotalsanitation.org/resource/odf-sustainability-study-plan

Ugboko, HU. Nwinyi, OC. Oranusi, SU. Oyewale, JO 2020, ' Childhood diarrhoeal diseases in developing countries', *Heliyon*, 6 (4) (2020), p. e03690

United Nations Develoment Program (UNDP) 2019, *'The Sustaionable Development Goal Report, 2019'*

United Nations Childrens Fund (UNICEF) 2014, 'Evaluation of the WASH Sector Strategy 'Community Approaches to Total Sanitation' (CATS)', UNICEF http://www.unicef.org/evaluation/files/Evaluation_of_the_WASH_Sector_Strategy_FINAL_VERSION_March_2014.pdf, (Accessed 25 February 2021)

`

United Nations Childrens Fund (UNICEF) 2019, 'Evaluation of the Community Led Total Sanitation and Hygiene Programme in Malawi', UNICEF Malawi. Water, Sanitation and Hygiene (WASH) Thematic Report

United Nations Childrens Fund (UNICEF) 2020 *Water Sanitation and Hygiene,* UNICEF Malawi United Nations Childrens Fund (UNICEF) Malawi. 2021. Post-ODF Sustainability Assessment Report.

United States Agency for Internatiomal Development (USAID) 2016, "*Sanitation: Water and Development Strategy Implementation Brief*", viewed 20 July 2020.https://www.usaid.gov/sites/default/files/documents/1865/Sanitation_Implementation_Brief_72516.pdf.

USAID/WSP. 2010. Introducing SaniFOAMS: *A framework to analyze sanitation behaviours to design effective sanitation programs.* World Bank Water and Sanitation Program.

Valcourt, Nicholas & Javernick-Will, Amy & Walters, Jeffrey & Linden, Karl 2020, 'System Approaches to Water, Sanitation, and Hygiene: A Systematic Literature Review', *International Journal of Environmental Research and Public Health*. 17. 702.10.3390/ijerph17030702.

Venkataramanan, V 2010, 'Testing CLTS Approaches for Scalability, Systematic Literature Review Grey Literature', The Water Institute at UNC. Plan International USA

*V*enkataramanan, 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): 17. https://doi.org/10.1289/EHP1965.*

`

Venkataramanan,V 2012, 'Testing CLTS Approaches for Scalability: Systematic Literature Review', ChapelHill, NC. https://waterinstitute.unc.edu/files/2015/03/CLTS-Systematic-Literature-Review-Final-Report-Appendix-1-4.pdf.

Venkataramanan, V 2016, 'Testing CLTS Approaches for Scalability CLTS Learning Series: Lessons from CLTS Implementation in Seven Countries." http://www.planusa.org/.

Vernon, N & Bongartz, P 2016, 'Going beyond open defecation free. Sustainable Sanitation for All Experiences, challenges, and Innovations', *Practical Action Publishing Ltd* www.practicalactionpublishing.org. (Accessed 4th February 2020)

Vernon, N & Bongartz, P 2016, 'Sustainable Sanitation for All'28.*Practical Action Publishing. https://doi.org/10.3362/9781780449272.001*

Wamera, E 2016, 'Who is managing the post-ODF process in the community? A case study .of Nambale sub-county in Western Kenya', Sustainable Sanitation for All: Experiences, Challenges, and Innovations, Practical Action, Rugby

Wanjohi, A & Syokau ,P 2021, *'How to conduct Likert scale Analysisis'*

WASHplus Learning Brief 2015, '*CLTS-Plus: Value-Added Sanitation Programming'*

Wasonga, J, Olang'o, CO & Kioli, F 2014, ' Improving Households Knowledge and Attitude on Water, Sanitation, and Hygiene Practices through School Health Programme in Nyakach, Kisumu County in Western Kenya', *Journal of Anthropology* Volume 2014, Article ID 958481, 6 pages http://dx.doi.org/10.1155/2014/958481

WaterAid, Vivid Economics 2021 Mission-critical: Invest in Water, Sanitation and Hygiene for A Healthy and Green Economic Recovery. Water

Water and Sanitation Program (WSP) 2011, 'Factors Associated with Achieving and Sustaining Open Defecation Free Communities: Learning from East Java, Water and Sanitation Program (WSP), Washington DC, http://www.communityledtotalsanitation.org/sites/communityledtotalsanitation.org/files/Factors_ODF_EastJava.pdf

Whaley, L & Webster, J 2011, 'The Effectiveness and Sustainability of Two Demand-Driven Sanitation and Hygiene Approaches in Zimbabwe', *Journal of Water, Sanitation and Hygiene for Development* 1 (1). *IWA Publishing*: 20–36. https://doi.org/10.2166/washdev.2011.015.

World health Organisation (WHO) 2017*, 'World health statistics 2017: monitoring health for the UN-SDGs, Sustainable Development Goals', Geneva: World Health Organization;* 2017. Licence: CC BY-NC-SA 3.0 IGO.

WHO/UNICEF 2015, 'Progress on Drinking Water and Sanitation: 2015 Update and MDG Assessment, Joint Monitoring Programme (JMP), WHO/UNICEF Geneva, viewed 20 July, 2020, www.wssinfo.org/fleadmin/user_upload/resources/JMP-Update Report 2015_English.pdf

WHO/UNICEF 2017, Joint Monitoring Programme, Progress on Sanitation and Drinking Water—2017 Update and SDG Baseline', World Health Organization: Geneva, Switzerland.

