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SUSTAINABILITY OF SANITATION CHANGE IN RURAL ETHIOPIA

DOCTORAL THESIS

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DECLARATION

I declare that the submitted doctoral dissertation is my original work, conducted under the supervision of Prof. RNDr. Josef Novotny, PhD, and all sources of literature have been appropriately cited. This thesis has not been previously submitted, in whole or in part, to obtain any other academic qualification. The following four published articles are part of this dissertation.

1. Novotný, J., & Mamo, B. G. (2022). Household-level sanitation in Ethiopia and its influencing factors: a systematic review. BMC Public Health, 22(1), 1448.
   Share of authorship 50%

2. Mamo, B. G., Novotný, J., & Ficek, F. (2023). Barriers for upgrading of latrines in rural Ethiopia: disentangling a sanitation socio-technical lock-in. Local Environment, 28(8), 1026-1044.
   Share of authorship 45%

3. Mamo, B. G., Novotný, J., & Admasie, A. (2023). Quality of latrines and willingness to improve them in rural Ethiopia. Journal of Water, Sanitation and Hygiene for Development, 13(5), 339-349.
   Share of authorship 50%

4. Mamo, B. G., & Novotný, J. (2024). Promotion of market-based sanitation in Ethiopia: a case study from Wolaita zone. Health Promotion International, 39(2), daae034.
   Share of authorship 66%

In Prague August 15, 2024 Biruk Getachew Mamo

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ABSTRACT

Access to safe sanitation facilities that effectively capture, and process human excreta and urine is essential for public health and socioeconomic improvement. The adoption and use of safe sanitation vary across countries and their development levels. Countries in Southeast Asia and Sub-Saharan Africa have low coverage of safe sanitation practices. Despite the efforts to achieve sanitation targets within recent global development frameworks, most of them face multi-scalar challenges and are left behind to meet these targets. Ethiopia is among the least performing countries in achieving the national sanitation targets of the Sustainable Development Goals (SDGs) by 2030. Ethiopia has made significant progress in reducing open defecation over the last two decades which is attributed to national sanitation strategies implemented under the health extension program. However, the sanitation facilities remain predominantly non-durable and fail to meet basic hygienic standards. Concerns thus arise that investments in sanitation may be wasted if upgrades to safe sanitation facilities are not realized and sustainability of the sanitation change ensured. This dissertation examines the barriers and drivers of such sustainable sanitation changes in rural households in Southern Ethiopia, using quantitative and qualitative case studies from 2019-2022. It systematically reviews primary evidence on household-level sanitation and investigates factors hindering latrine quality upgrades, household plans, and willingness to pay for hygienic latrine components. In addition, it explores demand- and supply-side challenges related to market-based sanitation, an approach aimed to facilitate improvement of sanitation infrastructure, drawing on qualitative data from semi-structured interviews and focus group discussions with various stakeholders. The research reveals that rural sanitation in Ethiopia is constrained by a socio-technical lock-in, characterized by the continued use of unhygienic latrines without significant adoption of sustainable sanitation practices. Despite the low standards of sanitation facilities, households expressed satisfaction with using them. Plans to upgrade latrines and willingness to pay for improved components are limited to regular maintenance rather than upgrading to functionally sustainable facilities due to poverty, material constraints and low purchasing power. Additionally, a lack of organized political and institutional support at lower administrative levels, coupled with multitasking and low remunerated change agents, adversely affects sanitation interventions. The study concludes that neither behavioral change nor market-based sanitation approaches alone will resolve the challenges to achieving safe sanitation in Ethiopia. Provision of subsidized sanitation products is required along with effective promotion to dispel the widespread belief that any latrine is inherently beneficial. Furthermore, structural economic advancements in rural households must be pursued to improve quality of life alongside the promotion of hygienic sanitation infrastructure.

Key words: Ethiopia, Sanitation, Latrine quality, Latrine upgrading, CLTS, MBS, Willingness to pay

LIST OF ABBREVIATIONS

C-TAM-TPB - Combined technology acceptance model—Theory of planned behavior

CLTS - Community-led total sanitation

HDAs – Health development armies

HEW – Health extension workers

HEP – Health extension program

IBM-WASH – Integrated behavioral model of water sanitation and hygiene

MBS – Market-based sanitation

MDGs - Millennium development goals

NGOs- Non-governmental organizations

OD - Open defecation

ODF – Open defecation free

RANAS - Risk, attitudes, norms, abilities, and self-regulation

SDGs - Sustainable development Goals

SSA – Sub Saharan Africa

UN - United Nations

UNICEF - United nations children's fund

WASH - Water, sanitation, and hygiene

WDA – Women development armies

WTP – Willingness to pay

WHO - World health organization

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1. INTRODUCTION

Access to safe sanitation, including facilities that safely capture and process human excreta and urine, is recognized as a fundamental human right and its provision is an essential requirement for public health and socioeconomic improvement (Ezzati, 2005, Murray et al. 2020). Sanitation refers to the provision of facilities and services for the safe disposal of human excreta. It encompasses both the access to and sustained use of these facilities to ensure the proper management of human waste in a manner that promotes health, enhancing human dignity and safety, and promoting overall well-being (WHO 2018). Hygienic sanitation is a precondition of environmental health, meaning the theory and practice of assessing, correcting, controlling, and preventing the factors in the environment that can potentially affect the health of present and future generations (Frumkin, 2016, p. 46). Public health burdens attributed to unsafe sanitation vary as per the development level of countries, and its distribution is not equitable across geographies (Abrams et al., 2021, Aragaw et al., 2023, Chen et al., 2023). Diseases attributed to poor sanitation (such as diarrhea) are major problems in low-and-medium income countries and not a major public health issue in developed countries (Troeger et al., 2020).

Ensuring the provision of safe and affordable sanitation services is a crucial responsibility of governments worldwide. As a result, in the last two decades the advancement of hygienic, safe, and sustainable sanitation practices has become a shared objective among governments, policymakers, and stakeholders and ensuring access to hygienic sanitation was considered among the main global development agendas (UNICEF/WHO 2019). Basic sanitation was recognized, and the targets for improvement were included in both recent global development frameworks: the Millennium Development Goals (MDG7) and the Sustainable Development Goals (SDG6). These efforts have stimulated governments, especially those from countries in the Global South, to include sanitation (closely interrelated with water and hygiene) among national development priorities (Gutierrez, 2007; Ngondi et al., 2010; Coffey et al., 2017; De Buck et al., 2017; Garn et al., 2017; Tidwell et al., 2019). Nonetheless, there is considerable variation in the pace of progress across nations, and only a quarter of countries are on track to attain the national sanitation targets of the SDG6 by 2030 (WHO, 2022). A significant portion of the global population remains without access to safe sanitation. Globally, over 3.4 billion people do not have access to safely managed sanitation, and more than 419 million people practice open defecation (OD) (WHO, 2021). In Africa, the majority of countries are not on track to achieve universal coverage of at least basic sanitation services by 2030 (WHO/UNICEF JMP 2023).

Globally, various sanitation intervention approaches aim to ensure access to facilities, encourage consistent use, and eliminate OD (Devine et al., 2013; Barrington et al., 2017; Crocker et al., 2017; Harter et al., 2020). These interventions can be broadly categorized into infrastructure-focused and

behavior-focused approaches. While the former provide essential physical facilities, such as latrines, particularly in under-resourced regions; the later aim to change sanitation practices through behavioral change messages, promoting the adoption and effective, sustainable use of latrines (Devine & Kullmann, 2011, Crocker et al., 2017). Policy direction and implementation strategies vary based on a country's sanitation status and available resources. In regions like Sub-Saharan Africa and South Asia, community-led total sanitation (CLTS) and market-based sanitation (MBS) are prevalent. These approaches, considered suitable for areas with low sanitation coverage or high OD rates, aim to improve latrine coverage by integrating sanitation technology (hardware) and behavior change (software). Despite significant investments and efforts towards global sanitation goals, the sustainability of the changes remains uncertain due to complex, multi-scalar factors, including environmental, social, behavioral, cultural, political, technological, and economic influences at various levels (Munamati et al., 2016; Kumar, 2017; Novotný et al., 2018a).

The CLTS approach effectively reduces open defecation (OD) practice but has raised concerns about the quality and sustainability of the adopted sanitation facilities (Venkataramanan et al., 2018; Ficek & Novotný, 2019). It prioritizes coverage over quality, often using low-cost materials prone to structural failure (UNICEF, 2020; Novotný & Mamo, 2022; Kouassi et al., 2023). Studies in various LMICs indicate that the failure to adopt durable latrines leads to a slippage into OD (Bateman & Engel, 2017; Crocker et al., 2017; Venkataramanan et al., 2018; Harter et al., 2020; Abebe & Tucho, 2020). Thus, changing the promotion approach to implementing safe sanitation practices through improved technologies is crucial. These technologies have to suit infrastructure-limited settings. The convenient method could be provision of prefabricated latrine components and promoting market expansion for sanitation products through subsidies or behavioral messages. If managed well, they can elevate household sanitation and support private sector businesses. However, economic constraints and a lack of understanding of improved technologies may reduce household demand (Gutierrez, 2007; Van Minh & Hung, 2011; Halkos & Tzeremes, 2012; Goddard et al., 2018; Perard, 2018; Mamo et al., 2023a). Perceived unaffordability further affects willingness to pay for sanitation products, with households often underestimating market prices or expecting free provision. Additionally, low market returns discourage private sector involvement (Mamo et al., 2023b; Mamo & Novotny, 2024).

The above-mentioned intervention approaches and its factors are also very relevant for Ethiopia, a focus country of my dissertation. With an estimated population of more than 130 million, Ethiopia significantly influences the regional and global indicators due to its population size and its low sanitation rates. Ethiopia used to be among the countries where OD was the most common. But achieved significant progress in improving sanitation conditions (Table 1), with the most significant decrease in the estimated national OD rate worldwide from 79% to 18% between 2000 and 2022 (UNICEF/WHO,

2023). The high coverage of latrine and a major transition from OD practice to latrine utilization were achieved through the implementation of a national hygiene and sanitation strategies (MoH 2011, 2013, 2015) via a country-wide community health extension program (HEP) (MoH 2015; Assefa et al. 2019).

Table 1. Countries in Africa with the largest number of people practicing - open defecation, unimproved sanitation and safely managed sanitation rate (%)

Country	Open defecation	Unimproved	Safely managed
Nigeria	18	19	32
Ethiopia	18	65	7
Niger	65	9	8
DRC	12	54	13
Chad	63	19	11

Source: UNICEF/WHO (2023)

Although Ethiopia was praised for its significant reduction in the percentage of population practicing OD, the majority of the population (majorly from rural settings) owns latrines of substandard quality (Awoke and Muche 2013; Irish et al. 2013; Crocker et al. 2017; Novotný et al. 2017, 2018a; Zeleke et al. 2019). The rate of households practicing OD also varies regionally. Geographically, high rates of OD are reported in Northern and Eastern Ethiopia, whereas central and Southern Ethiopia (Figure 1) practice relatively less OD (Kebede et al., 2024).

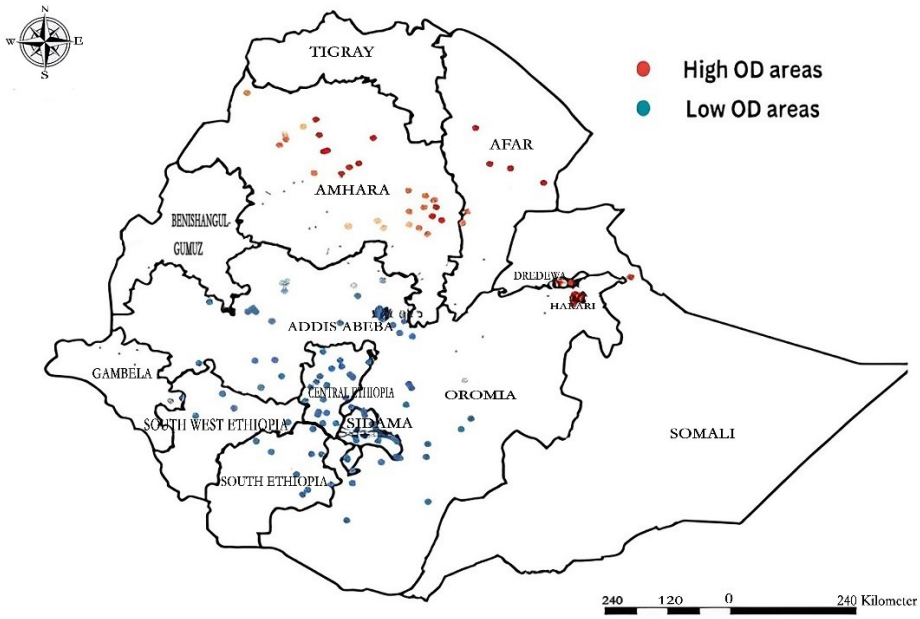

Figure 1. Spatial distribution of OD at household level at regional level, Ethiopia (Source: Kebede et al., 2024)

From my research as well as personal experience when working in both governmental and humanitarian organization-funded sanitation intervention projects for about a decade, I learned that the majority of rural households in Ethiopia tend to construct latrines using traditional methods, often employing any available materials without regard for quality or durability. This issue extends beyond the superstructure components to include inadequate consideration of pit size. The studies that were part of this dissertation also indicated that households are frequently caught in a cycle of reconstructing substandard latrines, with the average lifespan of a latrine being approximately four years (Mamo et al., 2023a). Infrastructure and material constraints, along with various psychological factors, hinder the process of upgrading or maintaining latrines. Less focus is given to the quality of latrines and regular upgrading and maintenance to ensure sustainability (Mamo et al., 2023b). Alternative sanitation technologies and the management and reuse of fecal waste or pit emptying are uncommon in Ethiopia, where interventions primarily focus on eliminating open defecation and ensuring latrine availability (Novotny et al., 2018). Advanced steps for sustainable sanitation are often neglected. Despite the substandard quality of latrines, households find satisfaction due to perceived health benefits and privacy, though the health impact is less evident (Novotný et al., 2028b). The traditional promotion approach that encourages the use of any latrine, regardless of quality, alongside satisfaction with substandard facilities, diminishes demand for safe sanitation (Mamo et al., 2023).

Recent policies seem to acknowledge these challenges (OWNP, 2019; Bakker & Feldman, 2021). In 2019, the "Total Sanitation to End Open Defecation and Urination" campaign aimed to make Ethiopia OD-free by 2024 (FMOH, 2019). On this regard, the MBS program was introduced to promote improved latrines by providing training on production and marketing, enhancing supply, and boosting demand through behavioral measures (FMOH, 2020; Phillips et al., 2022; USAID, 2023). MBS also has been integrated with the health extension program (HEP) to promote sanitation products (FMOH, 2020). However, challenges at local business, household, institutional, and political levels hinder progress (Vrana et al., 2017; Freeman et al., 2022; Mamo & Novotny, 2024). In addition, households' willingness to pay for sanitation products is influenced by income, and they often underestimate market prices, affecting their intention to upgrade (Mamo et al., 2023b). Household-level sanitation inequalities in Ethiopia indicate that achieving hygienic and equitable sanitation requires more than behavioral change; it necessitates broader socioeconomic development (Gashaw et al., 2023).

