UNIVERSITY OF ANTWERP

INSTITUTE OF DEVELOPMENT POLICY

Dissertation

Factors affecting water treatment at point-of-use

A comparative analysis with regard to access to water

Sonya OCHANEY

Master of Development Evaluation and Management

Supervisor: Prof. Dr. Nathalie Holvoet
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Preface

First, I would like to express my gratitude to my parents who have been a source of constant support, morally and financially, in pursuing my dreams and coming to Belgium for my Masters. This would not have been possible without them.

I would like to sincerely thank my supervisor Prof. Dr. Nathalie Holvoet for her guidance and support through this year. It was her work in the field of water, sanitation and hygiene that inspired me to pursue this topic.

I express my gratitude to the Institute of Development Policy (IOB) for accepting my application for the grant to conduct fieldwork in Tanzania. It has been the most wonderful experience. Here, I would like to extend my thanks to Sara Dewachter for her inputs and positivity and to Jackline Bwana (my translator and transcriber) without whose support the fieldwork would not have been possible.

Lastly, I would like to thank all my peers for this wonderful experience at IOB and in Belgium. It would have definitely not been the same without them.

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List of acronyms

BCC	Behavior Change Communication
CB	Community-based
CHAST	Child Hygiene and Sanitation Training
CLTS	Community-Led Total Sanitation
CD	Contextual
COWSO	Community-owned Water Supply Organization
FGD	Focus Group Discussion
HWTS	Household Water Treatment and Storage
IBM-WASH	Integrated Behavioral Model for Water, Sanitation and Hygiene
IDI	In-depth Interviews
JMP	Joint Monitoring Program
LGRP	Local Government Reform Program
MDG	Millennium Development Goals
MOROWASA	Morogoro Water Supply Authority
NAWAPO	National Water Policy
NT	Non-treaters
O&M	Operations and Maintenance
PHAST	Participatory Hygiene and Sanitation Transformation
POU	Point-of-use
PSD	Psychosocial Dimension
PSI	Population Services International
RANAS	Risks, Attitudes, Norms, Abilities and Self-Regulation
RCT	Randomized Control Trial
RWSSP	Rural Water Supply and Sanitation Program
SDG	Sustainable Development Goals
SHM	Sanitation and Hygiene Messaging
SM	Social Marketing
SWAp	Sector-Wide Approach
TD	Technology Dimension
TSH	Tanzanian Shillings
TSSM	Total Sanitation and Sanitation Marketing
URWSA	Urban Water Supply Authorities
WG	WaterGuard
WHO	World Health Organization
WSDP	Water Sector Development Program
WT	Water treaters

Executive Summary

Access to drinking water is a human right, yet poor water services and quality remains a major developmental issue globally. The lack of access to these services is proven to adversely impact varied developmental outcomes ranging from health, social and economic ones. Lack of access to safe drinking water is attributed to a number of issues like limited financial, institutional and informational capacity in developing countries. In settings where infrastructure for providing safe drinking water is limited, the treatment of water at point-of-use is an alternative.

This is a formative research conducted in the rural Mvomero district in the Morogoro region of Tanzania to design a behavior change communication intervention, to increase adoption of water treatment practices before consumption. The areas of study include – an examination of the contextual, psychosocial and technology dimension that influence household water treatment behavior, the role played by socio-economic profiles, gender and marginalized status of households, and differential access to water, in adoption of water treatment.

The study was conducted with a qualitative methodology. Primary data collection, in the form of focus-group discussions, key-informant interviews and in-depth interviews, was undertaken. Data was collected in three villages – Changarawe, Vitonga and Peko Misegese, each of which has different water supply system.

The findings illustrate the realities of water supply in rural areas, highlighting the gaps between policy and implementation. The analysis emphasizes the importance of psychosocial factors affecting behavior, but also that institutional structures (formal and informal), policies and technologies for water treatment cannot be discounted in the process of designing interventions. It reinforces the need for qualitative research to identify potentially disadvantaged groups and design interventions targeting them, to ensure that no one is left behind according to the Sustainable Development Goals.

The study recommends a theory-based approach for designing interventions, targeting households as a unit, with a focus on advocating for government policies, which will provide the impetus for behavior change.

Section One: Introduction

On 25th September 2015, 193 member states of the United Nations General Assembly agreed to the 2030 Agenda for Sustainable Development. The agenda is a plan of action for people, planet and prosperity wherein the member states unanimously agree to end poverty and take steps to transform the world in an equitable manner, ensuring that no one is left behind. It comprises of 17 Sustainable Development Goals (SDG) and 169 global targets related to development outcomes, addressing various issues and means of implementation (UN Water, 2018). It takes forward the idea of development as a multi-dimensional concept that was first put forward in the Millennium Development Goals (MDGs), focusing on social, economic as well as environmental dimensions.

Of the 17 goals that have been established, Goal 6 focuses on Water, Sanitation and Hygiene (WASH). Access to safe water and sanitation services has been recognized as a matter of human rights. The lack of access to these services and their usage has a tremendous effect for developmental outcomes due to its adverse social, economic and health impacts (COHRE, WaterAid, SDC, UN_HABITAT, 2008). Yet there is a huge proportion of the world's population that does not have access to these basic services and faces challenges of accessibility. Water resources form the crux of many other developmental outcomes such as food security, poverty reduction, sustaining economic growth in agriculture and maintaining healthy ecosystems (UN Water, 2018).

1.1 Issues related to drinking water in developing country context

Although access to drinking water is a human right, which highlights the role of the state in its provision, its quality remains a major developmental issue across many countries (Lilje & Mosler, 2018). Lack of access to safe drinking water is proven to have deleterious effects on health. A global increase in cholera cases, with an estimated 3-5 million cases and 100,000 to 120,000 deaths reported every year (WHO, 2012), can be linked to an increase in vulnerable people that reside in unsanitary living conditions with lack of access to safe drinking water and basic sanitation and hygiene (Lilje, Kessely & Mosler, 2015). Consuming unsafe water also has adverse effects on non-health related outcomes. It negatively impacts school attendance and economic

development as illnesses can lead to absenteeism, increased expenditures on healthcare and missed workdays (Hutton & Haller, 2004).

1.2 What can be done?

The treatment of water at point-of-use (POU) and safe storage systems is an alternative solution for places that lack infrastructure settings for provision of safe water (Lilje et al., 2018). Household Water Treatment and Storage (HWTS) practices such as boiling, chlorination and filtration can improve water safety and reduce occurrence of diarrheal diseases (Sobsey, Stauber, Casanova, Brown & Eliott, 2008).

Despite the established importance of household water treatment practices as mentioned above, it remains elusive reflecting a need for improved promotional efforts and effective behavior change interventions (Clasen, 2009; Luoto, Najnin, Mahmud, Albert, Islam, Luby, Unicomb & Levine, 2011). According to Lilje et al. (2018), the success of these interventions depend substantially on individual behavior changes which in turn are dependent on psychosocial factors such as attitudes, norms and perceived self-efficacy. A systematic review of behavior change research on POU water treatment interventions was conducted by Fiebelkorn, Person, Quick, Vindigni, Jhung, Bowen & Riley (2012). The review was aimed at understanding the factors that influence adoption of POU water treatment behavior in low and middle-income countries. The main finding the authors highlight is the presence of knowledge gaps. There is a need for formative research to understand the target populations, their existing behaviors and cultural practices, social context and the larger environmental context. This information must then be incorporated into project designs (Fiekelborn et al. 2012).

Drawing from the literature on identified gaps and elements that need enhanced attention, this study was conducted in order to examine the factors that affect treatment of water at point-of-use.