Wijesekera, S & Thomas, A 2015, 'Taking stock: Reaching the bottom billion beyond open defecation', *Waterlines,* 34(3), 206–209. http://www.jstor.org/stable/24688131

`

Wilbur, J & Danquah, L 2015, 'Undoing Inequity: Water, Sanitation and Hygiene Programmes That Deliver for All in Uganda and Zambia – An Early Indication of Trends ', Briefing paper, *38th WEDC International Conference*, Loughborough University, Loughborough, http://wedc.lboro.ac.uk/resources/conference/38/Wilbur-2191.pdf

Wilroy, J & Knowlden, A 2016, 'Systematic review of theory-based interventions aimed at increasing physical activity in individuals with spinal cord injury' *American Journal of Health Education,* Vol. 47 No. 3, pp. 163-175

Winch, PJ, Leontsini, E, Hulland, KRS, Ram, PK, Unicomb, L, et al. 2013, 'The Integrated Behavioural Model for Water, Sanitation, and Hygiene: a systematic review of behavioural models and a framework for designing and evaluating behaviour change interventions in infrastructure-restricted settings', *BMC Public Health*. 2013; 13:1015–. https://doi.org/10.1186/1471-2458-13-1015 PMID:24160869

Wiyo, KA, Kadewa, W, 2019, 'Will Malawi meet the MDGS targets for water and sanitation at district level? Evidence from the 2008 national census', *Adv Plants Agric Res.* 2019;9(1):6–12. DOI: 10.15406/apar.2019.09.00403

Wolf, J, Hunter, PR, Freeman, MC, Cumming, O, Clasen, T, Bartram, J, Higgins, JPT, Johnston, R. Medlicott, K, Boisson, S & Prüss-Ustün, A 2018, 'Impact of updated meta-analysis and meta-regression' , *Trop Med Int Health*, 23: 508-525. https://doi.org/10.1111/tmi.13051

`

World Health Organization 2020, '*Water, sanitation, and hygiene (WASH)'* https://www.who.int/health-topics/water-sanitation-and-hygiene-wash

WSP 2011 'Factors Associated with Achieving and Sustaining Open Defecation Free Communities: Learning from East Java', Research Brief, Water and Sanitation Program (WSP), Washington, DC, www.wsp.org/sites/wsp.org/files/publications/WSP-Factors-Achieving-ODF-East-Java.pdf

WSSCC 2019, *'Equality and Non-Discrimination Handbook for CLTS Facilitators'* Geneva, Switzerland:Water Supply and Sanitation Collaborative Council

Yeboah-Antwi, K, MacLeod, WB, Biemba, G, Sijenyi, P, Höhne, A, Verstraete, L,McCallum, C. M. & Hamer, DH 2019, 'Improving Sanitation and Hygiene through Community-Led Total Sanitation: The Zambian Experience', *The American journal of tropical medicine and hygiene,* 100(4), 1005–1012.https://doi.org/10.4269/ajtmh.18-0632

Yeboah-Antwi, K. MacLeod, WB, Biemba, G. Sijenyi, P, Höhne, A, Verstraete, L, McCallum, C. M, & Hamer, DH 2019, 'Improving Sanitation and Hygiene through Community-Led Total Sanitation: The Zambian Experience', *The American journal of tropical medicine and hygiene*, *100*(4), 1005–1012. https://doi.org/10.4269/ajtmh.18-0632

`

APPENDICES

Appendix I. Informed Consent Form

Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in

Behaviour Change Dynamics Beyond Open Defecation Free Certification:

A Pathway to Sustainable Sanitation in Balaka, Malawi.

Introduction

I am phdsan0319 from Mzuzu University. We are doing research on "Analysis of Behaviour Change Dynamics Beyond Open Defecation Free Certification: A Pathway to Sustainable Sanitation in Balaka, Malawi. This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or of another researcher.

Purpose of the research

This research aims to analyse behavioural change enabling factors that influence sustainable sanitation practices beyond open defecation free certification in Balaka.

Type of Research Intervention

This research will involve your participation in a group discussion and/or individual interview.

Participant Selection

You are being invited to take part in this research because of your participation in water sanitation and Hygiene programmes especially Community Led Total Sanitation in Balaka District

`

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration: The research takes place for a period of eleven months.

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.)

Reimbursements: You will not be provided any incentive to take part in the research.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following, we will publish the results so other interested people may learn from the research.

Who to Contact?

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: phdsan01319 on +265 999 233 933 / 888 519 255

This proposal has been reviewed and approved by Mzuzu University Research Ethics Committee (MZUNIREC) which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the Committee, contact Mr. Gift Mbwele, Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, Phone: 0999404008/0888641486

Do you have any questions?

`

Part II: Certificate of Consent

I have been invited to participate in research about "Analysis of Behaviour Change Dynamics Beyond Open Defecation Free Certification: A Pathway to Sustainable Sanitation in Balaka, Malawi."

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant _____

Signature of Participant _____ **Date** _____

Day/month/year

If illiterate [1]

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness _____ **Thumb print of participant** ☐

Signature of witness _____ **Date** _____

Day/month/year

[1] A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

`

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____ Date _____

Day/month/year

`

Appendix II. A Questionnaire for Heads of Household.

Behaviour Change Dynamics Beyond Open Defecation Free Certification: A Pathway to Sustainable Sanitation in Balaka, Malawi

Enumerator: …… Date: …… Questionnaire #.....

TA: ……..…GVH: ……..……Village: ……ODF Cert: (Y)(N) HH#.....