In Ethiopia, research on environmental health and sanitation, particularly water sanitation and hygiene, has begun to gain momentum recently, predominantly with publication starting after 2015, as reported in my first review article (Novotný & Mamo, 2022). This surge in research activity corresponds with the implementation of sanitation policies (particularly through HEP) and developmental agendas (MDG & SDG) which gained political recognition subsequently shifting the focus towards sanitation research.

It is most common that the sanitation literatures in Ethiopia focus on sanitation intervention (evaluating the relationship between sanitation intervention and human health), as well as examining the factors influencing common sanitation outcomes such as latrine adoption, use, and sanitation coverage, barely exploring the underlying explanations for observed sanitation conditions. On the contrary, there was and still is a notable lack of studies explicitly analyzing key areas related to sustainability, including latrine quality, household demand for sanitation upgrades, willingness to pay for improved sanitation products and services, supply-side issues, and associated challenges. This observation suggests that the trajectory of sanitation research in Ethiopia reflects the characteristics of Ethiopian sanitation policies, which tend to prioritize the creation of demand for basic latrines over identifying existing gaps and addressing future challenges. In addition, it is also rare to find critical research (critical interpretation and discussion of findings) that focuses on the policy and sanitation intervention approaches in Ethiopia. Research in this field is often presented as apolitical, avoiding challenging the authorities or discussions of local politics and power relations involved in the implementation of interventions at the micro-level (Ostebo et al., 2018, Novotny et al., 2018b).

The challenges and research gaps identified above have motivated my dissertation. As indicated above, although Ethiopia has achieved notable changes in sanitation patterns, the sustainability of these changes has been contested. **Therefore, the general objective of my dissertation is to examine this sustainability and to understand its constraints and underlying conditions.** The dissertation has been submitted as a collection of published papers supported by this introductory text. The articles (Table 2) include a systematic review of primary evidence on household level sanitation in rural Ethiopia and three articles based on field research that address issues of sustainability of sanitation change in Southern Ethiopia. The research was conducted in the context of previous interventional attempts to increase sanitation safety in Ethiopia, with an emphasis on their political-ecological and social consequences as well as those associated with policies and strategies implemented in Ethiopia through the HEP. It also contains an analysis of the global context based on available secondary data. The dissertation consists of two main parts.

The first part systematically addresses diverse research aspects through theoretical and methodological lenses, consisting of six sections. The initial section briefly discusses the theory of environmental risk transition, highlighting the role of demographic, socioeconomic, and environmental changes at the macro level. The second section explores global strategic frameworks on sanitation, providing context and a general understanding of its goals at a global level. The third section offers a multidimensional conceptualization of sanitation, examining it through human rights, and gender perspectives. The fourth section details existing conceptual frameworks for sanitation, emphasizing key drivers and barriers to sustainable sanitation change in Ethiopia. The fifth section explains two prominent sanitation

intervention approaches (CLTS & MBS), their contributions, and the challenges on their implementation. Finally, the sixth section presents the methodological approach, offering a concise overview of the research designs used in the articles in this dissertation.

The second part of the dissertation presents a series of published articles and contributes to the existing body of sanitation research. The studies are thematically related but focus on unique research questions and contexts within Ethiopia and they also employ slightly different methods and concepts (Table 2.). They were structured in a sequence of publication years. A summary of the objectives for each conducted study is provided below, while further details about the research questions, guiding concepts, methods, and results can be found in the respective case studies. As mentioned, the main goal of my dissertation is to investigate the barriers and drivers of sustainable sanitation changes in rural Ethiopia. This is addressed through a set of specific objectives that align to individual articles selected for this dissertation collection. The summary of these objectives and overview of their methods are presented below (Table 2).

Table 2: Summary of research articles.

Article (cite.)	**Main goal**	**Specific goals/research questions**	**Methods**
Novotny & Mamo (2022)	Assess published research that analyzes household level sanitation in Ethiopia and its drivers.	• Characterize available literature on household-level sanitation • Identify factors that influence sanitation outcomes. • Analyze relationships between factors and outcomes	Systematic review
Mamo, Novotny & Ficek (2023)	Examine factors inhibiting the upgrading of latrines in rural Ethiopia	• Examine sanitation conditions in study area • Assess plans to improve latrines and their drivers • Assess willingness to pay for prefabricated slab platforms and its influencing factors • Identify perceived costs of referral model latrine in comparison to actual costs	Cross-sectional survey consisted of structured interviews and direct observations of latrines
Mamo, Novotny &	Examined issues around latrine upgrading in Ethiopia	• Assess latrine quality in study area	Cross-sectional survey consisted of structured interviews and direct

Admasie (2023)		• Examine the extent of latrine upgrading and the respective plans and preferences.	observations of latrines
Mamo & Novotny (2023)	Examining the implementation of market-based sanitation (MBS) at grassroots level	• Identify challenges of MBS implementation on the demand side • Identify challenges of MBS implementation on the supply side	Qualitative data collected through semi-structured interviews and focus group discussions

- The first objective of my dissertation is to assess published research that analyzes the role of drivers of household level sanitation outcomes under similar geographical and institutional settings. It focuses on the systematic review of primary research studies examining sanitation conditions and their influencing factors in Ethiopia.

- The second objective focuses on analyzing the demand for latrine improvements and the factors driving this demand through the case study among general sample of households in Wolaita region, Southern Ethiopia. It examined the sustainability of sanitation conditions and its drivers in terms of both infrastructure-related and behavioral factors. In addition, the willingness of households to accept and pay for improved sanitation technologies, demand for latrine improvements and households' perception of costs with respect to a referral model latrine were assessed.

- The third objective examine factors inhibiting latrine quality and upgrades, along with the respective plans and preferences in rural households based on the case study focused on the sample of latrine-owning households in Sidama region, South Ethiopia.

- The fourth objective address both demand- and supply-side challenges, examining the grassroots-level implementation of market-based sanitation promotion. The case study draws on the qualitative data collected through semi-structured interviews and focus group discussions (FGD) with various actors (key informants) involved in or knowledgeable about both the demand- and supply-side issues around the MBS implementation and, more generally, the sanitation situation in the Wolaita Zone, South Ethiopia.

The dissertation concludes with a comprehensive conclusion that covers the key outcomes from the case studies. This includes a reflection on the findings, recommendations for future research and interventions, and suggested policy directions to guide potential direction for further intervention and application of sustainable sanitation for the benefit of rural communities in Ethiopia.

2. MACRO-LEVEL VIEWS AND GLOBAL FRAMEWORKS

2.1. Theory of environmental risk transition

Although my own empirical research primarily focuses on the micro-level of individual households and communities, it should be acknowledged that the micro-level situation is inherently influenced by processes operating at higher levels. In this respect, the theory of environmental risk transition can help to conceptualize the role of sanitation in the wider processes of population, socioeconomic and environmental change at macro-level (Smith & Ezzati, 2005). It focuses on the interactions between three closely related models of transitions induced by societal modernization in terms of the demographic, epidemiologic, and risk transitions (Figure 2). The environmental risk transition model makes a distinction between the traditional and modern environmental health hazards.

Traditional environmental health hazards are associated with household-level hazards that have typically been related to poverty and lack of development. They include lack of access to safe drinking water, unsafe sanitation and poor personal hygiene, poor housing conditions, lack of power source for cooking and lighting (i.e., lack of electricity). Whereas modern environmental health hazards are linked to excessive natural resource use or unsustainable development (over consuming natural resource and under protection of environment) that undermines its effect on human health and on the environment. These include water pollution from populated areas, urban air pollution from automobiles, solid and hazardous waste accumulation; deforestation, land degradation, and other major ecological change at local and regional level; climate change; and transboundary pollution etc. Traditional environmental health hazards are often quickly expressed as diseases, whereas modern environmental health hazards take a long time to develop as diseases, although not in every case. For example, if an individual is exposed to two separate environmental hazards at the same moment, such as drinking contaminated water and ingesting a carcinogenic chemical, he or she may experience diarrhea in hours (or in the next day after exposure) and cancer over time (Zeliger, 2015). In general, environmental risk factors and disease were more closely linked in time and economic development. Traditional environmental health hazards and related health risks are thus associated with the economic development of a certain society which can be changed through time following the economic transition to the modern lifestyle (Smith & Ezzati, Pattanayak et al., 2018).

The change in health characteristics due to environmental health hazards and associated health risks from traditional to modern with time and economic development has been called “risk transition” (Corvalán et al., 1999). Thus, an understanding of the risk transition is vital for designing timely preventive intervention strategies. The transition in diseases (i.e., epidemiological transition) has effect

on demographic transition (on the birth rates and death rates of the population and on the age distribution). The demographic transition describes the shift in societies from a state of high fertility (birth rates) and high mortality (death rates), when population sizes were relatively stable over long periods of time, though fluctuating dramatically due to epidemics, famines, and other factors preceding and during the demographic transition (Smith & Ezzati, 2005).

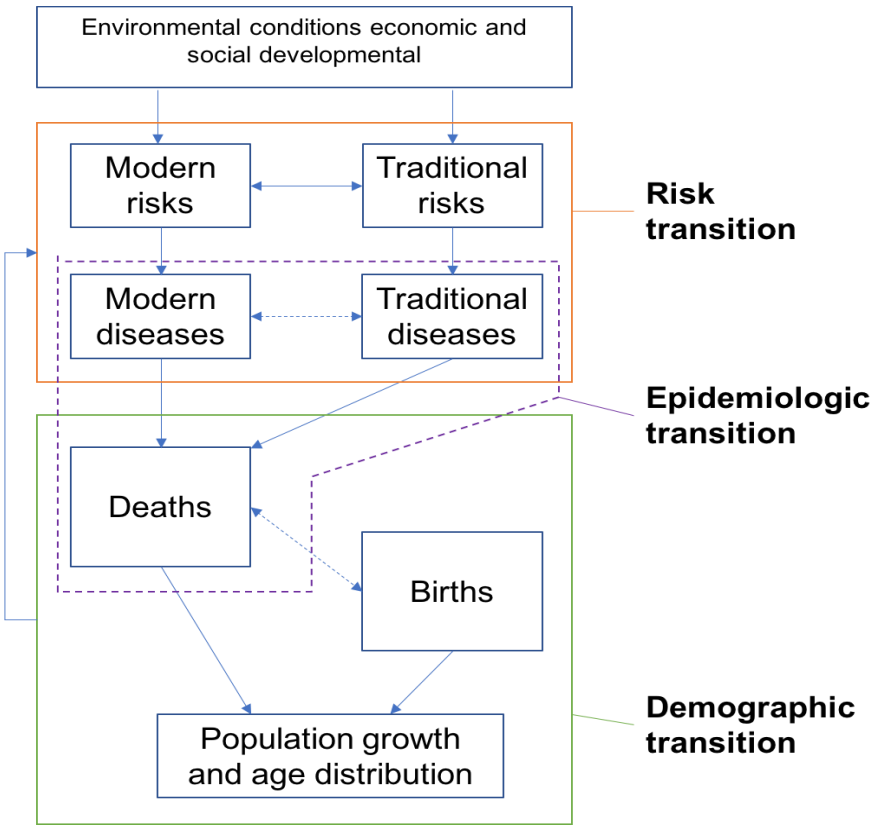

Figure 2. Relationship between the transition frameworks (adopted from Smith & Ezzati, 2005).

Environmental risk transition framework indicates that the environmental risks operate at different spatial levels with respect to stage of development though the level of severity varies (Figure 3). For example, diarrhea disease, which is caused by drinking contaminated water polluted with human feces, is an environmental risk factor that mainly affects infants and young children at the household level. Outdoor air pollution, lead pollution, occupational risks, and road traffic accidents are standout for community level environmental risks. Climate change is the major global environmental risk factor which occurs due to the human release of greenhouse pollutants into the global atmosphere. The relative importance of environmental risks operating at the global level, such as greenhouse gas emissions which causes climate change, increase with economic development, and their effects are not limited to a specific geographic area, but can be a global issue. Thus, household level risks fall with development,

community risks rise and then fall, and global risks rise throughout the development process relative to risks at lower levels.

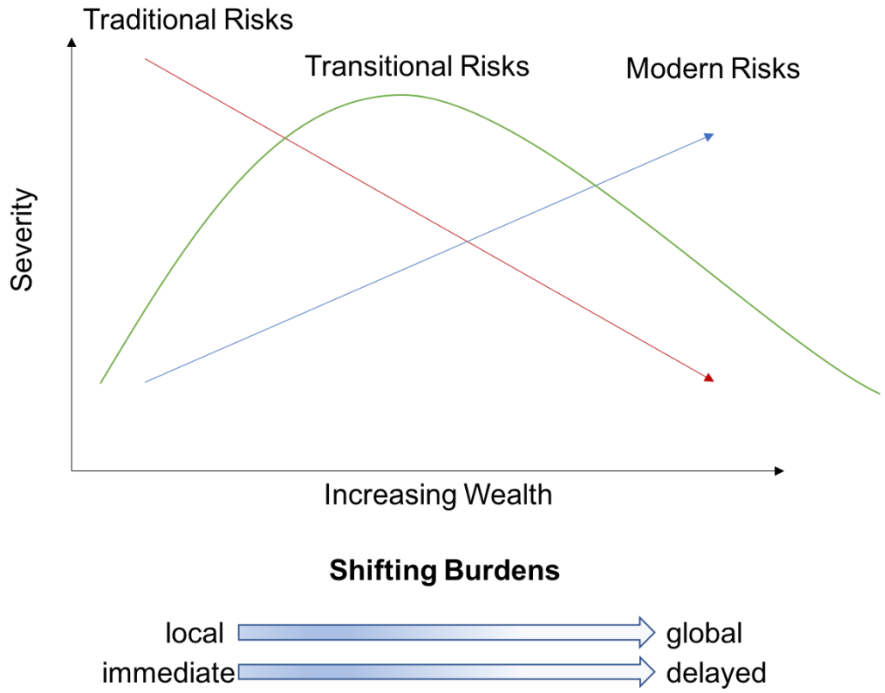

Figure 3. Environmental risk transition framework at household, community, and global level in relation to development (adopted from Smith & Ezzati, 2005)

While useful as a simplified conceptualization of macro-level change, the presented framework of environmental risk transition should be carefully interpreted. It is once again important to make clear that it compares the relative contributions of the distinct types of environmental risks rather than the scale of severity of risks in absolute terms. For example, people in poor countries may be (are) affected more by macro-level global climate change than those in rich countries in absolute terms, though in relative terms risks associated with climate change may be less important and less acute than those related to local environmental issues such as water or sanitation as the risk transition model suggests. Considering the absolute magnitude, the accumulation of distinct environmental risks, rather than their gradual replacement, can be the case for many developing countries such as Ethiopia.

In addition, the risk transition framework presented above also poses the risk of "modernization determinism," implying that all societies follow the same linear path from traditional to modern states, like the development trajectory of Western countries. This tempting assumption overlooks the pronounced historical and geographical differences, meaning distinct contexts in which associated

environmental challenges must be addressed. Sanitation challenges exemplify how misleading such analogies can be. Due to very different environmental and socioeconomic conditions, the water-intensive and centralized sanitation technologies that have played a pivotal role in addressing sanitation in Western countries have limited applicability in the Global South, particularly in Sub-Saharan Africa.