1.3 Research Objective

The main research objective is the study of factors that influence the adoption and sustenance of point-of-use water treatment methods in households. This research is a formative one and the findings will contribute to designing a behavior change communication (BCC) intervention to increase adoption of water treatment practices at POU, to support the 'Community-based Monitoring' research project that is currently implemented in Mvomero district by the framework of the Vlir-UOS sponsored IUC (project 3) with Mzumbe University.

1.3.1 Sub-questions

The study will focus on answering the following sub-questions:

- How do contextual, psychosocial and technology factors influence household water treatment behavior in the chosen villages and how can these be addressed through interventions?
- In what ways do socio-economic profiles, gender of decision-makers and marginalized status of the households play a role in the adoption of methods for HWT?
- Does differential access to water affect household water treatment behavior?

The first sub-question provides detailed information for developing a BCC intervention since the information collected highlights the most important factors according to the respondents. This exercise will allow for the intervention to be truly participatory and bottom-up in nature.

The second sub-question arises from the SDGs, which state that there needs to be increased attention to the needs of disadvantaged populations and the idea of "leaving no one behind" (WHO, 2017). The objective of universal access calls for equitable access and has implications regarding inequalities between population sub-groups. The study has focused on identifying disadvantaged population groups in the study sites and understand in-depth the factors that enable or constrain them from accessing water sources and adopting and/or sustaining water treatment methods in the household.

The third sub-question aims to examine if access to different sources of water

influence HWT behavior differently. This will be done by conducting a comparative analysis among the different factors and cleanliness perceptions in different locations dependent upon the varied sources of water supply. It is important to note that a comparative exercise of this nature has not been carried out previously and will prove to be a valuable addition to the literature on access to water and treatment of water at POU.

1.4 Structure of the paper

The paper is divided into five sections. Section two introduces the Tanzanian context and its water policies with a focus on the rural aspects and provides comparison with neighboring nations regarding progress related to water. Section three is a synthesis of the literature related to the current study with focus on importance of drinking water globally, the WASH sector, BCC theories and approaches and methods for HWT at POU. The section also introduces the conceptual framework applied for the study. Section four presents the methodology of the study, details the methods used for data collection, sampling and limitations. Section five is focused on presenting the findings from the primary data collection conducted and analyzing it in relation to relevant literature. The last section draws conclusions from the analysis of data and offers recommendations for future interventions and policies.

Section Two: Contextualization

Tanzania is the fourth most populous country in Sub-Saharan Africa with a GDP growth of 6.5 percent for the past fifteen years, yet 21 million people still lack access to improved drinking water (World Bank, 2018). Common drinking water sources include shallow wells, ponds, streams, rivers and lakes that are often used for multiple purposes. These and other unimproved sources are likely to be highly contaminated with fecal pathogens, putting the population at a high risk of waterborne enteric infections (Mohamed, Clasen, Njee, Malebo, Mbiligwe & Brown, 2016) with incidences of preventable diarrhea responsible for 8 percent of deaths in children below the age of five (UNICEF, 2018).

2.1 Water Policies

Tanzania's socialist past has had positive and negative impacts on its water and sanitation sector. The high profile *Mtu ni Afya* public education campaign led to widespread construction of household latrines, increasing coverage of basic household latrines higher than any other country in Africa, and encouraged boiling of drinking water (AMCOW, 2011; Mohamed et al., 2016). However, when it comes to water, free water policies tended to undermine sustainability and were partially responsible for chronic underinvestment in expansion as well as maintenance. The first National Water Policy adopted in 1991 signaled the advent of a long drawn process to address shortcomings of the previous system and instill donor confidence. User charges were introduced within the policy, along with the establishment of urban utilities that were to be self-financing (AMCOW, 2011). The main shortfall of the policy was identified in the implementation strategies that emphasized that the central government was the sole investor, implementer and manager of rural and urban projects, while part of the operational and maintenance costs (O&M) responsibility was shifted to the end users (Jiménez & Peréz-Foguet, 2010).

In 2002, a second National Water Policy (NAWAPO) was adopted, which strengthened provisions for cost recovery and introduced a stronger pro-poor rhetoric (AMCOW, 2011). In this act, the central government plays the role of coordinator and facilitator in the water sector, and the district level is responsible for implementation (Jiménez & Peréz-Foguet, 2010).

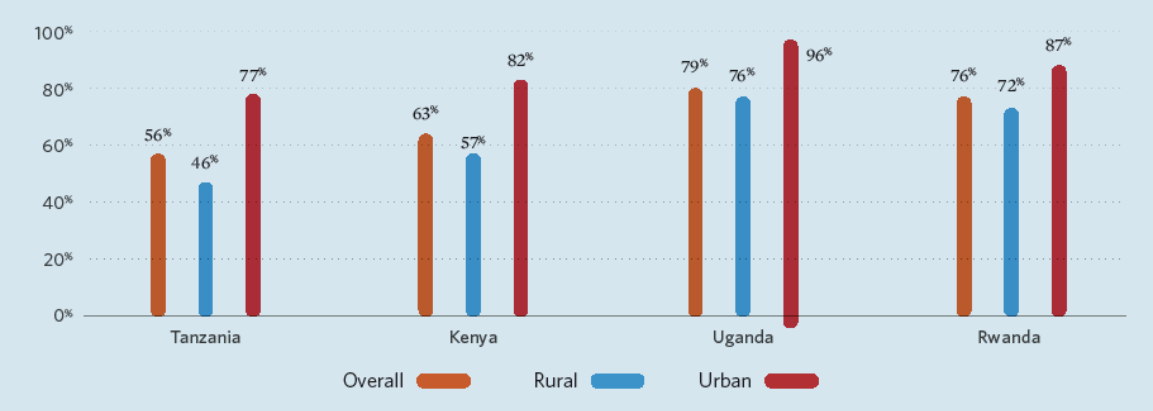
From 2005 onwards, a Sector-Wide Approach (SWAp) has been adopted. This is a multi-donor program aiming to improve coordination and increase national ownership of water sector investments. It has attracted number of commitments worth US$951 million over five years from different organizations and governments. The SWAp also includes efforts to improve sector performance monitoring and strengthen sector capacity. However, an uneasy relationship exists with donors since the sector has its own targets that diverge from national or MDG targets. Local governments took over the responsibility for investment in infrastructure, Urban Water Supply Authorities (UWSAs) are theoretically autonomous, but they remain dependent on operational subsidies from the government. Although performance monitoring it must be pointed out, has benefitted from a shift to SWAp. Inaccuracies and inconsistencies that exist are being highlighted (AMCOW, 2011).

Tanzania recognized the human right to water and sanitation in its constitution in 2013. Policy and plans for sanitation, drinking water and hygiene have been budgeted for and are being partially implemented. The Ministry of Water, Ministry of Health and Ministry of Education and Vocational Skills have lead roles in the WASH sector (GLAAS, 2014).

2.2 Progress related to MDGs and comparison with other countries

The need for implementation of these policies and provision of water as a human right is critical in Tanzania. The country not only failed to meet the Millennium Development Goals, but access to clean water declined from 55 percent to 53 percent in the last two decades (Twaweza, 2014). In comparison to other sub-Saharan countries, Tanzania is below the average of 59 percent overall accesses in the East African region (WHO, 2009).

Figure 2.1: Percentage of population with access to improved water sources compared with neighboring countries



*Source – UNICEF, 2018, pg. 3.

Tanzania performs poorly in comparison to its neighboring countries with respect to access to improved water sources. The proportion of rural population with improved water sources is a mere 46 percent, 20 percentage points below Uganda, which performs the best among the four countries. Even urban populations have 19 percentage points less access to improved sources compared to Uganda. Tanzania made the smallest gains in improved water coverage during the MDG era, when compared to its East African neighbors and the sub-Saharan region (World Bank, 2018). According to a WHO report (2004), the average Tanzanian survives on less than 50 liters of water per person per day, which is the minimum amount to meet basic needs and dignity. The government of Tanzania spends significantly less on WASH than Kenya and Ethiopia and experiences significant disparities in access (UNICEF, 2018).