	SECTION ONE DEMOGRAPHIC /PERSONAL FACTORS (SEX, AGE, RELIGION, LITERACY LEVEL)										
#		Respond by encircling your most appropriate choice									
	Question / Variable	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**
1	Gender of Household	Male *Mamuna*	1	Female *Mkazi*	2						
2	Age of Household Head *Zaka za olamulira banja*	< 10	1	09 – 17	2	18 – 25	3	26- 33	4	34 – 41	5
		42 – 50	6	< 50	7						
3	Marital status of HHH *Ndinu okwatira?wa?*	Married *Okwatira/wa*	1	Single *Osakwatira\wa*	2	Separated *Tinasiyana*	3	Divorced *Banja linatha*	4	Widowed *Wachikondi anamwalira*	
4	Education level of HHH *Maphunziro a olamulira banja*	Did not go to School *Sindinapite ku sukulu*	1	Primary – *Maphunziro a pulayimale*	2	Secondary *Maphunziro a sekondale*	3	Tertially *Ukachenjede*	4		
5	Religion *Chipembedzo*	Christian Chiikhilisitu	1	IslamChsislamu	2	Traditional Zamakolo	3	No religion Osapemhera	3		
6	Ethnicity *Mtundu* Yao 1	*Mchewa*	2	Lomwe	3	Tumbuka	4	Ngoni	5	*Others ....*	
7	No of Children in the house *Chiwelengero cha ana okhala pakhomopo* Male *Mamuna*	1-2	1	3-4	2	5-6	3	7 & above			
	Female *Mkazi*	1-2	1	3-4	2	5-6	3	7 & above	4		
8	Total number of children *Chiwelengero cha ana*	1-2	1	3-4	2	5-6	3	7 & above	4		
9	Size of HH *Kukula kwa banja*	1-2	1	3-4	2	5-6	3	7 & above	4		
10	Occupation Ntchito	Farming *Ulimi*	1	Business *Malonda*	2	C. Servant *Ogwira M'boma*	3	Artisan *wazaluso*	4	Others…… *zina*.	5
11	Type of House *Mtundu wa nyumba*	Mud grassthatched *Ya dothi ndi maudzu*	1	Brick grass thatched roof *Ya njerwa ndi maudzu*	2	Brick, Iron roof & cement floor *Ya njerwa, malata ndi simenti*	3	Brick, Iron roof no cement floor *Ya njerwa, malata, yopanda simenti*	4	Others Specify…… *Mtundu wina, tchulani*	5
12	Household Items *Zida/Zipangizo zomwe ali nazo*	Bicycle *Njinga yakapalasa*	1	Motorcycle *Njinga yamoto*	2	*Radio Wailesi*	3	*Phone Lamya*	4	Cart *Ngolo*	5
		Livestoock *Ziweto*	6	Agric garden *Munda*	7	Others Specify…… *Zina, tchulani*	8				

`

	SECTION TWO KNOWLEDGE ON SANITATION AND HYGIENE AFTER ODF STATUS CERRTIFICATION				
13	**Rate the following statements as (1) strongly agree (2) agree (3) disagree (4) strongly disagree by encircling the most appropriate response.**	Strongly Agree	Agree	Disagree	Strongly Disagree
14	CLTS was conducted in our area Msonkhano olimbikitsa anthu kusiya kunyela kutchire unachitika kwathu kuno	1	2	3	4
15	CLTS was conducted successfully in our area Msonkhano olimbikitsa anthu kusiya kunyela kutchire unachitika mopambabana kwathu kuno	1	2	3	4
16	CLTS is more about using a latrine t not just constructing a latrine. *CLTS imakhudzana kwambiri ndi kagwilitsidwe ntchito ka chimbudzi osati kumanga chimbudzi kokha*	1	2	3	4
17	CLTS strategy aims at communities attain ODF status *CLTS imayerekeza anthunkulandira ulemu oleka kunyera vpatchire/pamtunda*	1	2	3	4
18	This village was verified as an ODF. Mudzi uno unaleka kunyela kutchire	1	2	3	4
19	Use of latrine prevents diarrhoeal diseases *Chimbudzi chimagwilitsidwa ntchito popewa matenda otsekula mmimba*	1	2	3	4
20	Open defecation causes diarrhoeal diseases and worm infestations *Kuchita chimbudzi kutchile kumayambitsa matenda otsekula mmimba komanso nyongolosi*	1	2	3	4
21	ODF status is also about water protection, waste management, latrine ilet use, handwashing, Kusiya kunyela poyela kumalingananso ndi kuteteza madzi, kusamala zinyalala, kunyela muchimbudzi	1	2	3	4
22	After ODG status attainment, communities have to move up the sanitation ladder like handwashing with soap, latrine with drop hole cover, proper waste management, water safety etc	1	2	3	4
23	Hand washing with soap helps to kill germs in the hands *Kusamba mmanja ndi sopo kumathandiza kupha tizilombo mmanja*	1	2	3	4
24	Poor hygiene causes other diseases diseases like eye infections *Kusowa kwa ukhondo kumayambitsa matenda otsekula mmimba komando matenda a maso*	1	2	3	4

	SECTION THREE ATTITUDE ON SANITATION SERVICES AND HYGIENE PRACTICES AFTER ODF STATUS CERTIFICATION.				
25	**Rate the following statements as (1) strongly agree (2) agree (3) disagree (4) strongly disagree by encircling the most appropriate response**	Strongly Agree	Agree	Disagre e	Strongly Disagree
26	It is shameful not to have a latrine N*ndizamanyazi kukhala opanda chimbudzi pakhomo pako*	1	2	3	4
27	It is shameful and embarassing to be seen defecating in the open. *Ndimachita manyazi kuchita chimbudzi poyera*	1	2	3	4
28	It is shameful to use somebodys latrine *Ndi zochititsa manyazi kugwilitsa ntchito chimbudzi chawena*	1	2	3	4
29	It makes one feel uneasy discussing issues of human excreta with people *Sindimamasuka kukamba ndi anthu nkhani zokhudza manyi a munthu*	1	2	3	4
30	I am pleased and happy when I use a latrine *Ndimakhala okhutitsidwa komanso osangalala ndikagwilitsa ntchito chimbudzi*	1	2	3	4
31	The latrine is clean enough to use *Chimbudzi ndi cha ukhondo mokwanira kugwilitsa ntchito*	1	2	3	4
32	Lack of privacy discourages one from using a latrine *Kupanda chinsisi kumakandikanikitsa kugwiritsa ntchito chimbudzi*	1	2	3	4
33	It is safe when you go to defecate in a latrine *Ndi kotetezeka kunyela m chimbudzi*	1	2	3	4