2.2. Sanitation in global strategic frameworks

The two recent successive global strategic frameworks; the Millennium Development Goals - (MDGs) for 2000-2015 and Sustainable Development Goals (SDGs) for 2015-2030, have brought the world nations towards a universal set of interrelated goals and targets. The goals for the latter are balanced between the three pillars of sustainable development—social, economic, and environmental—that seek to address global challenges (Pradhan et al., 2017). It means efforts to consolidate the fragmented and disjointed nature of the international development agenda that has existed since the 1940s into a single framework (Weststrate et al., 2019). Developmental goals and targets for water, sanitation, and hygiene (WASH) are among other development agendas covered by these strategic frameworks.

The MDGs contributed to accelerating global progress toward WASH targets, encouraging donors, governments, international agencies, and country decision-makers to focus attention on the identified areas of need, and to measure the results of initiatives. Target 7c of the MDGs aimed to halve the population that had no sustainable access to water and basic sanitation before 2015. Though significant progress was made in meeting the targets set for access to safe drinking water, increasing the number of people using basic sanitation, and decreasing OD globally, major criticisms have emerged from both the leading organization (e.g., WHO) and the research community about the shortcomings of the indicators. According to the findings of the review paper, the indicator of "access to an improved water source" (MDG7c) fails to take water quality into account (Weststrate et al., 2019). Even if the target for access to safe drinking water was met, when water quality is used as an indicator, the percentage of the estimated population with access to safe drinking water decreases. Similarly, the indicator of "access to improved sanitation facilities" ignores the importance of safe wastewater and faecal sludge collection and treatment, and sanitation infrastructure maintenance or upgrading, which influence the estimation of people with access to sanitation. Existing inequalities between geographies, political and administrative settings, gender, and the human right to water and sanitation (marginalized/ disadvantaged groups) as well as methods for measuring inequality were other critique areas which were not considered in the indicators of the target (Rajapakse, et al., 2023).

Unlike the MDGs, the succeeding Sustainable Development Goals (SDGs) for the 2016–2030 period, include a self-standing water and sanitation goal—SDG 6. Its' adoption was based on results generated from in-depth studies by multiple parties, leading organizations such as the UN and its partners, and

research communities, which contributed to the formation of interlinked targets enhancing coherent and effective prioritization and decision-making (Allen et al., 2019). Under SDG6, target 6.2. —achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations; address the limitations that were seen in MDG7c. For example, in water, sanitation and hygiene (WASH), representing targets and indicators such measuring inequalities among gender (i.e., women and girls), disability, and disadvantaged groups based on ethnicity, race, religion, migratory status, or other characteristics were considered (Weststrate et al., 2019). SDG6 provides an integrated, evidence-based framework of sanitation targets and indicators to support national planning and reporting. It also encourages international cooperation and support in water and sanitation related activities and programs in developing countries and strengthens the participation of local communities in improving sanitation management. Thus, significant contributions and support in terms of filling the financial gaps, sanitation technological advancement, and knowledge sharing significantly impact sanitation change and its sustainability in low-income countries (Howard, 2021).

3. SANITATION RESEARCH THROUGH MULTIDIMENSIONAL PERSPECTIVES

Sanitation research is multidisciplinary, allowing for the examination of interventions and outcomes from various perspectives. It means the investigation of how the health problems assumingly related to unsafe sanitation can be controlled through specific sanitation interventions (Cha, S. et al., 2024). Examining the outcomes of these interventions became the dominant research topic conducted mostly through the epidemiological approach (e.g., Heller et al., 2005, Gutierrez, 2007, Munamati et al., 2016, Ben Yishay et al., 2017, Acey et al., 2019, Budge et al., 2019,). Sanitation interventions are thus comprehended as the main (and sometimes only) vehicle of change towards a safer sanitation environment and, ultimately, better health. Therefore, the research objectives are typically, directly, or indirectly, focused on assessing needs for these interventions, informing their design, examining their implementation, and their impacts on sanitation outcomes (as proximate outcomes) and/or health outcomes (as ultimate outcomes). Research conducted in non-interventional settings is also common to assess the prevalent sanitation conditions and understand their drivers that can be subsequently addressed by interventions. However, causal linkages between sanitation and health are known to be complex and difficult to establish empirically at microlevel (Freeman et al., 2016; Garn et al., 2017; Sclar et al., 2016).

On the other hand, sanitation change extends beyond human health impacts, encompassing often overlooked non-health benefits. The financial burden of healthcare and reduced productivity from

sanitation-related disease hinders economic activity (UNICEF, 2023). Moreover, unsafe facilities lead to absenteeism, especially among schoolgirls, force them to drop out, and affect educational outcomes. Psychologically, inadequate privacy and dignity in sanitation facilities cause stress and anxiety, negatively affecting mental well-being. It is argued that successful sanitation change can often not be attained solely by interventions focused on individual, household, and community level but also broader socio-cultural, political, environmental, and economic changes can enhance the outcomes of these interventions. For these and other reasons, sanitation research can be examined through political ecology, related to political economy but additionally reflecting closely linked human-environment interactions through critical sanitation research. Besides the relationship between political ecology, political economy, and environmental sanitation, the following two subsections address the impact of sanitation on gender equality, the empowerment of women and disadvantaged groups, and sanitation as a human right.

3.1. Human rights perspective

Access to sanitation is a fundamental human right. All individuals have the right to access sanitation facilities that offer privacy, uphold dignity and safety, and are both physically accessible and economically feasible (WHO, 2020). The practice of poor sanitation affects people's right to live in a healthy environment (Kirschner, 2011; Winkler, 2015). Moreover, it is a community matter. OD can adversely impact other members of the community, but not only the individual or community that practices OD. For many years, the human right to sanitation was neglected or not explicitly recognized in international human rights agreements. Eventually, the right to safe sanitation was declared a human right on July 28, 2010, by the UN General Assembly in Resolution 64/292 (Feris, 2015; Loen, 2020). In some countries, the right to sanitation has been enshrined in state constitutions. This is especially true for developing countries that have recently updated their constitutions, as well as other countries that include direct or indirect references to the right to sanitation. In the case of Ethiopia, Constitution of Federal Democratic Republic of Ethiopia stated in Article 44 (1) states that “All persons have the right to a clean and healthy environment”. This article suggests that while the right to sanitation is not explicitly mentioned, it is indirectly covered under the broader rights to health and a clean environment.

Adopting a human rights perspective extends beyond recognizing the right to hygienic sanitation in legislation. This perspective aligns with the human capability approach, advocating that sanitation interventions should empower individuals and promote community equality, emphasizing the crucial role of human agency in driving change. This approach significantly broadens the traditional understanding of sanitation, which is typically focused on fulfilling basic needs rather than ensuring and protecting human rights (Luh et al., 2013; Salman, 2014; Feris, 2015; Obani & Gupta, 2015). The

human right to sanitation assumes that people can use their capacity and skills to improve their sanitation environment. However, it argues that when people are unable to achieve hygienic sanitation conditions for reasons beyond their control, the states (and society in general) are obliged to ensure access to the means required for this.

In this perspective, this dissertation assessed how interventions promote and implement sustainable sanitation interventions regarding human rights. Based on my field survey and documented reports from other studies, it is evident that certain sanitation promotion approaches empower the community through sanitation promotions (Dery, 2020, Mamo & Novotný, 2024). However, there are still existing approaches that can disregard human rights related to sanitation. The practical evidence and that also applying in my research country, Ethiopia is that administrative bodies and implementers enforce rules that contradict the rights of individuals and households to sanitation, in an effort to achieve successful sanitation interventions (Novotny et al., 2018b, Mamo & Novotny, 2024). In Ethiopia, the CLTS approach employing social punishments such as mocking, throwing stones, and excluding from other social participation, including money penalties, jailing are imposed on those who do not construct latrine at the given time due to different reasons (i.e., unaffordability, lack of resources or construction materials or manpower, etc.). Shaming can also contribute to the imposition of sanctions such as denial of material and financial benefits, loss of livelihood, and loss of legal rights (Bateman & Engel, 2017, Mamo and Novotný, 2023a). This is also common elsewhere (Brewis et al., 2019b). Even though these practices are defended as an effective tool for behavior change and norm formation, they come with significant risks. Instilling shame in people who cannot afford a latrine can lead to more marginalization and social exclusion based on social judgment rather than concerns about possible behavioral change.

3.2. Gender perspective

Gender and sanitation are inextricably linked (Sahoo et al., 2015; O'Reilly, 2016). Women and girls are more disadvantaged than men in terms of access to safe sanitation in places where sanitation is inadequate (Khanna & Das, 2016). Due to the lack of a safe and functional latrine, people go to open fields, water bodies, bushes, or forests for defecation. In the case of women and girls when traveling to and from OD, they experience a higher risk of sexual harassment, violence, and insecurity (animal attack), which (O'Reilly, 2016) refers to as latrine insecurity. In addition to the physical infrastructure, the cultural and social expectations put women and girls in a difficult situation when defecating in a place where there is no access to safe sanitation. Social experiences and their possible consequences were significant stressors for women of all ages and stages of life, affecting their degree of comfort, familial status, and community standing (Sahoo et al., 2015). Women in various stages of life, most notably adolescent, married, pregnant, and adults, experience psychosocial and social stress where their acts were watched and strictly regulated due to a lack of facilities near their homes (Caruso et al., 2015;

Burt et al., 2016; Khanna & Das, 2016). The study reveals that women take a variety of steps to avoid the stress associated with OD, such as reducing their food or fluid consumption or completely avoiding it in certain circumstances, such as while traveling long distances or defecate only before dawn or wait until it gets dark to maintain privacy (Khanna & Das, 2016).

The gender-related aspects of sanitation vary as per geography and regions (Burt et al., 2016, Assefa et al., 2021). Gendered power relations within households are another aspect of sanitation. The decision makers about sanitation facility construction or maintenance are often men who are also typically the financial controllers (Fantahun et al., 2007, O'Reilly, 2016). On the other hand, there are traditional gender roles according to which water-fetching and latrine cleaning activities are traditional responsibilities of women and girls. Adoption of latrines therefore may add to the workload of women due to the intra-household division of labor.

The SDG-6 explicitly calls for gender equality in access to sanitation. SDG (6.2) acknowledges gender desirability, stating, "By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation", paying special attention to the needs of women and girls, and those in vulnerable situations. Some governments encourage women's active participation in community-based interventions. In this instance, Ethiopia can be mentioned as an example. Women are assigned to the position of community health worker so called "Women Development Armies (WDAs)" and become influential change agent in community health programmes to promote primary health services such as environmental sanitation, family planning, immunization, etc. (Maes et al., 2015). Engaging women in predetermined tasks to achieve specific, state-mandated, national centered goals is often seen as empowering women (Closser et al., 2019).

Gender is used in discourses to justify the need for local sanitation interventions. This need can be explained in two significant discursive dimensions. First, women are often socially well positioned for sanitation promotion even if the gender norms and power relations that a given community health worker navigates are context-specific, determined by local culture and politics (Steege et al., 2018). For example, Ethiopia's government chose women to be WDAs because the position is culturally acceptable due to the traditional responsibility of women for water and sanitation in households (FMoH, 2013). Second, assigning women to WDAs relates to a discourse that women and girls are primary beneficiaries of sanitation interventions. Giving women a model role in sanitation intervention is portrayed as enabling them to break through social and cultural barriers and exercise gender equality (Oswald et al., 2016). However, the underlying reasoning is relevant, these gendered discourses about the importance of women in sanitation can also be politically appropriated so women and women's roles can be (mis)used in interventions without empowering women (Maes et al., 2015).

4. CONCEPTUAL FRAMEWORKS AND INFLUENCING FACTORS

Effective sanitation change necessitates the integration of political, social, economic, cultural, and environmental factors, along with systematic behavioral changes at individual, household, and community levels. These factors can be analyzed through contextual, psychosocial, and technological dimensions (Dreibelbis et al., 2013). Understanding these interconnections underscores the importance of changes in these factors within broader structural contexts and inequalities that significantly impact sanitation interventions. Due to the high complexity of sanitation phenomena, causal theories are rarely employed in sanitation research. Instead, theoretical understanding often relies on various conceptual frameworks to identify and categorize factors influencing sanitation outcomes. The following conceptual models serve as crucial tools for both practitioners and researchers in "taming the complexity" and systematically organizing these influencers (Novotný et al., 2018a,).

Based on their empirical research in India, O'Reilly and Louis (2014) introduced the 'Toilet Tripod' model, a foundational yet practical framework for understanding the conditions necessary for successful toilet adoption. This model posits that toilet adoption is influenced not only by behavioral factors at the individual or household levels but also by the interplay of multi-scalar political, economic, and environmental factors. It underscores the importance of broader structural contexts and inequalities. The 'Toilet Tripod' model highlights three key analytical categories: multi-scalar political will, proximate social pressure, and political ecology factors. In contrast, Mosler's (2012) RANAS model of behavior change provides a conceptual framework that delineates dimensions of drivers crucial for shifts in behaviors related to WASH. The RANAS model classifies behavioral and psychological determinants into five blocks: Risks, Attitudes, Norms, Abilities, and Self-regulation. Due to its adaptability, the RANAS model can be applied in various forms of interventions. However, it primarily focuses on behavior at the individual or household level, often neglecting or only implicitly representing broader contextual influences such as institutions, technology, economic or political systems, and the environment (Novotný et al., 2018a). This consideration was addressed by Dreibelbis et al. (2013), who provided an inclusive classification of WASH determinants, categorizing them into three dimensions: contextual, psychosocial, and technological factors. These dimensions operate at various levels, including habitual, individual, interpersonal/household, community, and societal/structural. The Integrated Behavioral Model for WASH (IBM-WASH) explicitly represents what other behavior change models overlook. Unlike models that focus solely on individual behavior, IBM-WASH incorporates community and societal/structural levels alongside habitual and household levels. This approach highlights the impact of the broader socio-political context on behavioral models. Both the RANAS (Mosler, 2012) and IBM-WASH (Dreibelbis et al., 2013) models offer comprehensive classifications of theoretically and empirically justified factors and mechanisms crucial for understanding WASH drivers. It is also worth mentioning the Combined Technology Acceptance Model–Theory of Planned Behavior

(C-TAM-TPB) which integrates two well-established behavioral models: the Technology Acceptance Model (TAM) and the Theory of Planned Behavior (TPB) (Figure 4). This model is instrumental in evaluating users' behavioral intentions towards adopting new sanitation technologies while also examining the technological factors related to the functionality, products, and services associated with sanitation. According to TAM, behavioral intention is primarily influenced by two cognitive factors: perceived usefulness and perceived ease of use. These factors shape individuals' attitudes towards technology, which in turn determines their intention to use (i.e., accept) the technology and, ultimately, their actual use of it. On the other hand, TPB posits that behavioral intention is influenced by social norms, perceived behavioral control, and users' attitudes towards the new technology. Social norms pertain to the influence of significant individuals or groups on users' adoption of new technology, whereas perceived behavioral control encompasses the resources (e.g., skills, experience, financial means) and opportunities available to users that facilitate the performance of a behavior. Ignacio et al. (2018) expanded this model by introducing additional elements termed "external influences," including political climate, institutional support, user demand, and anxiety, which may impact perceived usefulness and perceived ease of use of new technology.