Table 2.1: National drinking water estimates (in percentages)

COUNTRY, AREA OR TERRITORY	Year	Population (thousands)	% urban	NATIONAL					RURAL					URBAN				
				At least basic	Limited (>30 mins)	Unimproved	Surface water	Annual rate of change in basic	At least basic	Limited (>30 mins)	Unimproved	Surface water	Annual rate of change in basic	At least basic	Limited (>30 mins)	Unimproved	Surface water	Annual rate of change in basic
United Republic of Tanzania	2000	33 992	22	32	8	43	17	1.24	21	8	50	21	1.06	69	8	20	3	0.67
	2015	53 470	32	50	13	24	13		37	15	31	18		79	9	9	3	

*Source - WHO, UNICEF – JMP, 2017, pg. 74.

The table above provides estimates of the type of drinking water source available to the population of Tanzania, with distinction drawn between rural and urban. It also showcases the change from the year 2000 to 2015. About 13 percent of the population of Tanzania still relies on untreated surface water. 37 percent of the rural population has access to basic drinking water services, while in urban areas it is 79 percent. About 18 percent of the rural population still accesses water from surface sources. While 75 percent of the urban population drinks water free from contamination, estimates of contamination in rural areas are unavailable (WHO, UNICEF – JMP, 2017).

These figures demonstrate that progress concerning drinking water has been slow in Tanzania and therefore there is a need to plan interventions that focus on water treatment at the household level until the government is able to invest and provide the necessary infrastructure for improved water sources to all citizens.

2.3 Tanzania's rural water supply: A historical context

This section emphasizes the development of rural water supplies and traces its trajectory, providing a contextual basis for the section on findings and analysis. Rural water supply in Tanzania was established at the end of 1940s, before achieving independence. The funding was distributed between the national and local government to the tune of 75 percent and 25 percent respectively. O&M costs were the responsibility of the local governments, borne through means of water rates and taxes. Shortly after independence, in 1965, the government decided that 100 percent of the funding for rural water supplies would be borne by the center and water at public domestic points would be free (Jiménez & Peréz-Foguet, 2010).

This policy of rural water supply began to change when in 1981, President Nyeyere stated that the users must look after the facilities, but this became a part of policy much later. Promises of rapid coverage, made in 1970, received a boost as a result of the International Drinking Water Supply and Sanitation Decade (1981-1990). Donors, who provided more than 50 percent of funds for rural water sector in Tanzania, were in support of this initiative and switched from program to project aid. But plans were not implemented and since sustainability was low, the rural coverage declined from 46 percent, according to government data, to 39 percent after international estimates (WHO & UNICEF, 2009). The policy of 2002 continued with an approach that had

been adopted previously, that is the demand-response approach to service delivery. This approach emphasizes that communities must demand, own and maintain their water services and participate in their design, full operation as well as maintenance costs. They also need to provide part of the capital costs in either cash or kind (Jiménez & Peréz-Foguet, 2010).

2.3.1 Decentralization

A Local Government Reform Program (LGRP) was launched in 1996 to make local governments more effective and efficient and to introduce participatory planning. In 2008, a new reform program was introduced emphasizing on decentralization by devolution. According to the Government of Tanzania, the LGRPs enhanced the capacities of the authorities and led to an increased awareness of local government reform and community participation in local development (Holvoet, Inberg & Van Aelst, 2015). Under the decentralization policies, local government (LG) authorities are responsible for investment in rural water supply infrastructure, while the national ministry focuses on policy and guidelines, capacity development and performance monitoring. This division of tasks became a norm only post-2007 when the Water Sector Development Program (WSDP) was formed. At the community-level, community-owned water supply organizations (COWSOs) are in charge of operations and maintenance (AMCOW, 2011). This was found to be true for two villages Changarawe and Vitonga, of the three that were chosen for the study. Each of them had a functioning water committee that was responsible for collecting user fees and maintenance of the water supply mechanism. Only the third village Peko, Misegese did not have a committee since the community accessed water from open sources and no infrastructure was laid for water supply.

However, according to the World Bank Group (2018), which conducted a diagnostic review of Tanzania, a history of centralized delivery and politicization of water is a cause for the failings in rural and urban contexts. The decentralization process has not been clear and is inefficiently implemented, leading to a misalignment of roles and responsibilities and functions that have adversely affected accountability relationships, which in turn impact service delivery. There is poor coordination and understanding regarding the timing and kind of support that LGs need to provide to the COWSOs leading to non-functional water points and politicians allocating funds for the

construction of new water points, interestingly around the election cycle (World Bank Group, 2018).

Section Three: Literature Review

This chapter examines coverage of drinking water services in greater detail and highlights why this focus is critical. It then discusses the WASH sector in the context of HWT, theories and approaches of BCC interventions, methods of water treatment, which then lead to an introduction of the conceptual framework.

3.1 Global importance to drinking water

Globally, although the situation for drinking water seems to be better than sanitation with 54 percent of the world's population receiving piped water at home, these systems work irregularly and are unsafe (Bartram & Cairncross, 2010).

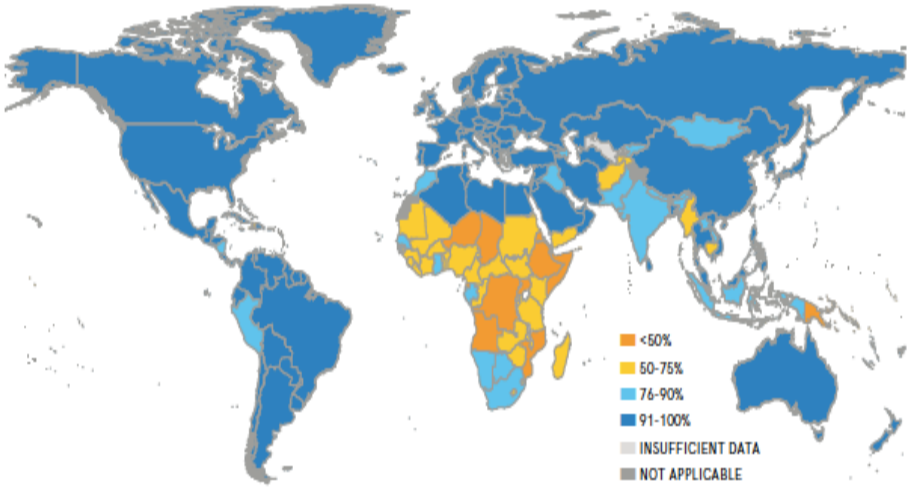
Table 3.1: Joint Monitoring Program (JMP) ladder for drinking water services

SERVICE LEVEL	DEFINITION
SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination
BASIC	Drinking water from an improved source, provided collection time is not more than 30 minutes for a round trip, including queuing
LIMITED	Drinking water from an improved source for which collection time exceeds 30 minutes for a round trip, including queuing
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal
Note: Improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, rainwater, and packaged or delivered water.	

*Source - WHO, UNICEF – JMP, 2017, pg. 8.

71 percent of the global population, in 2015, used a safely managed drinking water service i.e. located on the premises, available when needed and free from contamination. But 844 million people still lack a basic drinking water service and, in 2015, 159 million people were still collecting drinking water from surface sources, of which 58 percent lived in sub-Saharan Africa (WHO, UNICEF – JMP, 2017).