`

	SEECTION FOUR **SANITATION SERVICES AND HYGIENE PRACTICES AFTER ODF STATUS CERTIFICATION**											
	Llatrine and Hand Washing Facility Availability and Use ION											
#	**Question / Variable**	**Respond by encircling your most appropriate choice**										
34		**Response**	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**
35	Do you have a latrine *Muli ndi chimbudzi*			Yes *Eya*	1	No *Ayi*	2				
36	If yes, Do you use the latrine			Never Ayi	1	Sometimes Ntawi zina	2	Always Nthawi zonse	3		
37	If No,/Never Where do you defecate? *Ngati mulibe chimbudzi mumakanyelka kuti?*			Neighbors latrine *Chimbudzi cha oyandikana nawo*	1	River *Mumtsinje*	2	Bush *Kutchire*	3	Others Specify *Kwina monga..*	4
38	After ODF Certification, what has happened to your latrine *Ndi chiyani chinachitika ndi chimbudzi chanu kutsatira kusindikizidwa kwa ODF*			Nothing *Alibe*	1	Improved *Inakhala bwino*	2	Collapsed *Inagwa*	3	Dilapidated Chinaonongekelaru	4
39	If latrine collapsed/dilapidated, what did you do next *Ngati chimbudzi chinagwa munachitapo chani*			Nothing *Palibe*	1	Repaired *Tinachikonza*	2	Built new one *Tinamanga china*	3		
40	What type of latrine do you have *Muli ndi chimbudzi chotani*			Simple pit latrine grass thatched *Cha maudzu*	1	Simple pit latrine with slab *Cho sanipulati*	2	VIP *chapayipi ya mpweya*	3	Septic tank *Chimbudzi chamakono*	4
				Composting latrine *Chamanyowa*	5	Others Specify *Zina monga*	6				
41	If NO Why not having a pit latrine Ndichifukwa chiyani mulibe chimbidzi			Fell down *Chinagwa*	1	Never had one *Sindikumbepo*	2	Dilapidated *Chinaphwasuka*	3	Others Specify *Zina Monga*	
42	In this community, is it acceptable to defecate in the open Ku dera lino ndi zololedwa kuchita chimbudzi poyera?			Yes *Eya*	1	No *Ayi*	2				
43	Is the latrine you have now the same latrine you had during ODF certification *Chimbudzi chomwe muli nacho pano ndi chomwe munali nacho nthawi ya kusindikizidwa kwa ODF*							Yes *Eya*	1	No *Ayi*	2
44	Who was involved in larine building at your household *Ndani anakhudzidwa popanga chiganizo chomanga chimbudzi*	Husband *Abambo*	1	Wife *Amayi*	2	Brother/ Sister *Alongo*	3	Family Children *Ana a m'banja*	4	Relatives/ Friends *Achibale/ansi*	5
45	Are those who help latrine building/repairing given anything *Kodi omwe amathandiza kumanga/kukonanso chimbudzi amalandira chiona maso*					Never Ayi	1	Somemtime Nthawi zina	2	Always Nthawi zones	3
46	Is using the latrine when you need to defecate something you have been doing for the past three years? *Kodi mwakhala mukugwilitsa ntchito chimbudzi zaka zitatu zapitazi*							Yes *Eya*	1	No *Ayi*	2
47	How do mothers dispose of excreta of children *Azimayi amataya bwanji manyi a ana*			Bury in the soil *Kukwilira munthaka*	1	Dispose in pit-latrine *Kutaya kuchimbu*	2	Throw in the bush *Kutaya kutchire*	3	Others (specify *Zifukwa zina …'*	4
48	Do all household members use the latrine *Kodi anthu onse a pakhomo po amagwiritsa ntchito chimbudzi motani*					Never Ayi	1	Somemtime Nthawi zina	2	Always Nthawi zonse	3
49	If NO, Who fails to use the latrine *Ngati ayi, ndi ndani amakanika kugwilitsa ntchito chimbudzi*	Elderly *Akulu*	1	Children *Ana*	2	Sick *Odwala*	3	Disabled *Olumala*	4	Anybody *Aliyense*	5
50	What makes them fail to use the latrine *Ndi chifukwa chani amakanika kugwiritsa ntchito chimbudzi*	Negligence *Kusalab adila*	1	No privacy *Palibe kubisila*	2	Can't walk *Samakwanitsa kuyenda*	3	Afraid of failing in *Amaopa kugwera*	4	Others Specify *Zifukwa zina,*	5
51	What is done when a someone in the village is found defecating in the open? *Kodi wina atapezeka akuchita chimbudzi poyera mmudzi mwanu pamachitika zotani*		1	Pays fine *Amalipila chindapusa*	2	Forced to remove *Amamuoletsa*	3	Is wooed *Amawowozedwa*	4	Others specify *Zina Monga*	5

`

52	What support is givrn to those with latrine construction *Kodi omwe amvutika kumanga chi dudzi amathandizidwa bwanji?*	Given Money Amapatsidwa Ndalama	1	Given Cement *Amapatsidwa Simenti*	2	Given Plastic roofing sheet *Amapatsidwa Pepala ya pa denga*	3	Given Slab *Amapatsidwa Chovindikira pa djenje*	4	Nothing *Sapatsidwa kanthu*	5
53	Do you have a Hand washing facility Muli ndi Chosambira mmanja pafupi ndi chimbudzi							Yes *Eya*	1	No *Ayi*	2
54	Do you use the HWF to wash your hands Kodi mumagwiritsa ntvhito chosmbira mmanja cha pachimbudzi?					Never Ayi	1	Sometime Nthawi zina	2	Always Nthawi zonse	3
55	Do you wash your hands with soap after defecation *Kodi mumasamba mmanja ndi sopo mukamaliza kuchita chimbudzi*					Never Ayi	1	Sometime Nthawi zina	2	Always Nthawi zonse	3
56	If No, why don't you wash your hands after defaecating *Ngati AYI ndi chifukwa chani simumasamba mmanja mukamaliza kuchita chimbudzi?*			No water *Palibe madzi*	1	Hurrying *Changu*	2	Negligence kusalabadil	3	Forgetting *Kuiwala*	4