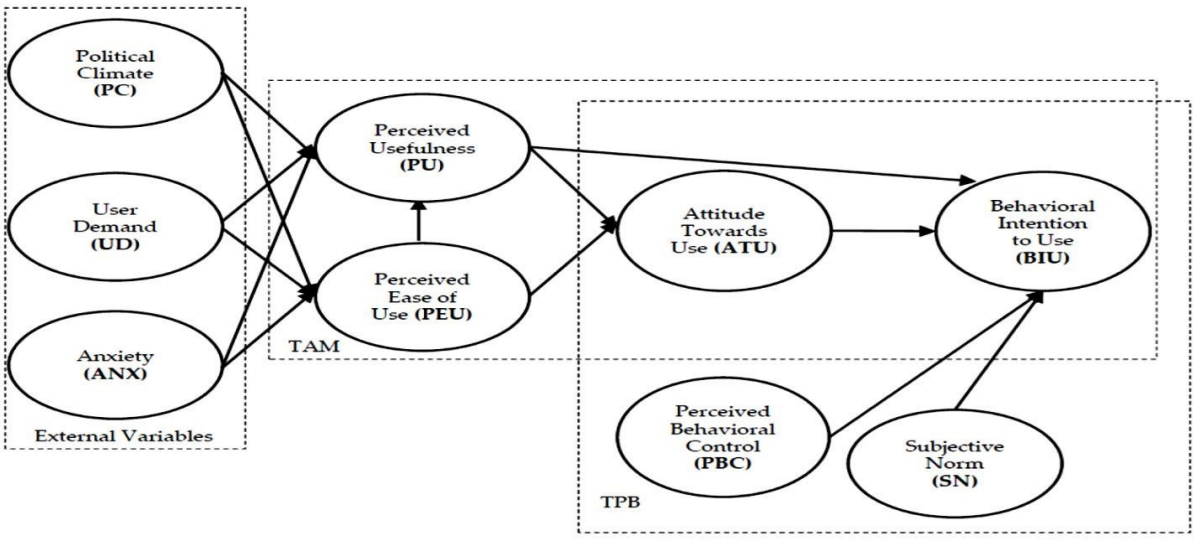

Figure 4. The C-TAM-TPB model (Ignacio et al., 2018)

However, the above-mentioned models do not systematically quantify the occurrence of specific influential drivers, or their thematic types based on existing empirical literature. To address this gap, systematic reviews of global contexts (Novotný et al., 2018a) and the Ethiopian context (Novotny & Mamo, 2022) were considered. These reviews classify drivers and demonstrate how they align with specific types of sanitation outcomes, offering more explicit guidance for researchers and practitioners.

4.1. Understanding the drivers of sanitation change in rural Ethiopia

In Ethiopia, sanitation interventions typically gain both political and institutional support through HEP and it is integrated with other developmental activities, but sanitation often receives lower priority (Mamo et al., 2024). Sanitation programs are grounded in national policies and strategies and require political and institutional (the government and its partners) participation to be implemented successfully. The dynamic, collaborative aspect of a multi-scalar political will, as well as its applicability at different levels, is crucial for its effective implementation. The higher-level political commitment, as well as lower-level implementers' fidelity are required to achieve a program end goal. Understanding national policy and strategy directions, creating a favorable working culture, and empowering local officials, informal local leaders, and model households for facilitation and follow-up are essential for integrating sustainable sanitation intervention at the community and household level. Communities and households need to be informed of updated strategic and technological developments and monitored and followed up on for their proper implementation. However, misinterpretation and application of sanitation policies hinder achieving desired outcomes. Moreover, overburdened frontline workers in the lower administrative units face reduced effectiveness due to workload discouraging full engagement (Mangham-Jefferies, 2014, Maes et al, 2015; Closser et al., 2020, Mamo et al., 2024). Additionally, politically driven conflicts lead to displacement, complicating government service provision and undermining sanitation programs and the broader health system in Ethiopia. Table 3 provides a summary of this and other drivers and barriers to sanitation change in Ethiopia, as discussed below.

The interaction between political and socioeconomic development and its influence on sustainable sanitation intervention is another area that needs to be assessed. Sanitation has an interaction with children's development, education, nutrition, and, more generally, a healthy and productive society. The interaction is bidimensional and they are the major contributing factors to the health-and non-health benefits (Halkos & Tzeremes, 2012; Anh et al., 2013; Novotny et al., 2018b; Perard, 2018; Ajemu et al., 2020). Inequality in socioeconomic status impedes sanitation progress and is directly linked to sanitation inequality. In relation to the general economic condition, social inequality in terms of household level wealth in the rural communities is affecting equal access to water and sanitation services. Most often, low attention is given to communities who are socially and economically disadvantaged, marginalized, and who live in informal settlements. In addition, members of communities such as the poorest of the poor, the disabled, female-headed households, and the elderly without access to labor mostly tend to utilize unsafe sanitation (Yu et al., 2014, Panagiota & Subramanian, 2017). In addition, inflation, driven by global economic trends, poses a new challenge for households planning sanitation investments, as it raises the costs of materials and products (Sisay et al., 2022; Tolasa et al., 2022). Therefore, these groups of communities require some form of assistance

or subsidies whether it is in the form of material assistance or financial support programs at the local level (Bayu et al., 2020; LoPalo et al., 2019, Mamo et al., 2023a, 2023b).

Another crucial dimension emphasized in both intervention and research is the psychosocial aspect. It includes social, psychological, and behavioral influences that affect targeted behavior. For example, the most studied or otherwise applied psychosocial factors relevant to WASH approaches to promoting targeted behavioral improvement are societal norms, social pressure, awareness and health risk perception, shame, fear, and disgust. Latrine use in some cases is influenced by gendered sociocultural norms. In rural Ethiopia, it is argued that the shame associated with practicing OD is particularly extreme for women, compelling them to consistently use latrines. Similarly, in certain regions, the cultural unacceptability of sharing a latrine with in-laws discourages married women from using latrines. In countries like India, sanitation practices are often linked to cultural traditions and religious beliefs associated with social norms. Some religious communities traditionally perceive OD as a clean healthy and wholesome practice while using toilet proximate to house consider as ritually polluting (Coffey et al. 2017; Kumar 2017). However, in Ethiopia, a country with two major religious groups—Christianity and Islam—religious beliefs do not conflict with latrine use or adoption. Based on my personal experience, sanitation interventions often receive support from religious leaders, who encourage their followers to build latrines and practice hygienic sanitation.

The proximate social pressures such as social capital, social norms, and social learning mechanisms within society are factors typically operate at the community level and drive households to adopt and use latrines. Developing a new behavior or maintaining the existing one can be determined by people's perceptions of the behavior of others, as well as their perceived disapproval when a person exhibits a new behavior (i.e., normative factors). It can also be learned by a person's observation and understanding of the actions of others, as well as his or her perceptions of certain behaviors that are often practiced by others (i.e., perceived descriptive norm). Or a person's perceptions of which behaviors are typically approved or disapproved of by referents (i.e., perceived injunctive norm). The presence of schoolchildren in the house, exposure of the household head to the town sanitation environment, social standing of the household head or a member of the household (i.e., teacher, religious leader, community leader), or reputation (i.e., becoming father or mother-in-law, having relatives) are among the typical examples of more specific indicators of sanitation change mechanisms that capitalize on the creation of social pressures and norms. Another source of social pressures conductive for improvements of sanitation conditions relates to gender. Valuing privacy and safety related to women, and elder people in the house can stimulate households to adopt latrine. Households can also start building latrines after seeing their neighbors, peer groups or relatives build latrines (i.e., the role of social learning and perceived descriptive norm).

Understanding the health risks associated with specific behaviors can significantly influence an individual's acceptance of sanitation interventions. Perceptions of health risks, including their severity and personal vulnerability, may prompt individuals to recognize that not using a hygienic latrine poses serious health threats and influences their decision to adopt and use sanitation facilities. In addition to perceived health risks, attitudinal factors such as feelings about the new behavior, as well as the perceived costs in terms of money, time, energy, or effort and the benefits of performing it, also determine a household decision on the adoption and utilization of sanitation facilities. A recent study reported that the incidence of diarrheal disease is lower in households with well-constructed latrines compared to those without (Seungman, 2024). As a result, targeting households with a strong understanding of sanitation benefits and leadership skills can enhance the effectiveness and speed of sanitation interventions, leading to improved outcomes as they have a potential to positively influence their counterparts.

Environmental factors are among the most common challenges that households in rural settings are often facing. In rural areas with high population density, the lack of space or land creates a difficult situation to build latrines. Environmental factors such as soil porosity, high topsoil gravel content, altitude, high rain fall, and high-water table are strongly associated with household's latrine adoption (Oswald et al., 2016). Households residing in those areas frequently construct low-durability latrines that collapse in a short period of time. Similarly, households residing in a minimal space, leading to a situation where they eventually run out of space for future latrine construction when the existing latrine pit gets full. This is the most prevalent situation in most rural communities with high population density. However, on-site latrine emptying is not practicable in Ethiopia. Water shortage and inequality in water access is another key factor for the adoption of improved latrines in areas where water scarcity is a major issue. People in such areas prioritize water for other purposes than installing handwashing facilities near latrines. Their traditional justification for not installing these facilities is "what is the worth of installing an empty container without water?". The contextual parameters of environment interact with politics around state interventions and various social inequalities such as those related to access to water or land ownership (O'Reilly & Louis, 2014).

During the sanitation behavior change interventions, whatever the reason for not adopting a latrine, the implementers sometimes apply intense administrative pressures on households to change sanitation behavior, which may be followed by fines, imprisonment, and exclusion from certain types of subsidies or community assistance. Furthermore, rather than facilitative ignition, the introduction, adoption, and usage of sanitation facilities (or sanitation technologies) has been motivated by command and-control measures. There is an argument that such an administrative pressures may be generated either misunderstanding the intervention approach (i.e., CLTS), policies or strategies or intentionally to gain control over the households for the present or future application of central government policies not only on public health issues but also other large-scale developmental and political oriented projects (Østebø

et al, 2018). It is believed that such pressures may have detrimental psychosocial consequences (e.g., loss of dignity, low self-esteem, isolation, and other associated psychosocial problems) for non-adopters, mostly vulnerable and marginalized groups (Bateman & Engel, 2018; Brewis et al., 2019, Novotný et al., 2018a).

Table 3. Summary of drivers and barriers of sanitation change in Ethiopia

Drivers of sanitation change	**Descriptions**
Political and institutional support	- Based on national policies and strategies through Health Extension Program - Integrated with other developmental activities - Requires government and partner participation - Needs dynamic, multi-scalar political will - Requires higher-level political commitment and lower-level implementers' fidelity - Empowering local officials, informal leaders, and model households - Politically driven conflicts affecting sanitation intervention - Complication of sanitation investments (MBS) - Monitoring and follow-up for proper implementation
Socioeconomic & demographic aspects	- Income, wealth, education, occupation, costs of toilets - Unaffordability of sanitation products and services (i.e., lack of income, inflation) - Family size, gender of household head, age
Psychosocial aspects	- Societal norms, social pressure, awareness and health risk perception, shame, fear, and disgust - Social, psychological, and behavioral influences on targeted behavior - People's perceptions of others' behaviors and perceived disapproval of new behaviors (normative factors) - Learn through observation and understanding of others' actions (perceived descriptive norm) - Perceptions of behaviors typically approved or disapproved by referents (perceived injunctive norm) - Privacy, safety, convenience
Health risk perceptions	- Understanding health risks associated with specific behaviors - Perceptions of severity and personal vulnerability to health risks
Gendered sociocultural norms	- Valuing privacy and safety for women and elderly - Shaming women associated with practicing open defecation (OD) - Cultural unacceptability of sharing latrines with in-laws (i.e., married women) - Water collection and taking care of latrines (cleaning)
Social pressures (household or community-level)	- Social capital, social norms, and social learning mechanisms - Presence of schoolchildren in the house - Exposure of the household head to urban sanitation environments - Reputation factors (e.g., becoming a parent-in-law, having relatives)

	- Households with a strong understanding of sanitation benefits and leadership skills that can positively influence their counterparts (i.e., social standing of household members such as teacher, religious leader, community leader)
Environmental challenges	- Lack of space or land ownership - Soil texture; Soil porosity, high topsoil gravel content, altitude, high rainfall, and high-water table - Water scarcity and distance of its sources - Unavailability of latrine construction materials - Erosion, flood
Administrative pressures	- Fines, imprisonment, and exclusion from subsidies or community assistance - Use of command-and-control measures for introducing, adopting, and using sanitation facilities - Misunderstanding or interpretation of intervention approaches (i.e., national policies and strategies) - Overburdened frontline workers facing reduced effectiveness (i.e., unfavorable working culture) - Control over households for the application of central government policies
Disadvantaged communities	- Low attention to socially and economically disadvantaged, marginalized community members - Exposing to detrimental psychosocial consequences (loss of dignity, low self-esteem, isolation, other associated psychosocial problems - Community support (financial or material)

5. SANITATION INTERVENTIONS IN ETHIOPIA

Ethiopia's healthcare system has experienced significant transformations from the Haile Selassie regime through the Derg era to recent administrations, mirroring the country's evolving political and economic contexts (Kloos, 1998). It indicates that changes in public health policies often follow regime changes. Modernizing the health care system, emphasizing curative and preventive services, was initiated and put into effect during both the Haile Selassie and Derg eras, though it was underdeveloped and struggled to meet the basic health needs of its population. Ethiopia's disorderly history of conflict, war, and famine has undermined past governments efforts to improve the population's health.

The groundwork for future development in Ethiopia health policy was laid from the 1993 (post-Derg Era and the beginning of the Melese Zenawi administration) to onwards with several policy developments including strategic sanitation and hygiene interventions. Consequently, the most effective large-scale sanitation interventions in both rural and urban areas commenced in the early 2000s, coinciding with HEP in 2003 (Assefa, et al., 2019). The creation of national strategic plans and

investment in human capital significantly contributed to the achievement of high latrine coverage and the reduction of open defecation.

Investing in human resources, particularly at lower administrative levels through the HEP, facilitated extensive outreach to communities and households in areas with limited infrastructure. Since 2003, the Ethiopian government has trained and deployed over 42,000 HEWs nationwide to deliver primary healthcare services through HEP (Bowser, et al., 2023). HEP was developed with the aim of changing health outcomes and increasing the coverage of essential services under different health packages, of which hygiene and environmental sanitation is the one component (Banteyerga, 2011, Assefa, et al., 2019). The program implementation is oversighted by the government and supported by the so-called changing agents that operate at village levels such as health extension workers (HEWs), model households, and the women development armies (WDA). While HEWs are the salaried government employees who monitor the overall sanitation and hygiene situation of the kebele (smallest administrative unit), model households are those households selected for their better implementation and performance of HEP packages and able to influence their peer groups and neighbors to adopt the same practices. WDAs are individuals of heads of model households from a village level to plan, monitor, and evaluate the hygiene and sanitation and other programs under HEP (Maes, et al., 2015). Training and empowering change agents, such as HEWs, WDAs members, and model households was designed to foster positive behavior changes in WASH interventions, and other health extension initiatives in Ethiopia. So far, Ethiopia's government has implemented two common community-based sanitation interventions: CLTS and MBS.