Figure 3.1: Proportion of population using at least basic drinking water services, 2015



*Source - WHO, UNICEF – JMP, 2017, pg. 3.

By 2015, 181 countries had achieved over 75 percent coverage with at least basic drinking water services. This is classified as using improved source of water that requires no more than 30 minutes per trip to collect water. In accordance with this definition, in 2015, 6.5 billion people were said to have at least a basic drinking water service (WHO, UNICEF – JMP, 2017).

Safely managed drinking water, the highest rung of the JMP ladder for drinking water, has been broken down into further elements. These are accessibility, availability and quality. Accessibility refers to the time taken to reach the water source, time spent in queue, filling containers and returning to the household. For the purpose of this study, the cost for water (Oben-Odoom, 2012) will also be included in the accessibility parameter. Affordability of water is also crucial to whether water is accessible or not. The criterion, availability, is the continuous and sufficient quantity of water availability to meet requirements of drinking water, personal hygiene and other household chores. While drinking water should be available in sufficient quantities, attaining this is difficult since services are unreliable and intermittent. Households therefore restrict consumption or store water to ensure availability (WHO, 2017). The criterion, quality, refers to water free from pathogens and elevated levels of harmful substances. A systematic review of literature from low and middle-income countries conducted to determine whether water from improved sources were less likely to

contain fecal contamination as compared to unimproved sources, found fecal contamination is not completely absent from improved sources of water and is inconsistent on the basis of source and setting (Bain, Cronk, Wright, Yang, Slaymaker & Bartram, 2014).

3.2 Why is access to safe drinking water an issue?

Lack of access to safe drinking water can be attributed to a number of reasons such as limited financial, institutional and informational capacity for treatment and provision, issues that are mostly experienced in developing countries therefore also increasing the disease burden in these countries. Although provision of universal access to safe, pathogen-free and reliable piped water supply is the ideal solution, the high capital and maintenance costs of these systems makes it difficult to achieve at a quick rate (Bartram, Ojomo, Elliot, Goodyear & Forson, 2015), making it a distant dream for many developing countries. That is one part of the problem.

The other aspect to be considered is that achieving the provision of universal access to improved water supply is not the end of the challenge. Even households or people with access to 'improved' water services such as household connections, public standpipes and boreholes may not have microbiologically safe water (Sobsey et al., 2008), since water can become contaminated at different points during distribution, transportation and storage (Wright, Gundry & Conroy, 2004). A major reason for this is the fecal contamination of source and treated water, which is exacerbated by increasing population, urban growth and increasing pollution of ground and surface water resulting from deforestation and climate change (Sobsey, 2002). A study conducted by Shaheed, Orgill, Montgomery, Jeuland and Brown (2014) on microbial quality of 'improved' drinking water sources in southeastern Asia proves that the definition of 'improved' does not account reliably for microbial safety. They discuss three factors that contribute to microbiological risks among households with improved sources of water - water storage, risks specific to piped water supplies and household water management practices. This paper focuses specifically on the third factor of microbiological risk, which are household water management practices.

3.3 Household Water Treatment

The importance of HWTS practices has been illustrated in the introduction section. This section will dive into the details of established practices of treating drinking water and combine BCC interventions that have been conducted to increase adoption and sustenance of HWTS in low-income country countries.

3.3.1 WASH Sector context

In recent decades, the field of water, sanitation and hygiene has witnessed a paradigmatic shift (Krukkert & Voorden, 2015). WASH interventions have two components – the 'what' that focuses on technology, service or practice and the 'how' which describes the promotional approach or mechanism of the intervention (3ie, 2018). There has been a shift in the supply-driven infrastructural focus towards a more "demand-driven, behavior-focused approach where government and support agents facilitate communities' own change processes" (Krukkert & Voorden, pg. 110, 2015), combined with what needs to be done for utilization of technology (software) and sustained use (3ie, 2018).

BCC interventions are employed in programs that promote positive changes with regard to health-related behaviors through tailored messages and providing an environment that facilitates individuals and communities to make changes. Although behavior change is important for promoting better health outcomes to improve health of populations globally (Painter, Borba, Hynes, Mays, Glanz, 2008), there is a critical need for these methods to be increasingly used in developing countries to tackle the health and developmental issues they face (Briscoe & Aboud, 2012).

In order for BCC interventions to have a positive impact there is a need for adopting and maintaining behaviors and technology over time at scale. Evidence regarding sustained adoption has been mixed and this can be attributed partially to a less-developed understanding of the factors that influence WASH behavior change and maintenance (Driebelbis, Winch, Leontsini, Hulland, Ram, Unicomb & Luby, 2013).

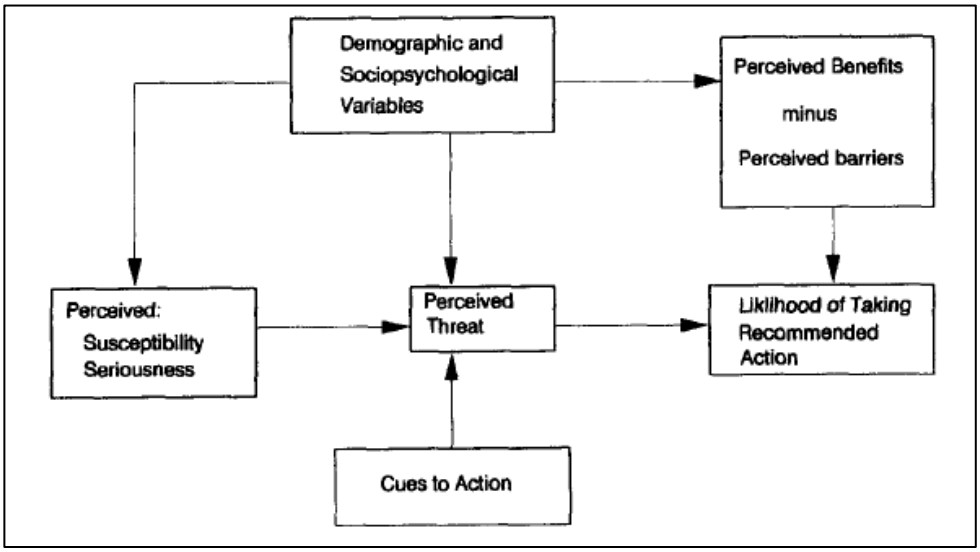
3.3.2 Behavior change communication: Theories and approaches

To improve the effectiveness of behavior change interventions and maximize their efficacy, a theoretical understanding of behavior change is necessary (Michie, Davis, Campbell, Hildon & Hobbs, 2015). Programs rarely combine theory, evidence and insights about their audience. Interventions usually follow a logic frame, but miss out the major factor that behavioral activities require certain drivers that are not always logical. This gap is to be filled by psychosocial theories (Briscoe et al., 2012) since theories guide the search to assess why people practice or do not practice health-promoting behaviors, assist in identifying the information needed to design effective interventions and design successful programs (Glanz & Bishop, 2010). Below is a description of the most widely used theoretical models of health behavior:

The Health Belief Model

One of the first theories of health, it was developed to understand why people did or did not use preventive health services. It theorizes that people's beliefs regarding vulnerability to disease and perceived benefit of taking action influence readiness to act and the barriers to taking the particular action and self-efficacy (Glanz et al., 2010).

Figure 3.2: The health belief model



*Source – Burns, 1992, pg. 34.