`	**SEECTION FIVE** **BEHAVIOUR CHANGE DETERMINANTS FOR SUSTAINABLE AFTER ODF STATUS CERTIFICATION**										
	Economical/Technical /Technological /Institutional Related Factors (Support, Latrine type and Durability)										
#	**Question / Variable**	**Respond by encircling your most appropriate choice**									
		Response	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**
57	Who is involved during planning of a community sanitation program	Local Health Committees akimiyi a mmudzi	1	Local leaders *Atsogoleri ammudzi*	2	Religious leaders *AMmipingo*	3	Government workers *A Mboma*	4	NGO Workers *AMabungw*	5
		Females A*mayi*	6	Men *Abambo*	7	Others *Ena Monga*	8				5
58	What technical conditions prevented you from constructing new latrine /repairing old one *Ndi zifukwa ziti zinakukanikitsani kumanga kapena kukonza chimbudzi chakale*			No skills *Sindingathe*	1	Inadequat Space *Kuchepa kwa malo*	2	Scarcity of materials locally *Kusowa zipangizo pafupi*	3	Materials rising cost *Kukwera mtengo kwa zipangizo*	4
59	Which conditions make constructing or repairing a latrine difficult? Chimapangitsa kukimmba kapena kukonzanso n chimbudzi ndi chyani	Sandy soils *Dothi la nchenga*	1	Rocky soils *Dothi la miyala*	2	*Water scarcity Kusowa kwa madzi*	3	High water table *Kuchuluka kwa madzi*	4	Flooding *Kusefukila kwa madzi*	5
60	Where do you get / buy the latrine construction materials *Mumapeza kapena kugula kuti zipangizo zomangira chimbudzi*					Local traders *Ogulitsa a ku dera*	1	Balaka Town *Mzinda wa Balaka*	2	Outside Balaka *Kunja kwa Balaka*	3
61	Is the cost of materials for latrine construction or repairing affordable *Kodi mtengo wa zipandizo zomangiza chimbudzi ndi osaboola mthumba?*							Yes *Eya*	1	No *Ayi*	2
62	Who gives you latrine construction, maintenance and WASH advise.? *Kodi ndani amapeleka upangili wa kuamanga,/kukonza chimbudzi komanso ukhondo wa madzi*	Nobody *Palibe*	1	Govt & NGO Ext Workers *Alangizi a Zaumoyo*	2	Local and Religious leaders. *Mafumu ndi atsogoleri a Mipingo*	3	Local Committees *Makomiti a mmidzi*	4	Mason and Local volunteer *Odzipeleka a kudera kuno*	5
63	What opportunities are used in your area to get sanitation information and support *Ndi njira ziti zomwe zilipo mmudzi zomwe mumathandizil[kila mkuoeza mauthenga ndi upangiri wa zaukhondo*	Ext Worker home visit *Kuyendeledwa pakhomo ndi alangizi a zaumoyo*	1	Sanitation meetings *Misonkhano ya zaukhondo moyo*	2	Leaflets/Bronchures Zikalata za umoyo	3	Sanitation Awareness campaigns Zolengeza *zolimbikitsa ukhondons*	4	Radio/ Television/ N.Papers *Wailesi kapena kanema*	5
64	Extension staff (Government or Non Govt) visit your home to talk about sanitation. After ODF certification. Alangizi amabwera kuzakulimbikitsani zaukhondo chipangileni chisangalalo chakulka kutchire					Never Ayi	1	Somemtime Nthawi zina	2	Frequent Nthawi zambiri	3

`

	Community related, Social and Cultural factors (Sharing a latrine, Privacy, Safety, Shame, Convenience, Dignity, Stigma, Discrimination) and Environmental/Ecological factors ((Water access, Soil profile, water table, floods. Leaching)										
65	In your community who is responsible for pit latrine construction? *Mu dera lanu ndi ndani amakhudzidwa pomanga chimbudzi*	Husband/Wife *Abambo/Amaya*	1	Children *Ana*	2	Friends *Anansi*	3	Leaders *Atsogoleri*	4	Ext workers	5
66	Who influences you on need to have sanitation facilities like latrine and hand washing facility *Ndi ndani amakulimbikitsani za kufunika kwa zipangizo za ukhondo monga chimbudzi komanso zipangizo zosambira mmanja*	Husband/Wife *Bambo/Mayi*	1	Children *Ana*	2	Community *Anthu a ku dera kuno*	3	Govt Workers Ogwira ntchito mmboma	4	NGO staff *Ogwira ntchito mmabungwe*	5
		Religious leaders *Atsogoleri a mipingo*	6	Political leaders *Atsogoleri* Andale	7	Comm Volunteer *Ongozipelek*	8	Local Leaders *Atsogoleri a ku dera*	9		
67	How far is the latrine from the house? (Meters) *Chimbudzi chili patali bwanji ndi nyumba(mphindi)*			<10 Meters	1	>10 Meters	2				
68	Is the latrine easily accessible even at night? *Mumatha kupita kuchimbudzi usiku?*			Yes *Eya*	1	No *Ayi*	2				
69	Which conditions make constructing or repairing a latrine difficult? *Chimapangitsa kukimmba kapena kukonzanso n chimbudzi ndi chyani*	Sandy soils *Dothi la mchenga*	1	Rocky soils *Dothi la miyala*	2	*Water scarcity Kusowa kwa madzi*	3	High water table *Kuchuluka kwa madzi*	4	Flooding *Kusefukila kwa madzi*	5
70	Are there any of the following beliefs/taboos that affect you in latrine construction and use in the village *Ndi zikhulu ziti mwa izi zmwe zimakhudzana ndi kagwilitsidwe ntchito ka chimbudzi*					Cultural *Zachikhalidwe*	1	Religious *Zachipembedzo*	2	Others specify *Zina Monga*	3
71	What is your source of water Madzi mumatunga kuti	Bore hole	1	Piped water	2	*Shallow well Chitsime*	3	Stream	4	Others specify *Zina Monga*	5
72	When is the water scarce *Ndi nthawi iti madzi amasowa*	Dry season	1	Wet season	2	Not Scarce	3				