5.1. Community Led Total Sanitation

The general approach to sanitation services has shifted significantly in the last two decades, from top down, material-provision-based programs that focus on household level demands to community-level concerns. The CLTS approach was developed aiming to create an ODF community through community participation (Harter et al., 2018, 2020). The CLTS objective is to "empower local people to analyze the extent and risk of environmental pollution caused by open defecation" (Kar, 2003). Empowerment is achieved through participatory activities used to create new social norms of the unacceptability of OD. This is facilitated by various means including those addressing emotions, both negative (a sense of shame about open defecation) and positive (pride of achieving an ODF village or owning a private latrine), in an effort, to improve collective behavior (Dickinson & Pattanayak, 2009; Venkataramanan et al., 2018). It is relevant to outline it here because until recently it was a major component of the Ethiopian national sanitation strategy. Ethiopia was one of the first countries to adopt CLTS, implementing it at scale since 2006 (Peal et al., 2010). The former Southern Nations, Nationalities, and People’s Region (now split into four different regions) where my research site for this dissertation is

situated was the first Ethiopian region where a CLTS program was implemented since 2003 (Peal et al., 2010) and gradually became the main part of the national sanitation strategy.

Ethiopia's socio-ecological settings were ideal for implementing CLTS, as it is more effective in communities with strong social cohesion, high baseline open defecation rates, and active local leadership (Dickinson & Pattanayak, 2009). The CLTS campaign is gained the political environment support contributed to significant achievement of high coverage of latrine adoption and reduction of OD in Ethiopia from estimated 92% in 1990 to 18% 2022. For its success, the HEP and the above-mentioned human resource development strategies laid a good foundation. However, it took a considerable amount of investment in terms of time in the community (require frequent follow-up visits), capital and human resources. In addition, it needs outside facilitators to facilitate the activities and conduct follow-up visits to ensure sustainability of the ODF villages (Crocker et al., 2017).

Though there is a substantial reduction of OD, the sustainability of this sanitation change is uncertain. Households were encouraged through the CLTS promotion to build self-made latrines using locally available materials. The prime effort is achieving the initial sanitation change (elimination of OD and provision of access to simple latrines), while expecting that once this is induced, households will be interested in upgrading and utilizing their latrines so the change can be sustained. However, these expectations often fail to materialize, and the unsustainability of sanitation outcomes is an unsettling feature due to different barriers that have not been sufficiently understood. Latrines in the majority of rural households are characterized as low quality and often collapse in a short life span. When latrines collapse, households tend to rebuild similar structures but upgrading them is an option (Chambers et al., 2021). Poor quality latrines that need maintenance, or repair collapse within a few years of construction, and that discourages households in terms of expense, time, and space, and forces them to return to OD. Households may prefer OD for several reasons, including psychological factors stemming from weak latrine construction, lack of privacy and safety, or dissatisfaction due to bad odors. Recent community-based studies report a high rate of slippage to OD (Abebe & Tucho, 2020, Kebede et al. 2024). Moreover, households typically lack the skills to construct sustainable sanitation facilities using modern technology, opting instead for traditional pit latrines. The implementation was reported as inadequate in quality and ineffective in supporting the sustainability of sanitation improvements and hygiene behaviors (UNICEF, 2016). Studies from several geographical settings are emerging with critics about its effectiveness, sustainability, and issues associated with its' promotion strategies (Crocker et al., 2017, Novotny et al., 2018b). It is apparent that Ethiopian sanitation policies have veered off course in achieving safe sanitation through the CLTS campaign. Shifting from a traditional promotion encouraging households to construct latrines from any locally available materials to a modern sanitation technology in Ethiopia is the major area to which policy attention should be given (Cavill et al., 2015; Crocker et al., 2017; Novotny et al., 2018b; Mamo & Novotny, 2024).

5.2. Market-Based Sanitation

Another approach relevant to mention in the context of my dissertation is the MBS approach, a prominent sanitation strategy for introducing and scaling-up the diffusion of sanitation technologies in the community. It is a comprehensive approach that encompasses sanitation marketing as one of the components. It involves creating an enabling environment for the private sector to invest in sanitation, developing innovative financing mechanisms, and building the capacity of local entrepreneurs to provide sanitation services (UNICEF, 2020). Using both social and commercial marketing techniques and aligning with the behavioral change promotion to scale up the demand and supply for improved sanitation it introduces, encourages, and supplies sanitation products for rural communities (Devine & Kullmann, 2011). Thus, the suppliers create demand for sanitation products by using basic social marketing principles, such as the 4 "Ps" of place, price, product, and promotion to address the demand (Evans, 2014).

Ethiopia has been implementing MBS, formerly called sanitation marketing, since 2013. Its implementation was informed by an assessment of the country's sanitation conditions over the past two decades. Despite increased sanitation coverage, the use of low-cost, locally available materials often compromises quality and sustainability. It became evident that relying solely on the CLTS approach may not be sufficient to achieve safe sanitation. MBS program was introduced as a new direction in a national sanitation strategy (FMOH, 2020), aiming to accelerate the adoption of improved latrines through the provision of hard-and -soft trainings on the production and marketing of the sanitation products and services, improve their supply, and boost demand through behavioral measures (FMOH, 2022; Phillips et al., 2022; USAID, 2023) integrating with the HEP (FMOH, 2020).

While selected areas were introduced latrine components such as prefabricated concrete or plastic slabs through NGO interventions, several challenges are reported affecting the programs intervention. These challenges are multifaceted and can be seen at the local business enterprise, at the household level (income, wealth, education, occupation, subjective psychological barriers), institutional and political challenges, and a lack of supply and demand hinder the development of technological solutions (Vrana et al., 2017, Freeman et al., 2022, Mamo and Novotny, 2024). Households' willingness to pay for sanitation products and services, as well as their plans to improve sanitation facilities, are closely tied to their income levels. Households tend to underestimate the market price of sanitation products and services, which impacts their intention to upgrade their latrines when they discover that prices exceed their expectations (Mamo et al., 2023b). In the process of sanitation technologies promotion, most often the initial stage activities can be seen as an easy step however, dissemination of the products, business financing, and the creation of viable local markets in later stages are critical steps that are not easy to accomplish (e.g., Schaub-Jones, 2011; Barrington et al., 2017). As it requires more capital, skill and

marketing, it is not easy only for governments to implement despite its substantial support and oversight the intervention. But it needs the participation of the stakeholder's investment through financial provision and skills share inclusively to lower-level implementers, private associations, and households in a means of training and material support.

Communities living in infrastructure-restricted settings are considered as potentially more beneficial from market-based sanitation intervention as it ensures such communities have easy and convenient access to latrine construction materials and latrine parts (i.e., prefabricated slab) (Figure 5). However, the household side's choice and demand and willingness to pay for sanitation products and services determines sanitation marketing effectiveness. The behavior and attitudes towards sanitation technology at individual and household level, are also seen as the barriers on its appropriateness and affordability to materialize sanitation products. Affordability is mostly determined by the cost of product and services as well as competing priorities of limited household funds (Rosenboom et al., 2011). Unfavorable conditions such as poor market access to sanitation products and their unaffordability are major factors due to the low socioeconomic status of households to own durable prefabricated sanitation products. The subsidy of sanitation products or facilitation of loan through the local financial institutions is uncommon in Ethiopia. In addition, the structural constraints such as lack of support from the institutional, political, and financial sectors regarding the provision of economic opportunities and incentives (loans or financial incentives to local producers) as well as subsidies for the poorest households to solve their financial challenges is the main barrier at the local level (Tidwell et al., 2019). From this and the above discussed factors it is understandable that the household-level sanitation inequalities in Ethiopia suggest that achieving hygienic and equitable sanitation cannot rely solely on behavioral change promotions. Therefore, serious attention must be given to broader socioeconomic development as a key prerequisite (Gashaw et al., 2023).

Figure 5: (a) Circular concrete slab and (b) rectangular concrete slab with plastic pan. (Source: Mamo & Novotny, 2024)

6. METHODOLOGY

6.1. Overview of methods used in the articles

This dissertation employs diverse research methods. The research surveys were mostly focused on micro- and household-level data, and they basically focused on links between the following three components of the logical chain: (1) sanitation interventions; (2) sanitation conditions; and (3) barriers or drivers of sustainable sanitation changes using the two broad streams of sanitation research, "epidemiological" and "contextual" approaches. The epidemiological approach was chosen as it helps to understand specific sanitation interventions and identifying key drivers of sanitation change (Fewtrell et al., 2005; Mollah & Aramaki, 2009; Wuijts et al., 2017). Whereas, the contextual approach emphasizes the broader context of sanitation and the role of other factors influencing the sanitation situation, either independently of or in conjunction with specific sanitation interventions.

Studies participants were selected from two locations in South Ethiopia: Sidama and Wolaita. These areas were chosen for two main reasons. Firstly, since the initiation of the first Ethiopian universal sanitation campaign (CLTS) in 2003, these regions have shown higher latrine adoption and lower open defecation rates, making them ideal for examining the sustainability of sanitation changes and their drivers. Secondly, the selection was based on the authors' prior work and research experience in these regions. To capture local environmental diversity, villages were purposefully selected, and a random walk technique was employed to sample households, reflecting their spatial structure. The methods for each studies are categorized based on data sources and their nature. The first study, among four published articles, utilizes a systematic review, the second and third studies adopt a cross-sectional approach, while the fourth study relies on qualitative data gathered through key informant interviews and focus group discussions.

Field level survey uses data collected through structured interviews conducted in households to gather a wide range of data, including demographic, socioeconomic, sociocultural, and socioecological variables. Information on local sanitation conditions, service availability, past and current interventions, political and institutional contexts, and measures used to encourage households into adopting sanitation facilities was collected. The surveyed households were selected randomly from the strata of kebeles with distinct travel accessibility and agro-ecological conditions (reflecting the vertical diversity of the area that comprises the low-, mid-, and high-land kebeles), ODF status, and protected drinking water availability in the context of studies. Interviews were conducted with heads of households, or if unavailable, another adult member, preferably the spouse. Additionally, direct observations of sanitation facilities and their surroundings were made. To capture opinions on problems and challenges on sanitation situations in a broader context (beyond household-level sanitation situations and preferences), semi-structured interviews were conducted with HEWs, HDAs, district WASH focal

personnel, heads of local health centers, and kebele leaders. These interviews provided detailed insights into sanitation programs and interventions, the success and failure of these interventions, motivations for building or upgrading latrines, poor sanitation practices, and ongoing open defecation campaigns.

Each study presents descriptive findings, including the sanitation situation of the study area. Variables were categorized and modeled carefully to achieve the intended results before analysis. Although data measures and analysis techniques varied according to the studies' objectives, regression analyses for quantitative data were performed using the SPSS complex samples module, with regression models fitting to the selected outcomes. For qualitative data, interview transcription and translation were verified by the certified linguist. A deductive-inductive approach is used to identify main and specific themes, and the findings are presented under their respective themes in compliance to (Tong et al., 2007).

The districts (Figure 6) included in the study were chosen in consultation with the local administrative bodies. All participants and informants participated in our field research voluntarily, based on their oral consents that were sought and provided at the beginning of the interviews, after an introductory description of the survey and its purpose. The participants were assured of the anonymity and confidentiality of the collected material. Consents for audio recording were also sought and provided at the beginning of the qualitative interviews with local representatives. Prior to the surveys, our research received formal approvals from Ethiopian authorities at the zonal office, woreda office and in the surveyed kebeles. The research project was also approved by the ethical committee of Charles University (approval number 2019/16).

While detailed descriptions of methods are available in individual articles, a brief overview of each of the studies included in this dissertation is provided below in a sequential order of publications from old to new.

1. Novotný and Mamo (2022); A systematic review that assess evidence on factors influencing household-level sanitation outcomes in Ethiopia examined 37 primary studies that analyzed household-level sanitation, and its influencing factors based on the preset inclusion criteria.

2. Mamo et al. (2023); With the general aim of examining factors inhibiting the upgrading of latrines, this study draws on a cross-sectional survey among 504 rural households in Wolaita Zone, South Ethiopia. The survey consisted of structured interviews of households and direct observations of latrines. The data was also supplemented by qualitative interviews with local representatives and government officials.

3. Mamo et al. (2023) examined latrine quality, latrine upgrading and the respective plans and preferences of households in the Loka Abaya district, Sidama region, South Ethiopia. Cross-

sectional study was conducted in 549 rural households using structured interviews and direct observations of sanitation facilities in the latrine owning households.

4. Mamo and Novotný (2024) rely on qualitative data gathered through key informant interviews and focus group discussion with various stakeholders, examining both demand- and supply-side challenges. The study is based on field research conducted in four districts of Wolaita zone where the MBS projects are implemented. In total, 30 key informant interviews and 8 FGDs were conducted with different stakeholders at the selected zonal, district and village levels.

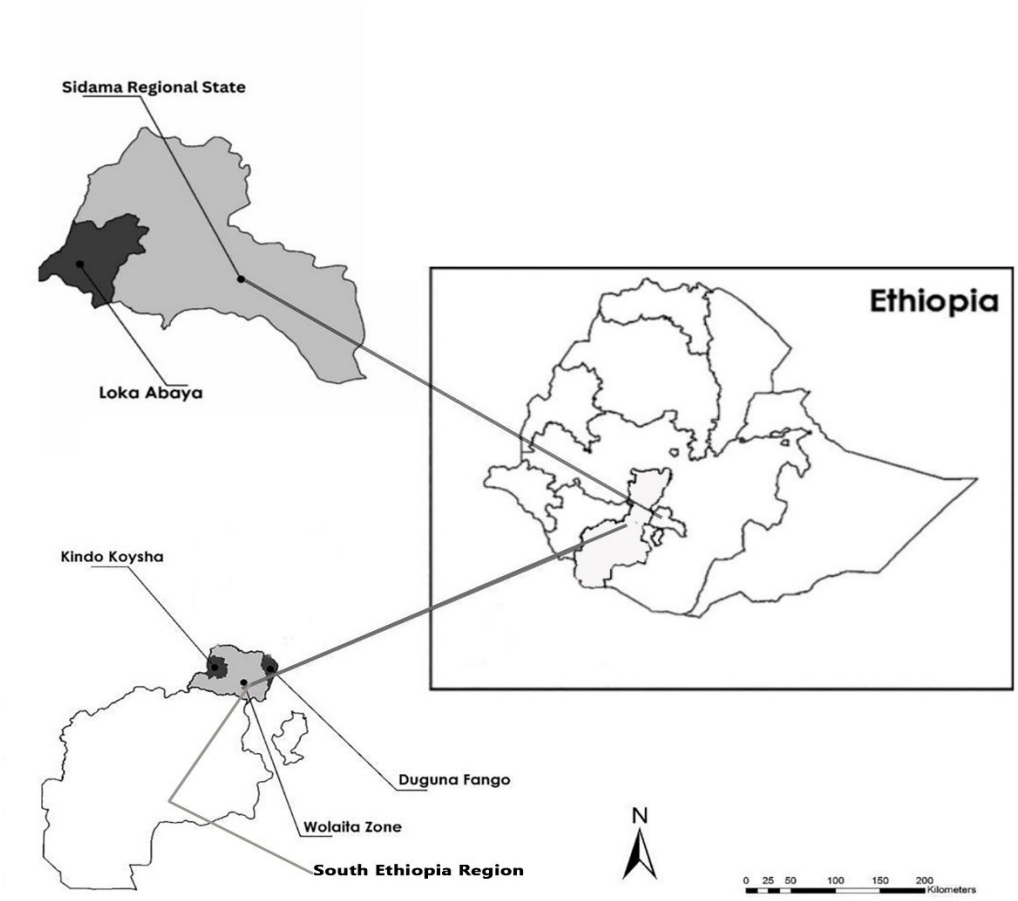

Figure 6. Locations of study areas (Source: Author)

7. CONCLUSION

Sanitation interventions in Ethiopia have notably increased latrine adoption among rural households, largely due to the sanitation activities integrated into HEP. However, a recent UNICEF/WHO report indicates that Ethiopia is among the countries that are too slow in progress to meet the 2030 goals including the sanitation targets citing that only 7% of the rural population using the basic sanitation services (UNICEF/WHO, 2023). Given the overall progress, one could argue that the sanitation investments in Ethiopia have not yielded adequate results. Despite the significant reduction of OD in Ethiopia, hygienic sanitation is rather the exception than the rule across the country. The factors contributing to the slow progress of sanitation change, and its sustainability are multi-scalar, making it challenging to pinpoint specific causes explicitly.