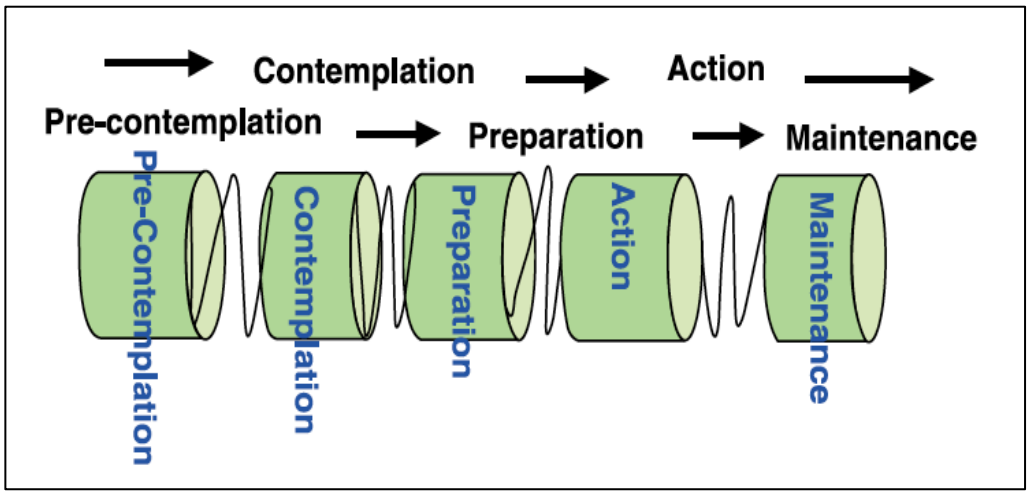
The model accounts only for intended behavior through perceptions and disregards external factors that preclude compliance, a limitation in itself (Burns, 1992). The

importance of including external factors for behaviors associated with HWT practices is accounted for in the conceptual framework this study utilizes.

Trans-theoretical Model (Stages of change model)

Long-term changes in health require multiple actions and adaptations over time. The theory proposes that people are at different stages of adopting health behaviors. The model describes a sequence of steps for behavior change; no recognition of the need for change, thinking about change, planning for change, adopting new habits and lastly maintaining the practice.

Figure 3.3: Stages of change theory



*Source – Chen, 2006, pg. 8.

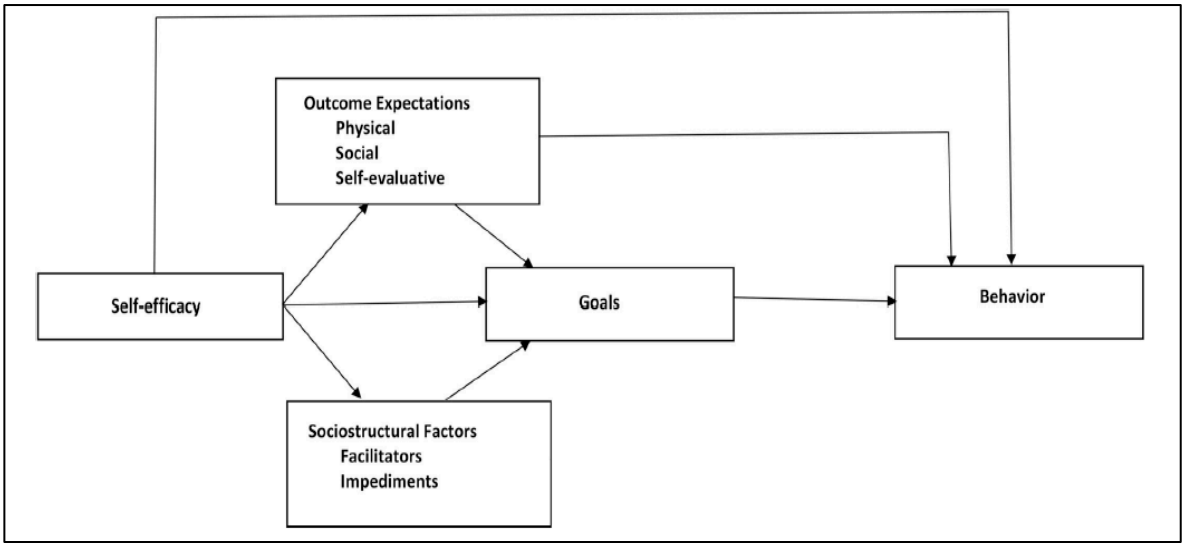
These stages are not always followed in a linear pattern and individuals may elapse to an earlier stage depending on their motivation and self-efficacy (Glanz et al., 2010). The theory is useful for tailoring an intervention depending on the stage in which the individual is (Chen, 2006).

Social Cognitive Theory

Albert Bandura's Social Cognitive Theory is widely studied in the field of psychology and has applications in diverse fields (Beauchamp, Crawford & Jackson, 2019). It explains human behavior in a dynamic and reciprocal model (key aspect) in which personal factors; environmental influences and behavior interact continually. Relevant constructs of the model include observational learning, reinforcement, self-control and

self-efficacy. A person's confidence in his/her ability to take action and persist despite challenges (self-efficacy) is important for influencing health behavior change efforts (Glanz et al., 2010).

Figure 3.4: Social Cognitive Theory



*Source – Beauchamp et al., 2019, pg. 111.

Social Ecological Model

The model helps understand factors affecting behavior and provides guidance to developing programs through social environments. It emphasizes multiple levels of influence and highlights the fact that behaviors shape and are in turn shaped by the social environment (Glanz et al., 2010).

Figure 3.5: Social ecological model

*Source – http://www.esourceresearch.org/Default.aspx?TabId=736

The focus on creating a conducive environment is similar to the concepts of social cognitive theory (Glanz et al., 2010). The different levels that are a part of the social ecological model have been integrated in the conceptual framework that has been used for this study.

Behavior change approaches

A review conducted by 3ie (2017) focused on published and unpublished studies on interventions in low and middle-income countries that use promotional approaches for changing behaviors concerning hand washing, latrine use and open defecation. They categorize these approaches into 3 broad categories, which have been summarized below in table 3.2. Although interventions consist of various elements and cannot always be seamlessly distinguished, these categorizations provide a basis to focus on the underlying rationale, implementation procedure, advantages, shortcomings and monitoring and evaluation (M&E) strategies (Ochaney, 2019). The findings suggest that community-based approaches (CB) and sanitation and hygiene messaging (SHM) involve people in planning and decision-making and social marketing approach (SM) considers audience as consumers of a product. CB approaches have the most consistent results when they include a sanitation component, SHM has a positive influence but effects are not sustainable over the long term and SM tends to be applied with variations and may not reach the poorest population.

Table 3.2: Approaches to BCC

	Social marketing approach	**Sanitation and hygiene messaging**	**Community-based approaches**
Level of community involvement	Low. A top-down approach.	Bottom-up planning and designing. Formative research is important. Implementation is top-down.	High in planning and decision-making Inspired from a participatory approaches
Focus of approach	Marketing techniques for promotion of sanitation. Focus: Product, Price, Place and Promotion	Information provided on the basis of: which specific practices are placing health at risk? Motivating factors for adoption of safe practices? Target audience? Effective means of communication?	Encourages behavior change by letting people take lead. Differs from households to community level.
Types of interventions	Saniya and Total Sanitation and Sanitation Marketing (TSSM)		Participatory Hygiene and Sanitation Transformation (PHAST) and Child Hygiene