`

SECTIOIN SIX
STAGES OF CHANGE ASSESSMENT SCALE.

Each statement below describes a how a person might feel when starting using a toilet or approaching problems in their life resulting from open defecation. Please indicate the extent to which you tend to agree or disagree with each statement. In each case, make your choice in terms of how you feel right now, not what you have felt in the past or would like to feel. for all statements that refer to your "problem", answer in terms of problems related to open defecation.

There are five possible responses to each of the items in the questionnaire: Strongly Disagree, 2=Disagree, 3=Undecided, 4=Agree, 5=Strongly Agree Circle the number that best describes how much you agree or disagree with each statement

Toilet and a Hand Washing Facility Construction

#	Variable	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		Toilet	HWF	Toilet	HWF	Toilet	HWF	Toilet	HWF	Toilet	HWF
1	It doesn't make much sense for me to consider constructing a Latrine/ HWF *Sichazeru kuti ndiganizire zomanga chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
2	I've been thinking that I might want to change something about Latrine / HWF Construction *Ndakhala ndikuganiza kuti ndingathe kusintha china chake monga kumanga chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
3	At times my failure to construct a Latrine / HWF is a difficult problem but I'm working on it. *Nthawi zina kulephera kwanga kumanga chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi limakhala vuto lalikulu koma ndikuyesetsa kulithetsa*	1	1	2	2	3	3	4	4	5	5
4	It is frustrating, but I feel I might be having a recurrence of a Latrine/ HWF construction I hought I had resolved. *Ndizokhumudwitsa, koma ndikuwona kuti mwina ndimanganso chimbudzi china /ndipanganso chosambira mmanja pochoka kuchimbudzi china.*	1	1	2	2	3	3	4	4	5	5
5	Trying to change and construct a latrine / HWF is pretty much a waste of time for me because the problem of not having a Latrine /HWF doesn't have to do with me. *Kuyesa kusintha ndikumanga chimbudzi / kupanga chosambira mmanja ndikungotaya nthawi chabe kwa ine*	1	1	2	2	3	3	4	4	5	5
6	I guess I have faults, but there's nothing that I really need to change and construct a latrine / HWF *Ndikuganiza kuti ndili ndi zolakwika, koma palibe chomwe ndikufuna kusintha kuti mpakana kumanga chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
7	I thought once I had resolved my problem of not having a Latrine / HWF I would be free, but sometimes I still find myself struggling with it N*dimaganiza kuti ndikangothetsa vuto langa losakhala ndi chimbudzi / chosambira mmanja pochoka kuchimbudzi ndidzakhala omasuka, koma nthawi zina ndimavutikabe nazo mumtima*	1	1	2	2	3	3	4	4	5	5
8	II may have a problem with Latrine / HWF construction and I think I should work on it. *Ndikhoza kukhala ndi vuto lomanga chimbudzi ndipo ndikuganiza kuti ndiyenera kulikonza*	1	1	2	2	3	3	4	4	5	5
9	I am really working hard to change and construct a Latrine /HWF WF *Ndikuyesetsa komanso kuliimbika kuti ndimange chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi.*	1	1	2	2	3	3	4	4	5	5
10	II hope that someone will have some good advice for me about Latrine / HWF construction*Ndikukhulupilira kuti wina andipatsa malangizo abwino wokhudza kumanga chimbudzi / kupanga chosambira mmanja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
11	Anyone can talk about changing and have a Latrine / HWF; I'm actually going to do something about it. *Aliyense akhonza kulankhula za kusintha ndi kukhala ndi chimbudzi / chosambira mmanja koma Ine ndichitapo kanthu ndithu.*	1	1	2	2	3	3	4	4	5	5
12	After all I had done to try and construct a Latrine / HWF every now and then the problem of not having a Latrine / HWF comes back to haunt me. *Pambuyo pa zonse zomwe ndidachita pomanga chimbudzi / kupanga chosamabira mmanja, nthawi ndi nthawi vuto losakhala ndi chimbudzi / chosambira mmanja limandibwereranso mmaganizo*	1	1	2	2	3	3	4	4	5	5