In this context, this dissertation aimed to examine the sustainability of sanitation change and to understand its constraints and underlying conditions. It examined how specific sanitation drivers influence various household-level sanitation outcomes in Ethiopia and assessed the willingness of households to accept and pay for improved sanitation technologies and the factors inhibiting latrine quality and upgrades along with the respective plans and preferences. It also addressed both demand and supply-side challenges examining the grassroots-level implementation of MBS promotion in Ethiopia. In Ethiopia, the adopted latrines at the rural households level are characterized as substandard, low-quality latrines, with only around 39% of households had access to latrines with solid slab platforms and 28% of latrine-owning households do not properly use their sanitation facilities (Novotny & Mamo, 2022).

This dissertation uncovered that the effectiveness of sustainable sanitation change in rural Ethiopia is hindered by widespread acceptance of low-quality and non-durable latrines. The predominant sanitation facilities consist of simple, dry, unventilated self-constructed single pit latrines. Household-level sanitation outcomes are influenced by a range of interrelated factors (see Novotny & Mamo, 2022). The most significant among these are socio-economic and demographic characteristics, along with psychological considerations such as privacy, safety, and convenience. Also, knowledge of infrastructure plays a crucial role in shaping the conception of what hygienic latrine means. Furthermore, factors related to the availability and accessibility of sanitation infrastructure, spatial and environmental conditions, and sociocultural influences are also frequently cited by households as impacting their sanitation practices. General socioeconomic factors are closely intertwined with demographic and cultural drivers of sanitation. A notable example is the consistently documented poor sanitation conditions among disadvantaged groups within the community, such as female-headed households, individuals with disabilities, and the elderly. This situation underscores how sanitation reflects an additional dimension of gendered socioeconomic inequality in Ethiopia. Beyond their limited economic resources, these groups often lack the capacity and skills to construct or adapt latrines

(Novotny, et al., 2018, Tamene & Afework, 2017, Ross, et al., 2011, Aiemjoy, et al., 2017). Without access to material, financial, or technical support, they are more likely to rely on substandard sanitation facilities compared to their counterparts.

We identified widespread satisfaction with low quality latrines, even those lacking basic attributes such as solid walls, roofs, doors, or slabs, appear to curb the households demand for latrine improvement. Satisfaction with substandard latrine appears to be positively influenced by psychological factors related to perceived health benefits and privacy (Novotný et al., 2018b). While the sense of privacy from latrine use is a direct and intuitively understood benefit, the health impact is less recognizable based on own evidence as the health impacts of sanitation, if achieved, tend to be confounded by other factors, delayed in time (conditional on consistent long-term use hygienic sanitation), and dependent on sanitation practices of others in the community. The observation of the role of perceived health impacts in the environment where the previously mentioned conditions are not met thus indicate that these perceptions have been socially constructed. At the same time, these constructed perceptions enhance the already mentioned satisfaction with poor quality toilets, undermining the willingness to invest in their improvement.

There is a common assumption that the initial adoption of rudimentary latrines and their use will motivate users to gradually improve them. Our results nevertheless revealed that this is rarely true. As mentioned, people expressed satisfaction with the low-quality facilities, indicating that poor latrine quality alone is not a significant motivation for upgrading. The belief that encouraging households to use any latrine from the implementers, regardless of quality and durability, coupled with satisfaction with substandard latrines, negatively affects the demand for upgrading sanitation facilities. We identified a socio-technical lock-in characterized by the sustained use of unhygienic latrines without recognizable shifts up the sanitation ladder (Mamo et al., 2023). This prevailing belief poses significant barriers on both the demand and supply sides for safe and sustainable sanitation.

Though households have the intention to upgrade their latrines they face different barriers such as high costs, insufficient external support, or the unavailability of necessary materials, emphasizing the significance of material and financial constraints so the problem cannot be explained just on a psychological/behavioral basis. According to our results, WTP for improved sanitation products and services was positively associated with households' plans to improve latrines, indicating that WTP effectively captures a relevant aspect of the demand for toilet upgrading (Mamo et al., 2023). Household income was identified as a strong predictor of WTP, together with other variables reflecting households' material situation, such as land and livestock ownership. The low purchasing power of most rural households thus impairs the demand for improved sanitation products and services. These findings underscore the crucial role of objective material constraints and affordability in decisions to invest in hygienic sanitation in rural Ethiopia. Research literature from other countries than Ethiopia also show

that the socioeconomic situation of households represents a major factor for the investments of households into hygienic sanitation (Gross & Günther 2014; Simiyu 2017; Turrén-Cruzet al. 2020; Tiwari et al. 2022). In addition, previous experience with non-durable latrine structures appears to discourage households from investing in latrine components (i.e., solid slabs). Households frequently cited the environmental factors such as soil conditions, erosion, and flooding playing a significant role (Mamo et al., 2023). As a result, in areas where these challenges persist, the household's intention is mostly to involve regular maintenance and rarely addressed substantial functional upgrading (Chambers et al., 2021).

The MBS programme has been a major attempt to address the problems above. It has been implemented across the country for nearly a decade to expand divers options and boost the demand for hygienic sanitation products and services. However, our and other evidence indicates that it does not seem to have brought any notable change in sanitation conditions so far. We found that, among various challenges hindering the implementation of MBS, the financial limitation within the community affects both the demand and supply sides. On top of unaffordability of majority of households, due to inflation, the escalating prices of the sanitation products (or construction materials) now exceed the financial resources households posing a challenge for them to afford hindering their ability to make purchase even when there is demand. Similar studies from Sub-Saharan Africa maintain this finding Gross and Günther (2014) in Benin, Peletz et al. (2017) in Tanzania, or Peletz et al. (2019, 2021) in Kenya. The studies reported that the insufficient WTP for improved sanitation products is due to the lack of households' economic resources. By contrast, Novotný et al. (2018a) identified a socially constructed perception of financial unaffordability of toilets in India that was not straightforwardly related to household poverty or wealth. This may reflect the higher level of socioeconomic development of India compared to countries in Sub-Saharan Africa or regional differences in sociocultural and environmental sanitation drivers.

Apart from the economic and objective material constraints, challenges related to administrative, political and institutional support are affecting the overall sanitation interventions in Ethiopia (Mamo & Novotny, 2024). The external factors like unstable political and security situation in various locations in the country affecting the implementation of sanitation interventions. The Ethiopian sanitation strategy has largely relied on the existing HEP and its change agents (health extension workers, health development army members) as well as material and financial support from development partners. From the field level surveys it was able to be discovered that these change agents are involved in both health service activities and non-health-related tasks, including local politics and NGO projects (Mamo & Novotny, 2024). In particular, the stress, dissatisfaction and discouragement of local change agents because of the workload and low remuneration indicated serious drawbacks and gendered inequalities in the HEP performance at the grassroot-level (Mangham-Jefferies, et al., 2014). This facts are also reported by some previous literature (e.g. Maes et al., 2015; Closser et al., 2020).

It is obvious that the Ethiopian government prioritized the low-cost sanitation intervention approach like CLTS or MBS as key components of the national sanitation strategy. However, it is becoming clear that achieving the tipping point in the transition to sustainable sanitation contradicts this approach. It indicates that the Ethiopian government requires more investments. However, this argument can be extended beyond the sanitation sector to broader health policy and beyond financial to human resources. Given the scarcity of public resources in Ethiopia and the presence of other burning issues associated with the current complications of the political and economic situation, it is unlikely that adequate sanitation change will be achieved soon. As a result, structural economic advancement in rural households must be facilitated to improve quality of life, in addition to community education about the means of hygienic sanitation and the promotion of hygienic sanitation infrastructure, including the adoption of safe sanitation practices.

While acknowledging the economic and infrastructure limitations in rural Ethiopia, efforts should focus on subsidizing households, as the current CLTS and MBS approaches alone may not suffice to promote latrine upgrading. Highlighting subsidies, it's crucial to involve the local private sectors which currently shows limited interest in sanitation due to low returns on investment. Facilitating loans through financial institutions and providing workspace could attract investors, particularly start-ups, to engage more actively in local sanitation initiatives. This could maintain the notable limited engagement of the national sanitation strategy with the private sector in the context of Ethiopia. Substantial government support and oversight, as well as identifying financing options and market-compatible social subsidy approaches, could help reach both the private sector and the poorest (Guiteras et al., 2015).

There is significant regional disparity in sanitation outcomes in Ethiopia. Northern Ethiopia has a much higher rate of open defecation compared to other regions, whereas southern Ethiopia and much of Oromia exhibit high latrine coverage and low open defecation rates (Kebede et al., 2024). Geographical settings, and political centrality could advantage regions with better sanitation outcomes, but implementing strategies effectively can help mitigate challenges in less favorable areas (regions). Sanitation interventions in Ethiopia benefit from political and institutional support through the HEP. However, while sanitation is often integrated with other developmental activities, it tends to receive lower priority. To ensure sustainable sanitation interventions, it is essential to assess the interaction between political and socioeconomic development and its impact on these efforts and assure that implementation should be uniform nationwide, particularly in agrarian rural communities.

There is a significant lack of understanding regarding the role of hygienic latrines in preventing pathogen transmission. Sanitation interventions often emphasize initial outcomes, such as eradicating open defecation and ensuring latrine availability and use (Novotny et al., 2018, Novotny and Mamo, 2022). However, more advanced steps toward achieving safe and sustainable sanitation outcomes are most often overlooked. It is crucial to effectively communicate that unhygienic sanitation facilities may

be equally or even more hazardous than open defecation, in order to dispel the widespread belief that using any latrine is inherently beneficial to human health. Therefore, addressing this challenge requires policy interventions that dismantle the existing misconception. Furthermore, sanitation strategies must be clearly communicated to leaders and administrative bodies, and the sanitation agenda should be prioritized equally alongside other developmental agendas in the country.

Apart from the need for structural change in the policy and socioeconomic directions, the focus of research on sanitation needs to be reformed. Current research mainly emulated the focus of the approach chosen for national sanitation strategy (CLTS) on initial latrine adoption and use and their determinants. Key areas such as a demand for upgrading sanitation facilities and a variety of issues on the supply side have received less attention in research. It is also recommended that research should concentrate more on the sustainability and quality of sanitation facilities and not solely on latrine coverage or availability and utilization. I also call for a more critical approach to sanitation research in Ethiopia.

This dissertation illuminates crucial findings and generates new knowledge by examining the drivers and barriers to sustainable sanitation change in the infrastructure-limited settings of South Ethiopia. The findings and research approach are replicable in similar contexts and more broadly across the Global South. I aim for this research to support fellow researchers, practitioners, and policymakers in achieving sustainable sanitation improvements and contribute to ongoing global sanitation efforts.

8. REFERENCES

Abebe, T. A., & Tucho, G. T. (2020). Open defecation-free slippage and its associated factors in Ethiopia: A systematic review. Systematic Reviews, 9(1), 252. https://doi.org/10.1186/s13643020-0151

Abrams, A. L., Carden, K., Teta, C., & Wågsæther, K. (2021). Water, sanitation, and hygiene vulnerability among rural areas and small towns in south Africa: Exploring the role of climate change, marginalization, and inequality. Water, 13(20), 2810. 1-6

Acey, C., Kisiangani, J., Ronoh, P., Delaire, C., Makena, E., Norman, G., Levine, D., Khush, R., & Peletz, R. (2019). Cross-subsidies for improved sanitation in low-income settlements: Assessing the willingness to pay of water utility customers in Kenyan cities. World Development, 115, 160– 177. https://doi.org/10.1016/j.worlddev.2018.11.006

Aiemjoy, K., Stoller, N. E., Gebresillasie, S., Shiferaw, A., Tadesse, Z., Sewent, T., ... & Oldenburg, C. E. (2017). Is using a latrine "a strange thing to do"? A mixed-methods study of sanitation preference and behaviors in rural Ethiopia. The American journal of tropical medicine and hygiene, 96(1), 65.

Ajemu, K. F., Desta, A. A., Berhe, A. A., Woldegebriel, A. G., & Bezabih, N. M. (2020). Latrine Ownership and Its Determinants in Rural Villages of Tigray, Northern Ethiopia: Community-Based CrossSectional Study. Journal of Environmental and Public Health, 2020, 1–8. https://doi.org/10.1155/2020/2123652

Allen, C., Metternicht, G., & Wiedmann, T. (2019). Prioritising SDG targets: Assessing baselines, gaps and interlinkages. Sustainability Science, 14, 421-438.

Anh, N. V., Hang, N. D., Hutton, G., & Weitz, A. (2013). The Economic Returns of Sanitation Interventions in Vietnam. 6.

Aragaw, F. M., Merid, M. W., Tebeje, T. M., Erkihun, M. G., & Tesfaye, A. H. (2023). Unimproved source of drinking water and its associated factors: a spatial and multilevel analysis of Ethiopian demographic and health survey. BMC Public Health, 23(1), 1455.

Assefa, Y., Gelaw, Y. A., Hill, P. S., Taye, B. W., & Van Damme, W. (2019). Community health extension program of Ethiopia, 2003–2018: successes and challenges toward universal coverage for primary healthcare services. Globalization and health, 15, 1-11.

Assefa, G. M., Sherif, S., Sluijs, J., Kuijpers, M., Chaka, T., Solomon, A., ... & Muluneh, M. D. (2021). Gender equality and social inclusion in relation to water, sanitation and hygiene in the Oromia region of Ethiopia. International Journal of Environmental Research and Public Health, 18(8), 4281.