			and Sanitation Training (CHAST) and Community-Led Total Sanitation (CLTS).
Modes of delivery	Target population considered potential consumers. Private sector experience influences product development and promotion. Mix of promotional methods ranging from mass media to household visits.	Consists of one-way communication for increasing skills and knowledge.	Employs 'mass social mobilization' that engages people from all levels and sectors to deal with shared social problems.
M&E	Monitoring may be resource intensive requiring trained field workers since it combines different approaches involving face-to-face interaction. Evaluations: Observational study, Experimental: Cluster Randomized Control Trials (RCT) and Quasi experimental: Non RCT.	Experimental Cluster RCT, Experimental RCT, Experimental RCT (mixed methods) and observational.	Bottom-up monitoring ensures community needs are met. Evaluations: Quasi-experimental: Non RCT (mixed methods), Experimental: Cluster RCT, Experimental RCT and qualitative methods
Effectiveness	The use of these approaches is less uniformly applicable, showing positive effect when hand washing and sanitation components are combined.	Positive influence on behaviors related to hand washing with soap. Effects are not sustainable in the long term and barely impact sanitation outcomes.	Shows the most consistent results where a sanitation component was a part of the program.
Strengths	Combines the objectives of the public sector with the expertise and professionalism of the private sector. Can be scaled-up to the national level at low budgets.	Provides relevant and important information to people regarding health practices and behaviors.	Bottom-up approach. Involvement of women and children in the projects increases sense of ownership and chances of sustainability.
Weaknesses	It may not reach the poorest of people who are in need.	Mere provision of knowledge is unlikely to lead to change behavior and practices since that requires time, access to certain resources could be resisted due to social norms.	Participatory approaches need highly trained field workers and reliance on their quality is high. Issue of ignorance of structural issues or contexts

* Source - Adapted from Peal, Evans & Voordern, 2010; 3ie, 2017; Sumedh M.K., 2018, WaterAid, 2013, UNICEF & LSHTM, 1999

3.3.3. HWT methods and technologies

Sobsey (2002) reviews various methods and technologies available to protect and treat water during storage and collection to improve its microbial quality and reduce risk of exposure to waterborne diseases. The report identifies the most promising techniques

based on the following parameters: effectiveness in improving and maintaining microbial quality of water, reducing waterborne diseases, technical difficulty or simplicity of use, accessibility cost, socio-cultural acceptability, sustainability and potential for dissemination.

The report makes a distinction between physical (boiling, exposure to sunlight, filtration) and chemical (coagulation, chlorination flocculation) methods of HWT. These methods are used in developed and developing countries and their effectiveness in improving the microbial quality of water have been tested under different conditions (including within laboratories and also in the field) and catering to different people. Key differences exist in the availability and affordability of these technologies in developing countries, as well as the need to adapt them to the local conditions and cultural or community preferences (Sobsey, 2002).

Lantagne, Quick and Mintz (2006) summarize five common HWTS options that can improve health gains associated with water and can have a positive effect on poverty alleviation and development.

Table 3.3: Methods of water treatment

Method	Benefits	Drawbacks
Chlorination	Reduces bacteria and viruses Protects against contamination Easy to use High acceptability Scalable and low-cost	Relatively low protection against some viruses Potential objections to taste and odor Concerns regarding potential long-term carcinogenic effects
Filtration[1]	Locally available Inexpensive options Simple to use	Effectiveness regarding pathogen removal, Filter maintenance and lack of residual protection
Solar disinfection (SODIS)	Proven to reduce bacteria and viruses Positive health impact Acceptable to users because of low-costs Ease of use and minimal change in water taste	Need to pretreat water that is dirty Limited volume of water can be treated at a time Lengthy process hampers acceptability
Filtration and chlorine	Reduce microbial contaminants drastically Produce product water that meets international	Costly and requires training and skills

[1] Filtration is the use of natural materials to filter visible contaminants from water.

disinfection[2]	guidelines and national standards for microbial quality High acceptability among users due to ease of use.	
Flocculation and chlorination	Removes viruses, bacteria, parasites, heavy metals Proven to have positive health impacts, while eliminating concerns about the carcinogenic effects of chlorination due to the removal of organic material in the treatment process	Relatively costly therefore limiting its use for poorer populations

Source* - Adapted from Sobsey, 2002; Latagne et al., 2006

This review of behavior change communication approaches and common methods of water treatment lead to the next section, which introduces the conceptual framework of the study.

3.4 Introduction to the conceptual framework

Mohamed et al. (2016) conducted a study in rural Tanzania to assess the microbiological effectiveness of several HWTS methods before considering a national scale up of HWTS. The results of the study were positive since there was an improvement in microbial quality at POU.

Although the study measured the effectiveness of various methods of HWT, its categorical focus on technology aspects left questions concerning behavior change (psychosocial elements) unanswered. In order to scale the intervention at a national level, it is important that contextual, technological and psychosocial dimensions be considered before planning. A combination of these two (technology and psychosocial dimension) can then inform a successful policy (contextual dimension).

Another intervention conducted in Malawi began with a social marketing approach of a chlorine disinfectant known as "WaterGuard" (WG) by Population Service International (PSI), which was then combined with a behavior change component. An evaluation conducted to document the sustained use of treatment methods found that although the use of the product had declined from 61 percent to 28 percent it was still

[2]The combined process of filtration and chlorine disinfection is widely practiced for community water treatment in developed countries, especially for surface sources of drinking water.

an improvement from the levels recorded before the intervention (Wood, Foster & Kols, 2012).

This intervention, according to the evaluation results, can be considered a success story due to several factors. Firstly, the government in collaboration with PSI provided a policy environment that promoted HWT, making access to resources easier by providing it at health clinics for free of cost. Secondly, the intervention was based upon the trans-theoretical model providing a strong grounding in health-related theory. This steered the intervention towards working on the various psychosocial elements at different levels (perceived risk, shame, nurture, knowledge, self-efficacy) that are critical for adoption and sustenance of behavior change. Thirdly, the provision of the product for water treatment, demonstration of its use and explanation of its value to the community proved to be factors in changing the community wide norms regarding water treatment practices.

The example offers an insight into the various dimensions that need to be integrated in an intervention to increase adoption and sustenance of a behavior. Following this example, the study has utilized a conceptual framework, the Integrated Behavioral Model (IBM) –WASH, that was developed to take into account all the factors mentioned in the various studies focusing on WASH and behavior change. The model widens the scope by including other factors previously excluded. Some examples of those are the type of technologies used and the costs and complexities of using them.

Additionally, the Risks, Attitudes, Norms, Abilities and Self-Regulation (RANAS) model complements the IBM-WASH. Lilje et al. (2015) conducted a formative study in the Chad Basin to determine the factors that influence water treatment behavior. They have applied the RANAS model for their study since it focuses on psychosocial factors of behavior change and has a predictive ability, useful for assessing intervention potential for behavior change concerning POU water treatment. The model also depicts which type of behavior change technique can be applied by providing evidence to develop strategies for program design (Lilje et al., 2015). The approach has been established to design and evaluate behavior change strategies that target factors influencing behavior in a specific population. It focuses on systematic behavior change

through identification of potentially relevant factors based on theories of psychology (Mosler & Contzen, 2016).

Both of these together guided the data collection, coding and analysis of the study.

3.4.1 IBM-WASH Framework and RANAS model

The authors Dreibelbis et al. (2013) conducted a systematic review of articles that were focused on water, sanitation and hygiene and referred to conceptual frameworks, models and theories related to the sector. The findings from their review helped develop a comprehensive behavior change framework that guided technology selection and hygiene promotion and helped operationalize definitions and explore the relations between the various dimensions at different levels. Research conducted in Bangladesh[3] on the basis of the framework helped validate it (Hulland, Leontsini, Dreibelbis, Afroz, Dutta, Nizame, Luby, Ram & Winch, 2013).