`

Toilet Use and Washing Hands with Soap after using a toilet

#	Variable	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
		Toilet	HWF	Toilet	HWF	Toilet	HWF	Toilet	HWF	Toilet	HWF
1	It doesn't make much sense for me to consider using a toilet / Washing Hands after using a toilet. *Sizanzeru kwa ine kulingalira kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
2	I've been thinking that I might want to change and start using a toilet / Wash Hands after using a toilet *Ndakhala ndikuganiza kuti nditha kusintha ndikuyamba kugwiritsa ntchito chimbudzi / kusamba m'manja pokhoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
3	At times my failure to use a toilet / Washing Hands after using a toilet is a difficult problem but I'm working on it. *Nthawi zina kulephera kwanga kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka ku chimbudzi limakhala vuto lalikulu koma ndikuyesetsa kulithetsa*	1	1	2	2	3	3	4	4	5	5
4	It is frustrating, but I feel I might be having a recurrence of a using a Latrine/ Washing hands I thought I had resolved. *Ndizokhumudzitsa koma ndikuona kuti ndiyambiranso kugwiritsa ntchito chimbudzi / kusamba mmanja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
5	Trying to change and start using a latrine / Washing Hands after using a toilet is pretty much a waste of time for me *Kuyesera kusintha ndikuyamba kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka kuchimbudzi ndikungotaya nthawi chabe kwa ine*	1	1	2	2	3	3	4	4	5	5
6	I guess I have faults, but there's nothing that I really need to change and start using a latrine / Washing Hands after using a toilet. *Ndikuganiza kuti ndili ndi zolakwitsa, komabe ndikufunika kusintha ndikuyamba kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
7	I thought once I had resolved my problem of not start using a latrine / Washing Hands after using a toilet I would be free, but sometimes I still find myself struggling with it. *Ndimaganiza kuti nditathetsa vuto langa losagwiritsa ntchito chimbudzi / losasamba m'manja pochoka ku chimbudzi ndidzakhala omasuka, koma nthawi zina ndimavutikabe nazo mumtima.*	1	1	2	2	3	3	4	4	5	5
8	I may have a problem with starting using a latrine / Washing Hands after using a toilet and I think I should work on it. *Nditha kukhala ndi vuto losagwiritsa ntchito chimbudzi / losasamba m'manja pochoka kuchimbudzi ndipo ndikuganiza zochitapo kanthu*	1	1	2	2	3	3	4	4	5	5
9	I am really working hard to change and start using a latrine / Washing Hands after using a toilet *Ndikugwira ntchito molimbika kuti ndisinthe ndikuyamba kugwiritsa ntchito chimbudzi / kusamba mmanja pohoka kuchimbudzi*	1	1	2	2	3	3	4	4	5	5
10	I hope that someone will have some good advice for me about start using a latrine / Washing Hands after using a toilet *Ndikukhulupilira kuti wina andipatsa malangizo abwino oti ndiyambe kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka ku chimbudzi*	1	1	2	2	3	3	4	4	5	5
11	Anyone can talk about changing and start using a latrine / Washing Hands after using a toilet; I'm actually going to do something about it. *Aliyense akhonza kulankhula za kusintha ndikuyamba kugwiritsa ntchito chimbudzi / kusamba m'manja pochoka kuchimbudzi koma Ine ndichitapo kanthu ndithu.*	1	1	2	2	3	3	4	4	5	5
12	After all I had done to try and start using a latrine / Washing Hands after using a toilet every now and then the problem of not having a Latrine / HWF comes back to haunt me. *Pambuyo pa zonse zomwe ndidachita poyamba kugwiritsa ntchito cimbudzi / poyamba kapena kusamba m'manja ndikachoka ku chimbudzi nthawi ndi nthawi vuto losagwiritsa ntchito chimbudzi / losasamba mmanja pochoka kuchimbudzi limandibwereranso mmaganizo*	1	1	2	2	3	3	4	4	5	5

`

Appendix III: Key Informants Interview Guide / Checklist

Behaviour Change Dynamics Beyond Open Defecation Free Certification: Pathway to Sustainable Sanitation.

KEY INFORMANTS INTERVIEW GUIDE

Institution / Organisation / Department……Position……Date……

#	Item	Response/Remark
1	What are the successes of CLTS in your area after ODF certification?	
2	What are the challenges experienced with CLTS after ODF certification?	
3	What is the situation of latrines in the villages in terms of availability, construction and maintenance after ODF certification after ODF certification?	
4	What are the challenges with building/maintaining latrines in the villages?	
5	Do communities defecate in the open and what do you think are the causes	
6	What is your observation on the availability of Hand Washing Facilities and hand washing with soap after toilet use	
7	What are the challenges with hand washing practice in the village?	
8	Is CLTS being monitored in the villages, How and by Who?	No Yes (Explain) By Who How 1 2 3 4
9	How do you think households without latrine or want a better latrine be supported?	
10	Are communities supported in to ensure sanitation and hygiene services to ensure sustained sanitation practices	No Yes (Explain) By Who How

`

		1
		2
		3
		4
11	How do you think could CLTS help to achieve the districts sanitation goals?	
12	Are you involved and continuing supporting or engaged in CLTS or sanitation services, Why and How?	No Yes (Explain)
		What is done How it is done
		1
		2
		3
		4
13	Do you, a partner or Government monitor ODF status? If Yes How is it done?	No Yes (Explain)
14	Has there been any improvements in sanitation and hygiene after ODF certification in the following: Latrine construction, , Drop hole cover, Hand washing, management, safe toilet etc.?	Latrine Construction
		Latrine use
		Toilet sharing
		Open defecation
		Drop hole cover
		Hand washing with soap
		Latrine maintenance
15	What are the sanitation goods and services for sustained sanitation services and hygiene practices available in the village if any and who?	What are the goods/services?
		Who provide the goods/services?
16	What are the key stakeholder/players of sanitation and hygiene program in the village and what do they do?	Stakeholder What they do
		1
		2
		3
		4
17	What do you think can be done to ensure sustained ODF status in the villages	

`

Appendix IV: Focus Group Discussion Guide

Behaviour Change Dynamics Beyond Open Defecation Free Certification: a Pathway to Sustainable Sanitation

FOCUS GROUP DISCUSSION GUIDE

Enumerator: …… Date: ……..……

TA…….…….Committee: …. ….……

#	Item	Response/Remark
1	What are the success of CLTS five years after ODF attainment	
2	What are the challenges experienced with communities in CLTS five years after ODF attainment (Latrine construction., maintenance, Latrine use, Handwashing with soap, Availability and cost of materials)	
3	Has there been any improvements in sanitation and hygiene after ODF certification in the following:	Latrine Construction Latrine use Toilet sharing Open defecation Drop hole cover Hand washing with soap Latrine maintenance