Awoke, W. & Muche, S. 2013 A cross sectional study: latrine coverage and associated factors among rural communities in the District of Bahir Dar Zuria, Ethiopia. BMC Public Health 13 (1), 99.

Bakker, E. and Feldman, P., 2021. Ethiopia's Business Environment and How It Influences WASH Market Development. Updated Ed. Addis Ababa: USAID Transform WASH.

Banteyerga, H. (2011). Ethiopia's health extension program: improving health through community involvement. MEDICC review, 13, 46-49.

Barrington, D. J., Sridharan, S., Shields, K. F., Saunders, S. G., Souter, R. T., & Bartram, J. (2017). Sanitation marketing: A systematic review and theoretical critique using the capability approach. Social Science & Medicine, 194, 128–134. https://doi.org/10.1016/j.socscimed.2017.10.021

Bateman, M., & Engel, S. (2017). To Shame or Not to Shame—That is the Sanitation Question. Development Policy Review, 36. https://doi.org/10.1111/dpr.12317

Bayu, T., Kim, H., & Oki, T. (2020). Water Governance Contribution to Water and Sanitation Access Equality in Developing Countries. Water Resources Research, 56(4), e2019WR025330. https://doi.org/10.1029/2019WR025330

Ben Yishay, A., Fraker, A., Guiteras, R., Palloni, G., Shah, N. B., Shirrell, S., & Wang, P. (2017). Microcredit and willingness to pay for environmental quality: Evidence from a randomizedcontrolled trial of finance for sanitation in rural Cambodia. Journal of Environmental Economics and Management, 86, 121–140. https://doi.org/10.1016/j.jeem.2016.11.004

Brewis, A., Wutich, A., du Bray, M. V., Maupin, J., Schuster, R. C., & Gervais, M. M. (2019a). Community hygiene norm violators are consistently stigmatized: Evidence from four global sites and implications for sanitation interventions. Social Science & Medicine, 220, 12–21. https://doi.org/10.1016/j.socscimed.2018.10.020

Bowser, D., Kleinau, E., Berchtold, G., Kapaon, D., & Kasa, L. (2023). Return on investments in the Health Extension Program in Ethiopia. Plos one, 18(11), e0291958.

Budge, S., Hutchings, P., Parker, A., Tyrrel, S., Tulu, T., Gizaw, M., & Garbutt, C. (2019). Do domestic animals contribute to bacterial contamination of infant transmission pathways? Formative evidence from Ethiopia. Journal of Water and Health, 17(5), 655–669. https://doi.org/10.2166/wh.2019.224

Burt, Z., Nelson, K., & Ray, I. (2016). Towards gender equality through sanitation access. UN women. /docman/rosaopen/eeae2b/dd_001489_2016_genderequality_sanitation_access_unwomen.pdf

Caruso, B. A., Sevilimedu, V., Fung, I. C.-H., Patkar, A., & Baker, K. K. (2015). Gender disparities in water, sanitation, and global health. The Lancet, 386(9994), 650–651. https://doi.org/10.1016/S0140-6736(15)61497-0

Cavill, S., Chambers, R., & Vernon, N. (2015). Sustainability and CLTS: taking stock.

Cha, S., Jung, S., Abera, T., Beyene, E. T., Schmidt, W. P., Ross, I., ... & Bizuneh, D. B. (2024). Performance of Pit Latrines and Their Herd Protection Against Diarrhea: A Longitudinal Cohort Study in Rural Ethiopia. Global Health: Science and Practice.

Chambers, K. G., Carrico, A. R., & Cook, S. M. (2021). Drivers of sustained sanitation access: social network and demographic predictors of latrine reconstruction after flooding disasters. Environmental Science: Water Research & Technology, 7(10), 1861-1872.

Chen, L., Jiao, J., Liu, S., Liu, L., & Liu, P. (2023). Mapping the global, regional, and national burden of diarrheal diseases attributable to unsafe water. Frontiers in Public Health, 11, 1302748.

Chol, C., Negin, J., Garcia-Basteiro, A., Gebrehiwot, T. G., Debru, B., Chimpolo, M., Agho, K., Cumming, R. G., & Abimbola, S. (2018). Health system reforms in five sub-Saharan African countries

that experienced major armed conflicts (wars) during 1990–2015: A literature review. Global Health Action, 11(1), 1517931.

Closser, S., Napier, H., Maes, K., Abesha, R., Gebremariam, H., Backe, G., Fossett, S., & Tesfaye, Y. (2019). Does volunteer community health work empower women? Evidence from Ethiopia's Women's Development Army. Health Policy and Planning, 34(4), 9.

Coffey, D., Spears, D., & Vyas, S. (2017). Switching to sanitation: Understanding latrine adoption in a representative panel of rural Indian households. Social Science & Medicine, 188, 41–50.

Corvalán, C. F., Kjellström, T., & Smith, K. R. (1999). Health, Environment and Sustainable Development: Identifying Links and Indicators to Promote Action. Epidemiology, 10(5), 656. https://doi.org/10.1097/00001648-199909000-00036

Cotton, A. P. (2013). Rethinking sustainable latrine use through behaviour change and local capacity. 44(September).

Crocker, J., Saywell, D., & Bartram, J. (2017). Sustainability of community-led total sanitation outcomes: Evidence from Ethiopia and Ghana. International Journal of Hygiene and Environmental Health, 220(3), 551–557. https://doi.org/10.1016/j.ijheh.2017.02.011

David Schaub-Jones (2011). Market-based approaches in water and sanitation: The role of entrepreneurship. https://www.jstor.org/stable/24686742

De Buck, E., Van Remoortel, H., Hannes, K., Govender, T., Naidoo, S., Avau, B., Veegaete, A. V., Musekiwa, A., Lutje, V., & Cargo, M. (2017). Approaches to promote handwashing and sanitation behaviour change in low-and middle-incomecountries: Amixed method systematic review. Campbell Systematic Reviews, 13(1), 1–447.

Dery, F., Bisung, E., Dickin, S., & Dyer, M. (2020). Understanding empowerment in water, sanitation, and hygiene (WASH): a scoping review. Journal of Water, Sanitation and Hygiene for Development, 10(1), 5-15.

Devine, J., Cross, P., & Coombes, Y. (2013). Moving households up the sanitation ladder through sanitation marketing. Sanitation and Hygiene in Africa: Where Do We Stand? 59.

Dickinson, K., & Pattanayak, S. K. (2009). Open sky latrines: Do social interactions influence decisions to use latrines. Working Paper.

Dreibelbis, R., Winch, P. J., Leontsini, E., Hulland, K. R., Ram, P. K., Unicomb, L., & Luby, S. P. (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(1), 1015.

Ezzati, M. (2005). Environmental risks in the developing world: Exposure indicators for evaluating interventions, programmes, and policies. Journal of Epidemiology & Community Health, 59(1), 15–22. https://doi.org/10.1136/jech.2003.019471

Fantahun, M., Berhane, Y., Wall, S., Byass, P., & Högberg, U. (2007). Women's involvement in household decision-making and strengthening social capital—crucial factors for child survival in Ethiopia. Acta paediatrica, 96(4), 582-589.

Feris, L. (2015). The human right to sanitation: A critique on the absence of environmental considerations: The Human Right to Sanitation. Review of European, Comparative & International Environmental Law, 24(1), 16–26. https://doi.org/10.1111/reel.12088

Fewtrell, L., Kaufmann, R. B., Kay, D., Enanoria, W., Haller, L., & Colford, J. M. (2005). Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: A systematic review and meta-analysis. The Lancet Infectious Diseases, 5(1), 42–52. https://doi.org/10.1016/S1473-3099(04)01253-8

Ficek, F. & Novotný, J. 2019 Comprehending practitioners' assessments of community-led total sanitation. Health Promotion International 34 (6), e129–e138.

FMOH (2019). National ODF Campaign 2024. Total Sanitation to End open Defecation and Urination (TSEDU). Addis Ababa, Ethiopia 2019.

FMOH (2020). National Market Based Sanitation Implementation Guidelines. Federal Ministry of Health. Addis Ababa, Ethiopia. November 2020.

FMOH (2022). National sanitation subsidy protocol. Addis Ababa, Ethiopia 2022.

Freeman, M. C., Delea, M. G., Snyder, J. S., Garn, J. V., Belew, M., Caruso, B. A. & Gobezayehu, A. G. 2022 The impact of a demand-side sanitation and hygiene promotion intervention on sustained behavior change and health in Amhara, Ethiopia: a cluster-randomized trial. PLoS Global Public Health 2 (1), e0000056.

Freeman, M. C., Majorin, F., Boisson, S., Routray, P., Torondel, B., & Clasen, T. (2016). The impact of a rural sanitation programme on safe disposal of child faeces: A cluster randomised trial in Odisha, India. Transactions of the Royal Society of Tropical Medicine and Hygiene, 110(7), 386– 392. https://doi.org/10.1093/trstmh/trw043

Frumkin, H. (2016). Environmental health: From global to local. John Wiley & Sons.

Garn, J. V., Sclar, G. D., Freeman, M. C., Penakalapati, G., Alexander, K. T., Brooks, P., Rehfuess, E. A., Boisson, S., Medlicott, K. O., & Clasen, T. F. (2017). The impact of sanitation interventions on latrine coverage and latrine use: A systematic review and meta-analysis. International Journal of Hygiene and Environmental Health, 220(2), 329–340. https://doi.org/10.1016/j.ijheh.2016.10.001

Gashaw Ayanaw Wudu, Menberu Teshome, Tesfanesh Tadesse (2023). Unlocking the root causes of prolonged poverty and unmet poverty reduction efforts in northeast Amhara: A political ecology perspective. Social Sciences & Humanities Open. Volume 8, Issue 1. https://doi.org/10.1016/j.ssaho.2023.100642.

Goddard, F. G., Delea, M. G., Sclar, G. D., Woreta, M., Zewudie, K. & Freeman, M. C. 2018 Quantifying user preferences for sanitation construction and use: application of discrete choice experiments in Amhara, Ethiopia. Tropical Medicine and International Health 23 (12), 1364–1373.

Guiteras, R., Levinsohn, J., & Mobarak, A. M. (2015). Encouraging sanitation investment in the developing world: A cluster-randomized trial. Science, 348(6237), 903–906.

Gutierrez, E. (2007). Delivering pro-poor water and sanitation services: The technical and political challenges in Malawi and Zambia. Geoforum, 38(5), 886–900. https://doi.org/10.1016/j.geoforum.2005.09.010

Halkos, G. E., & Tzeremes, N. G. (2012). The effect of access to improved water sources and sanitation on economic efficiency: The case of Sub-Saharan African countries: South African Journal of Economics Vol. 80:2 June 2012. South African Journal of Economics, 80(2), 246–263. https://doi.org/10.1111/j.1813-6982.2011.01281.x

Harter, M., Inauen, J., & Mosler, H.-J. (2020). How does Community-Led Total Sanitation (CLTS) promote latrine construction, and can it be improved? A cluster-randomized controlled trial in Ghana. Social Science & Medicine, 245, 112705. https://doi.org/10.1016/j.socscimed.2019.112705

Harter, M., Mosch, S., & Mosler, H.-J. (2018). How does Community-Led Total Sanitation (CLTS) affect latrine ownership? A quantitative case study from Mozambique. BMC Public Health, 18(1), 387. https://doi.org/10.1186/s12889-018-5287-y

Heller, L., Colosimo, E. A., & Antunes, C. M. (2005). Setting priorities for environmental sanitation interventions based on epidemiological criteria: a Brazilian study. Journal of water and health, 3(3), 271-281.

Howard, G. (2021). The future of water and sanitation: global challenges and the need for greater ambition. AQUA—Water Infrastructure, Ecosystems and Society, 70(4), 438-448.

Irish, S., Aiemjoy, K., Torondel, B., Abdelahi, F. & Ensink, J. H. 2013 Characteristics of latrines in central Tanzania and their relation to fly catches. PLoS One 8 (7), e67951.

Jacqueline Devine and Craig Kullmann (2011). Introductory Guide to Sanitation Marketing.

Jonathan Jared Ignacio, Roy Alvin Malenab , Carla Mae Pausta, Arnel Beltran 1,Lawrence Belo, Renan Ma. Tanhueco, Marlon Era, Ramon Christian Eusebio, Michael Angelo Promentilla and Aileen Orbecido (2018). Perceptions and Attitudes Toward Eco-Toilet Systems in Rural Areas: A Case Study in the Philippines. 10(2), 521; https://doi.org/10.3390/su10020521

Kar, K. (2003). Subsidy or self-respect? Participatory total community sanitation in Bangladesh.

Kebede, N., Delie, A. M., Bogale, E. K., Anagaw, T. F., Tiruneh, M. G., Fenta, E. T., ... & Tareke, A. A. (2024). Mapping and predicting open defecation in Ethiopia: 2021 PMA-ET study. BMC Public Health, 24(1), 1671.

Khanna, T., & Das, M. (2016). Why gender matters in the solution towards safe sanitation? Reflections from rural India. Global Public Health, 11(10), 1185–1201. https://doi.org/10.1080/17441692.2015.1062905

Kirschner, A. J. (2011). The human right to water and sanitation. Max Planck Yearbook of United Nations Law, 15, 445–487.

Kloos, H. (1998). Primary Health Care in Ethiopia: From Haile Sellassie to Meles Zenawi. Northeast African Studies, 5(1), 83-113.

Kouassi, H. A. A., Andrianisa, H. A., Sossou, S. K., Traoré, M. B., & Nguematio, R. M. (2023). Sustainability of facilities built under the Community-Led Total Sanitation (CLTS) implementation: Moving from basic to safe facilities on the sanitation ladder. Plos one, 18(11), e0293395.

Kumar, A. (2017). Beyond latrines and targets: Sanitation mission in India. Development in Practice, 27(3), 408–413. https://doi.org/10.1080/09614524.2017.1290050

Loen, M. (2020). Constitutionalising Rights to Water and Sanitation: International Norm Diffusion or Local Politics? (Master's thesis, The University of Bergen).

LoPalo, M., Coffey, D., & Spears, D. (2019). The consequences of social inequality for the health and development of India's children: The Case of Caste, Sanitation, and Child Height. Social Justice Research, 32(3), 239–254. https://doi.org/10.1007/s11211-019-00323-x

Luh, J., Baum, R., & Bartram, J. (2013). Equity in water and sanitation: Developing an index to measure progressive realization of the human right. International Journal of Hygiene and Environmental Health, 216(6), 662–671. https://doi.org/10.1016/j.ijheh.2012.12.007

Maes, K., Closser, S., Vorel, E., & Tesfaye, Y. (2015). A Women's Development Army: Narratives of Community Health Worker Investment and Empowerment in Rural Ethiopia. Studies in Comparative International Development, 50(4), 455–478. https://doi.org/10.1007/s12116015-9197-z

Mamo, B. G., Novotný, J., & Admasie, A. (2023b). Quality of latrines and willingness to improve them in rural Ethiopia. Journal of Water, Sanitation and Hygiene for Development, 13(5), 339-349.

Mamo, B. G., Novotný, J., & Ficek, F. (2023a). Barriers for upgrading of latrines in rural Ethiopia: disentangling a sanitation socio-technical lock-in. Local Environment, 28(8), 1026-1044.