Table 3.4: The IBM-WASH

Levels	Contextual factors	Psychosocial factors	Technology factors
Societal/Structural	Policy and regulations, climate and geography	Leadership/advocacy, cultural identity	Manufacturing, financing, and distribution of the product; current and past national policies and promotion of products
Community	Access to markets, access to resources, built and physical environment	Shared values, collective efficacy, social integration, stigma	Location, access, availability, individual vs. collective ownership/access, and maintenance of the product
Interpersonal/Household	Roles and responsibilities, household structure, division of labour, available space	Injunctive norms, descriptive norms, aspirations, shame, nurture	Sharing of access to product, modelling/ demonstration of use of product
Individual	Wealth, age, education, gender, livelihoods/employment	Self-efficacy, knowledge, disgust, perceived threat	Perceived cost, value, convenience, and other strengths and weaknesses of the product
Habitual	Favourable environment for habit formation, opportunity for and barriers to repetition of behaviour	Existing water and sanitation habits, outcome expectations	Ease/Effectiveness of routine use of product

*Source – Dreibelbis et al. 2013, pg. 6.

The three dimensions that the model emphasizes are **Contextual, Psychosocial and Technology factors.** Each of these dimensions is further deconstructed at five levels. The **societal level** refers to broad institutional, organizational and cultural factors. The

[3] Hulland et al. (2013) conducted a study in Bangladesh with the IBM-WASH framework. The study was to inform the design of a handwashing station for two subsequent RCTs in Bangladesh testing the health effects of handwashing. In turn, the results of this research process helped validate the application of the IBM-WASH framework to a specific technology supported behavioral outcome.

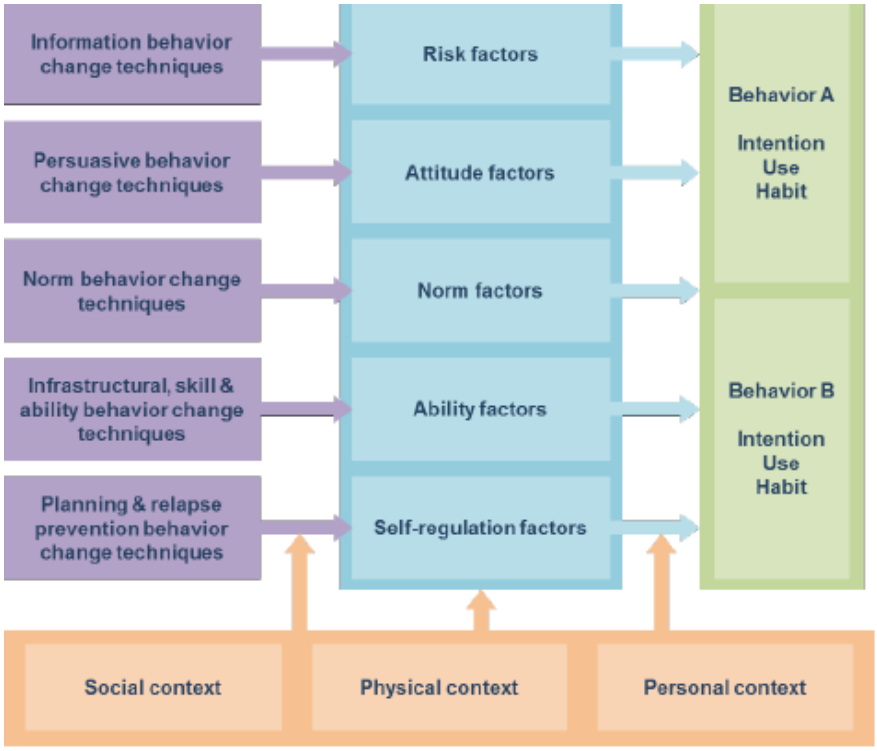
community level comprises of the physical as well as social environment in which individuals are placed and the formal and informal institutions that effect individual behavior and experiences. The **household level** focuses on interaction between members, including factors like division of labor, household structure and descriptive norms. The **individual level** includes socio-demographic characteristics such as age, wealth and gender, and attitudes toward the product. The last level, **habitual**, provides an opportunity to explore whether the intended behavior is one that is practiced everyday and what are the processes and factors that enable or constrain this (Dreibelbis et al., 2013).

The **contextual dimension** (CD) refers to determinants related to the setting and/or environment. These are factors that are outside the scope of influence of programs but are important to consider since they influence individual and community behavior towards adoption and sustenance of WASH products and behaviors. Very few studies consider the contextual dimension and its influence on WASH behaviors (Dreibelbis et al., 2013).

The **psychosocial dimension** (PSD) consists of those attributes that generally form the focus of behavior change interventions. They have been referred to by various terms in many health models such as the Health Belief Model, Theory of Planned Behavior, and Social Cognitive Theory (Dreibelbis et al., 2013).

The **technological dimension** (TD) is the product or technology aspect of any intervention. It includes aspects of hardware and its characteristics that have an impact on behavioral outcomes (Dreibelbis et al., 2013). The three dimensions are not only related to WASH practices, but also align with the concept of 'reciprocal determinism' in Social Cognitive Theory (section 3.3.2), which describes a mutual interaction between the individual, the behavior and the environment in which the behavior is practiced (Dreibelbis, Hulland, McDonald, Sultana, Schwab & Winch, 2013).

Figure 3.6: RANAS model



*Source – Mosler and Contzen, 2016. Pg. 7.

This model has four components, namely, psychosocial factors (blue blocks), behavior change techniques (BCT) (purple blocks), behavioral outcomes (green blocks) and contextual factors (pink blocks). For the purpose of this research, the psychosocial factors will be explored along with with the IBM-WASH model. The **Risk** factors represent a person's awareness of health risks, vulnerability to a health risk and severity (coded under PS dimension at household level). **Attitude** comprises a person's positive or negative stance towards a certain behavior including perceived cost of the technology and their emotions towards the use (coded under T at individual level). The block on **Norms** is representative of the social pressure (approval or disapproval) and personal belief to perform a certain behavior (PS dimension at community level). **Ability** is similar to perceived self-efficacy in practicing and continuing a behavior (PS dimension at individual level). **Self-regulation** is about planning, commitment and self-monitoring of a behavior (coded under PS dimension at habitual level) (Mosler et al., 2016).

Section Four: Methodology

This study of factors that influence water treatment at POU was qualitative in nature. Since the goal was to provide formative information for a BCC intervention, qualitative methods of data collection were better suited due to their ontological, epistemological and methodological approach.

The research was undertaken from the perspective of the constructivist paradigm, allowing for multiple realities to co-exist and be explored based on social experiences within a contextual understanding. The paradigm takes into consideration that realities are co-created within the interaction between people and the investigator and interpretative understanding is given to subjective meanings (Guba & Lincoln, 1994). This paradigm was the best fit in this instance since behavior change communication requires a bottom-up understanding of people, their contexts and multiple variables that allow for successful programs and policies to be developed. This study does not begin from any theory, but a theory will be constructed based on the findings from the data collection. Although the use of a theory from the outset is missing, the conceptual framework will provide direction for data collection and analysis.

4.1 Methods of data collection

The data collection for the study relies on primary sources and secondary literature. Secondary literature provided information on SDGs, the WASH sector, BCC interventions and policy related to water and supply specific issues in Tanzania.

Primary data collection was conducted through observation, focus group discussions, in-depth interviews and semi-structured interviews. Observations of the source of water supply and the household treatment methods were done in the households where in-depth interviews were conducted.

Semi-structured interviews were conducted with village officials/ local leaders to comprehend details about the supply side of water, the policies, local realities regarding water and views on quality, affordability and accessibility.

Focus groups discussions (FGDs) were to be conducted with two groups (individuals who treat water and those who do not treat water before use) in each of the villages. These discussions helped to broadly gather information regarding community-wide practices and attitudes towards HWT, information regarding the accessibility and availability of water from the demand side, enablers and constraints of HWTS practices and social networks within the community that influence households for HWTS. Two FGDs were conducted in Changarawe since that was the only village that had enough respondents who treated water.