`

4	How do the institutions Governments, NGOs, FBOs and CBOs) contribute to community led total sanitation	
5	What has been happening since ODF attainment in the communities (What, When, By Who)	Meetings Follow up Health talks Others
6	Does the community, in your opinion, have a role in community led total sanitation? Explain	
7	What are the structures, committees or individuals existing and working in CLTS in the community	
8	What in your opinion on the sociocultural factors that affect the implementation of community led total sanitation?	
9	What are the challenges being faced with communities in sustaining ODF status?	
10	What do you think can be done to ensure sustained ODF status in the villages	Individuals Communities Committees Leaders NGO Government

`

Focus Group Discussion Participants

No	Name	Age Years	Gender	Position	Signature / Finger Print	PhoneNumber
1			M F			
2			M F			
3			M F			
4			M F			
5			M F			
6			M F			
7			M F			
8			M F			
9			M F			
10			M F			
11			M F			
12			M F			
13			M F			
14			M F			
15			M F			

`

Appendix V: Observation Guide

Analysis of Behaviour Change Dynamics Beyond Open Defecation Free Certification: a Pathway to Sustainable Sanitation

OBSERVATION CHECKLIST / GUIDE

Enumerator: ……HH ……. …Date: ……..

TA: …….……GVH: …….……Village: …….……

Please circle the appropriate response and/or fill in observation where required

		Response	**Code**	**Response**	**Code**	**Response**	**Code**	**Response**	**Code**
1	Pit-latrine available	Yes	1	No	2				
2	Location of Pit Latrine	In the house	1	Less than 50m	2	50 – 100 m	3	>100 m	4
3	Drop hole cover available	Yes	1	No	2				
4	Drop hole covered	Yes	1	No	2				
5	Door available	Yes	1	No	2				
6	Roof available	Yes	1	No	2				
7	Floor slab available	Yes	1	No	2				
8	Presence of sheet	Floor	1	Wall	2	Outside latrine	3		
9	Evidence of latrine use	Clean path	1	Well-trodden footpath	2	Smelling toilet	3	Cleaned toilet	4
10	Hand washing facility available	Yes	1	No	2				
11	Location of HWF	Inside	1	Close to the door outside	2	>2m away	3		
12	Soap available	Yes	1	No	2				
13	Evidence of hand washing use	Clean water	1	Dirty water	2	Water available	3	Broken HWF	4
14	Faeces seen in any of the following as evidence of open defecation -	Around the house	1	Footpath to latrine	2	Bush around household	3	On path to house	4

`

Appendix VI : Clearance Letter from Balaka District Health Office

Communications should be addressed to
THE DISTRICT HEALTH OFFICER
Telephone No: 01552344
Fax No : 01552347

In reply please quote Ref No BDH/.....
The District Health Office
Balaka District Hospital
Box 138
BALAKA

25th July 2022

The Postgraduate Coordinator
Mzuzu University
P/Bag 201, Luwinga
Mzuzu 2

Dear Sir,

LETTER OF SUPPORT TO CONDUCT A STUDY ON ANALYSIS OF BEHAVIOUR CHANGE DYNAMICS BEYOND OPEN DEFEACATION FREE CERTIFICATION: A PATHWAY TO SUSTAINABLE SANITATION IN BALAKA

Mr. Laston Kamwana, a PhD student at Mzuzu University, intends to conduct a study on '*analysis of behavior change dynamics beyond open defecation free certification: a pathway to sustainable sanitation in Balaka'*. We are aware that the findings of the study will contribute to sustainable behavioural changes in sanitation practices in communities in Balaka after being declared the first open defecation free district in 2017.

On behalf of the Director of Health and Social Services and the entire management, we support the proposed study to be conducted at Balaka District.

Yours faithfully,

Dr Leone Tumizgani Lowole
Senior Medical Officer
For: Director of Health and Social Services

BALAKA DISTRICT COUNCIL
HEALTH SECTION
DISTRICT MEDICAL OFFICER
25 JUL 2022
P.O. BOX 138, BALAKA

`

Appendix VII: Ethical Clearance from Mzuzu University Research Ethics Committee

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/22/84 **20/09/22**

Laston Kamwana,
Mzuzu University,
P/Bag 201,
Mzuzu.
kamwanal@mchs.adventist.org

Dear Laston Kamwana,

RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR PROTOCOL REF NO: MZUNIREC/DOR/22/84: ANALYSIS OF BEHAVIOUR CHANGE DYNAMICS BEYOND OPEN DEFECATION FREE CERTIFICATION: A PATHWAY TO SUSTAINABLE SANITATION IN BALAKA, MALAWI

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study. The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Committee Address:
Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

`

Yours Sincerely,

Gift Mbwele

SENIOR RESEARCH ETHICS ADMINISTRATOR

For: CHAIRMAN OF MZUNIREC

Committee Address:
Secretariat, Mzuzu University Research Ethics Committee, P/Bag 201, Luwinga, Mzuzu 2; E-mail address: mzunirec@mzuni.ac.mw

Figure 12 Condition of Simple Pit Latrines

Figure 13 Pot used for anal cleansing also used for hand washing

Borehole Communal tap

Figure 14 Sources of Water in Balaka.

Figure 15 Type of Simple Pit Latrines available in Balaka four years after ODF certification

Figure 16 Condition of Pit Latrines after Dilapidation

Figure 17 Condition of Pit Latrines that make people fail to use them

`

,

Ordinary Tippy Tap (Mpondagiya)

Figure 18 Handwashing facilities in use in Balaka

Figure 19 Sanitation Plat Foams