Mamo, B. G., & Novotný, J. (2024). Promotion of market-based sanitation in Ethiopia: a case study from Wolaita zone. Health Promotion International, 39(2), daae034.

Medhanyie, A., Spigt, M., Kifle, Y., Schaay, N., Sanders, D., Blanco, R., ... & Berhane, Y. (2012). The role of health extension workers in improving utilization of maternal health services in rural areas in Ethiopia: a cross-sectional study. BMC health services research, 12(1), 1-9.

Mangham-Jefferies, L., Mathewos, B., Russell, J., & Bekele, A. (2014). How do health extension workers in Ethiopia allocate their time? Human resources for health, 12, 1-12.

Mekete, K., Ower, A., Dunn, J., Sime, H., Tadesse, G., Abate,E., et al. (2019) The Geshiyaro Project: a study protocol for developing a scalable model of interventions for moving towards the interruption of the transmission of soil-transmitted helminths and schistosome infections in the Wolaita zone of Ethiopia. Parasites & Vectors, 12, 1–12.

MoH. 2011. "National Hygiene & Sanitation Strategic Action Plan for Rural, Per-urban & Informal Settlements in Ethiopia." Federal Democratic Republic of Ethiopia Ministry of Health.

MoH. 2013. “Ethiopian National Sanitation Marketing Guideline.” Federal Democratic Republic of Ethiopia Ministry of Health.

MoH. 2015. “Health Sector Transformation Plan 2015/16-2019/20.” Federal Democratic Republic of Ethiopia Ministry of Health.

Mollah, K. A., & Aramaki, T. (2009). Social-epidemiological study for evaluation of water supply and sanitation systems of low-income urban community in Dhaka, Bangladesh. Journal of Water and Health, 8(1), 184–191. https://doi.org/10.2166/wh.2009.201

Mosler, H.-J. (2012). A systematic approach to behavior change interventions for the water and sanitation sector in developing countries: A conceptual model, a review, and a guideline. International Journal of Environmental Health Research, 22(5), 431–449.

Munamati, M., Nhapi, I., & Misi, S. (2016). Exploring the determinants of sanitation success in SubSaharan Africa. Water Research, 103, 435–443.

Murray, C. J., Aravkin, A. Y., Zheng, P., Abbafati, C., Abbas, K. M., Abbasi-Kangevari, M., ... & Borzouei, S. (2020). Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The lancet, 396(10258), 1223-1249.

Ngondi, J., Teferi, T., Gebre, T., Shargie, E. B., Zerihun, M., Ayele, B., Adamu, L., King, J. D., Cromwell, E. A., & Emerson, P. M. (2010). Effect of a community intervention with pit latrines in five districts of Amhara, Ethiopia. Tropical Medicine and International Health, 15(5), 592–599. https://doi.org/10.1111/j.1365-3156.2010.02500.x

Novotný J, Kolomazníková, H., & Humňalová, J. (2017). The role of perceived social norms in rural sanitation: An explorative study from infrastructure-restricted settings of South Ethiopia. International Journal of Environmental Research and Public Health, 14(7), 794. https://doi.org/10.3390/ijerph14070794

Novotný, J. & Mamo, B. G. 2022 Household-level sanitation in Ethiopia and its influencing factors: a systematic review. BMC Public Health 22 (1), 1–15.

Novotný, J., Humňalová, H., & Kolomazníková, J. (2018a). The social and political construction of latrines in rural Ethiopia. Journal of Rural Studies, 63, 157-167.

Novotný, J., Lepič, M., & Hasman, J. (2018b). Contextual factors and motivations affecting rural community sanitation in low- and middle-income countries: A systematic review. International Journal of Hygiene and Environmental Health, 221(2), 121–133. https://doi.org/10.1016/j.ijheh.2017.10.018

Novotný, J., & Mamo, B. G. (2022). Household-level sanitation in Ethiopia and its influencing factors: a systematic review. BMC Public Health, 22(1), 1448.

O’Reilly, K. (2016). From latrine insecurity to latrine security: Creating safe sanitation for women and girls. WIREs Water, 3(1), 19–24. https://doi.org/10.1002/wat2.1122

O’Reilly, K., & Louis, E. (2014). The latrine tripod: Understanding successful sanitation in rural India. Health & Place, 29, 43–51.

Obani, P., & Gupta, J. (2015). The Evolution of the Right to Water and Sanitation: Differentiating the Implications: The Evolution of the Right to Water and Sanitation. Review of European, Comparative & International Environmental Law, 24(1), 27–39. https://doi.org/10.1111/reel.12095

Østebø, M. T., Cogburn, M. D., & Mandani, A. S. (2018). The silencing of political context in health research in Ethiopia: Why it should be a concern. Health Policy and Planning, 33(2), 258–270. https://doi.org/10.1093/heapol/czx150

Oswald, W. E., Stewart, A. E. P., Flanders, W. D., Kramer, M. R., Endeshaw, T., Zerihun, M., Melaku, B., Sata, E., Gessesse, D., Teferi, T., Tadesse, Z., Guadie, B., King, J. D., Emerson, P. M., Callahan, E. K., Moe, C. L., & Clasen, T. F. (2016). Prediction of low community sanitation coverage using environmental and sociodemographic factors in Amhara Region, Ethiopia. American Journal of Tropical Medicine and Hygiene, 95(3), 709–719. https://doi.org/10.4269/ajtmh.15-0895

OWNP. (2019). Ethiopia One WASH National Program report.

Panagiota Kotsila, V. Subramanian Saravanan (2017). Biopolitics Gone to Shit? State Narratives versus Everyday Realities of Water and Sanitation in the Mekong Delta. Volume 93, 2017, 374-388, https://doi.org/10.1016/j.worlddev.2017.01.008.

Pattanayak, S. K., Pakhtigian, E. L., & Litzow, E. L. (2018). Through the looking glass: Environmental health economics in low- and middle-income countries. In Handbook of Environmental Economics (Vol. 4, pp. 143–191). Elsevier.

Peal AJ, Evans BE, van der Voorden C. (2010) Hygiene and sanitation software: an overview of approaches. Geneva: Water Supply & Sanitation Collaborative Council.

Perard, E. (2018). Economic and financial aspects of the sanitation challenge: A practitioner approach. Utilities Policy, 52, 22–26. https://doi.org/10.1016/j.jup.2018.03.007

Phillips, A. E., Ower, A. K., Mekete, K., Liyew, E. F., Maddren, R., Belay, H., ... & Anderson, R. (2022). Association between water, sanitation, and hygiene access and the prevalence of soil-transmitted helminth and schistosome infections in Wolayita, Ethiopia. Parasites & Vectors, 15(1), 1-16.

Pradhan, P., Costa, L., Rybski, D., Lucht, W., & Kropp, J. P. (2017). A systematic study of sustainable development goal (SDG) interactions. Earth's Future, 5(11), 1169-1179.

Rajapakse, J., Otoo, M., & Danso, G. (2023). Progress in delivering SDG6: Safe water and sanitation. Cambridge Prisms: Water, 1, e6.

Rosenboom, J. W., Jacks, C., Phyrum, K., Roberts, M., & Baker, T. (2011). Sanitation marketing in Cambodia. Waterlines, 30(1), 21–40.

Ross, R. K., King, J. D., Damte, M., Ayalew, F., Gebre, T., Cromwell, E. A., ... & Emerson, P. M. (2011). Evaluation of household latrine coverage in Kewot woreda, Ethiopia, 3 years after implementing interventions to control blinding trachoma. International health, 3(4), 251-258.

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

course in Odisha, India. Social Science & Medicine, 139, 80–89. https://doi.org/10.1016/j.socscimed.2015.06.031

Salman, S. M. A. (2014). The human right to water and sanitation: Is the obligation deliverable? Water International, 39(7), 969–982. https://doi.org/10.1080/02508060.2015.986616

Seungman Cha, Sunghoon Jung, Tadesse Abera, Ermias Tadesse Beyene, Wolf-Peter Schmidt, Ian Ross, Yan Jin and Dawit Belew Bizuneh. Performance of Pit Latrines and Their Herd Protection Against Diarrhea: A Longitudinal Cohort Study in Rural Ethiopia. Global Health: Science and Practice June 2024, 12(3): e2200541; https://doi.org/10.9745/GHSP-D-22-00541

Sclar, G. D., Penakalapati, G., Amato, H. K., Garn, J. V., Alexander, K., Freeman, M. C., Boisson, S., Medlicott, K. O., & Clasen, T. (2016). Assessing the impact of sanitation on indicators of fecal exposure along principal transmission pathways: A systematic review. International Journal of Hygiene and Environmental Health, 219(8), 709–723. https://doi.org/10.1016/j.ijheh.2016.09.021

Sharma, A. (2020). Aligning regional priorities with global and national goals: Constraints on the achievement of Sustainable Development Goal 6 in rural Bihar, India. Area Development and Policy, 1–11. https://doi.org/10.1080/23792949.2020.1829495

Sisay, E., Atilaw, W. and Adisu, T. (2022) Impact of economic sectors on inflation rate: evidence from Ethiopia. Cogent Economics & Finance, 10, 2123889.

Smith, K. R., & Ezzati, M. (2005). How environmental health risks change with development: The Epidemiologic and environmental risk transitions revisited. Annual Review of Environment and Resources, 30(1), 291–333. https://doi.org/10.1146/annurev.energy.30.050504.144424

Steege, R., Taegtmeyer, M., McCollum, R., Hawkins, K., Ormel, H., Kok, M., Rashid, S., Otiso, L., Sidat, M., Chikaphupha, K., Datiko, D. G., Ahmed, R., Tolhurst, R., Gomez, W., & Theobald, S. (2018). How do gender relations affect the working lives of close to community health service providers? Empirical research, a review and conceptual framework. Social Science & Medicine (1982), 209, 1–13. https://doi.org/10.1016/j.socscimed.2018.05.002

Tamene, A., & Afework, A. (2021). Exploring barriers to the adoption and utilization of improved latrine facilities in rural Ethiopia: An Integrated Behavioral Model for Water, Sanitation and Hygiene (IBM-WASH) approach. PloS one, 16(1), e0245289.

Tidwell, J. B., Terris-Prestholt, F., Quaife, M., & Aunger, R. (2019). Understanding demand for higher quality sanitation in peri-urban Lusaka, Zambia through stated and revealed preference analysis. Social Science & Medicine, 232, 139–147. https://doi.org/10.1016/j.socscimed.2019.04.046

Tolasa, S., Whakeshum, S. T. and Mulatu, N. T. (2022) Macroeconomic determinants of inflation in Ethiopia: ARDL approach to cointegration. European Journal of Business Science and Technology, 8, 96–120.

Tong, A., Sainsbury, P. and Craig, J. (2007) Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care, 19, 349–357.

Troeger, C. E., Khalil, I. A., Blacker, B. F., Biehl, M. H., Albertson, S. B., Zimsen, S. R. M., Rao, P. C., Abate, D., Ahmadi, A., Ahmed, M. L. C. brahim, Akal, C. G., Alahdab, F., Alam, N., Alene, K. A., Alipour, V., Aljunid, S. M., Al-Raddadi, R. M., Alvis-Guzman, N., Amini, S., … Reiner, R. C. (2020). Quantifying risks and interventions that have affected the burden of diarrhoea among children younger than 5 years: An analysis of the Global Burden of Disease Study 2017. The Lancet Infectious Diseases, 20(1), 37–59. https://doi.org/10.1016/S1473-3099(19)30401-3

UNICEF (2020). United Nations Children's Fund, Guidance on Market-Based Sanitation, UNICEF, New York, 2020.

UNICEF/WHO (2019). Progress on Household Drinking Water, Sanitation and Hygiene 2000-2017: Special Focus on Inequalities. World Health Organization.

UNICEF/WHO (2023) Progress on Sanitation and Hygiene in Africa 2000-2022. New York: United Nations Children's Fund (UNICEF) and World Health Organization (WHO), 2023.

USAID. (2023). Performance Evaluation of the USAID/Ethiopia Transform Water, Sanitation, and Hygiene (WASH) Activity. Washington, DC, USAID Water, Sanitation, and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) #2 Activity.

Vrana, K., C. Garbutt, M. Wubshet, M. Yasin-Jemal, B. Getachew, and M. Gizaw. 2017. "A Comparative Analysis of the Impact of Hygiene Promotion and Sanitation Marketing in Rural Ethiopia." Loughborough University. Conference contribution. https://hdl.handle.net/2134/31556.

Van Minh, H., & Hung, N. V. (2011). Economic aspects of sanitation in developing countries. Environmental Health Insights, 5, EHI-S8199.

Venkataramanan, V., Crocker, J., Karon, A., & Bartram, J. (2018). Community-Led Total Sanitation: A mixed-methods systematic review of evidence and its quality. Environmental Health Perspectives, 126(2), 026001. https://doi.org/10.1289/EHP1965

W.D. Evans, S.K. Pattanayak, S. Young, J. Buszin, S. Rai, Jasmine Wallace Bihm (2014). Social marketing of water and sanitation products: A systematic review of peer-reviewed literature. 18-25: 10.1016/j.socscimed.2014.03.011

Weststrate, J., Gianoli, A., Eshuis, J., Dijkstra, G., Cossa, I. J., & Rusca, M. (2019). The regulation of onsite sanitation in Maputo, Mozambique. Utilities Policy, 61, 100968.

WHO (2018). Guidelines on sanitation and health. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO.

WHO (2020). State of the World's Sanitation: An urgent call to transform sanitation for better health, environments, economies, and societies. New York: United Nations Children's Fund (UNICEF) and the World Health Organization, 2020.

WHO (2021). Progress on household drinking water, sanitation and hygiene 2000-2020: five years into the SDGs. Geneva: World Health Organization (WHO) and the United Nations Children's Fund (UNICEF), 2021. Licence: CC BY-NC-SA 3.0 IGO

WHO (2022). Strong systems and sound investments: evidence on and key insights into accelerating progress on sanitation, drinking-water and hygiene. UN-Water global analysis and assessment of sanitation and drinking-water (GLAAS) 2022 report. Geneva: World Health Organization; 2022. Licence: CC BY-NC-SA 3.0 IGO.

Winkler, I. T. (2015). The human right to sanitation. U. Pa. J. Int'l L., 37, 1331.

Wuijts, S., van den Berg, H. H. J. L., Miller, J., Abebe, L., Sobsey, M., Andremont, A., Medlicott, K. O., van Passel, M. W. J., & de Roda Husman, A. M. (2017). Towards a research agenda for water, sanitation and antimicrobial resistance. Journal of Water and Health, 15(2), 175–184. https://doi.org/10.2166/wh.2017.124

Yu, W., Bain, R. E., Mansour, S., & Wright, J. A. (2014). A cross-sectional ecological study of spatial scale and geographic inequality in access to drinking-water and sanitation. International Journal for Equity in Health, 13(1), 113. https://doi.org/10.1186/s12939-014-0113-3

Zeleke, D. A., Gelaye, K. A. & Mekonnen, F. A. 2019. Community-led total sanitation and the rate of latrine ownership. BMC Research Notes 12 (1), 1–5.