In-depth interviews (IDIs) were conducted at the household level to understand the factors mentioned in the focus groups as those that encourage or constrain the practices of household water treatment. The interviews focused on gender roles and decision-making aspects beyond the household level, which are important aspects for designing interventions and provided information regarding best means of delivering information and increasing adoption and sustenance of HWTS practices. Secondary data and primary data collection with various sources were used to triangulate the information received.

4.1.1 Instruments (Refer to Annex)

FGDs and IDIs were held through guides that were developed drawing from secondary literature available on access to water, role of local government, and guided by the conceptual framework. Additional questions were added depending on the context and responses received, and in order to develop a nuanced understanding.

4.2 Sampling

The sampling for the study is purposive in nature. All the respondents were chosen due to certain specific characteristics. For the semi-structured interviews, the duty bearers of each village i.e. the Village Chair (VC) and the Village Executive Officer (VEO), were interviewed.

For the FGDs the primary respondents were women since they are the ones who are responsible for fetching water and treating it before use (as inferred from the secondary literature available). One FGD had mixed respondents since the VC had invited them.

For the in-depth interviews, the households were considered as respondents. The sampling was based on the factors that are the most relevant in that particular context and are the distinguishing factors between marginalized/disadvantaged and other households. The key informant, the VC[4], chose these households.

4.3 Sites for data collection

Three sites, Changarawe, Vitonga and Peko Misegese, were chosen for data collection. They were selected because of differential water supply systems (more in Section 5) on the basis of prior information available from the 'Community-based Monitoring' research project.

4.4 Analysis

Firstly, since the FGDs and interviews were held in Swahili, they had to be translated to English. Following this, the analysis of data was conducted with the use of the NVivo software, which provides assistance for qualitative data analysis. Analysis was done through coding of the data collected and the codes were derived from the conceptual framework indicated for the study.

4.5 Limitations

Since, respondents for FGDs and IDIs were chosen by the VC, there was a possibility of selection bias. Although parameters for sample selection were conveyed, it was dependent on the VC's interpretation and the dynamics of the particular village, compelling flexibility from the researcher.

Language was another key limitation. Since the interviews were conducted in Swahili, there was heavy reliance on the translator. This might have led to interpretations of what respondents say on part of the translator that are then conveyed to the researcher, leading to double interpretations of the reality. Thus this can distort findings and therefore analysis.

[4] He/she holds a political position and has knowledge regarding all the households in the community, thereby making them an important source of information.

Another limitation that needs to be mentioned at the outset is the problem of generalizability of findings. The study was conducted over a short period and sample size for data collection was limited, therefore making it a challenge to generalize results based on the findings.

Section Five: Findings and Analysis

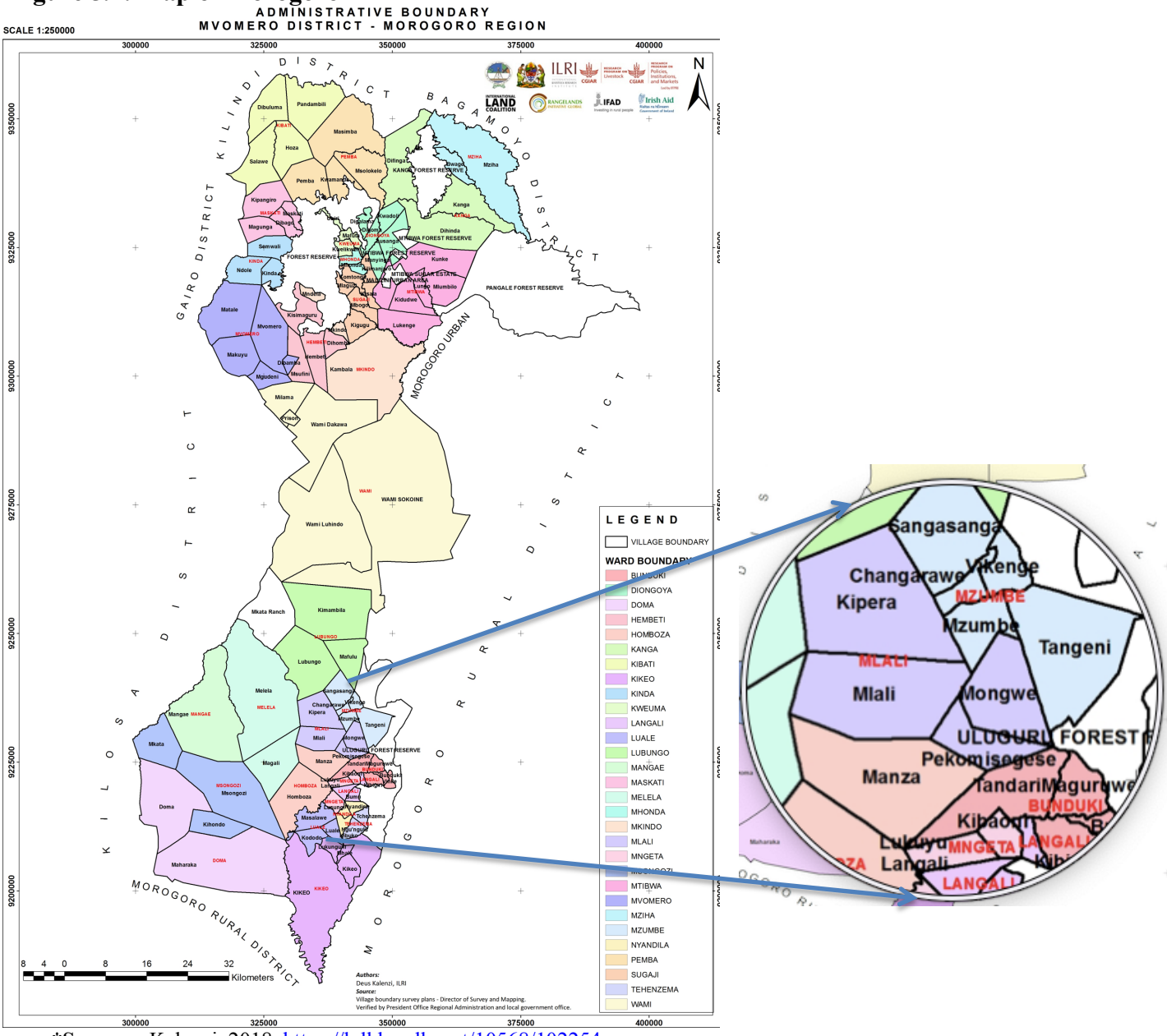
This chapter compiles data that has been collected during fieldwork and examines it to answer the key research questions. Each sub-section will aim to answer different sub-questions. First, there is a detailed description of each village, then a focus on the provision of water to its residents and lastly an analysis of the supply aspect on the basis of accessibility, availability and quality.

The second section will focus on factors that affect treatment of water at POU. This section will be divided on the basis of the three dimensions: contextual, psychosocial and technology at different levels. The next section will include a comparative analysis of factors among the three villages regarding water treatment. Since the supply of water is different to each village, it is interesting to investigate the residents' perceptions regarding need for treatment of water at POU. Therefore section one and two shall cumulatively provide a response to the third sub-question.

The third section will unpack a comparison between different households in the three villages to confirm whether marginalized status of households has a role to play in water treatment. This analysis will be done on the basis of the in-depth interviews that were conducted.

5.1 Background of study sites

Figure 5.1: Map of Morogoro



***Source** – Kalenzi, 2018, https://hdl.handle.net/10568/102254

5.1.1. Changarawe

Located close to Mzumbe University, Changarawe has a total of 10 hamlets. It comprises of 1067 households with a total population of 8,457.

Access to water

Interviews with duty bearers revealed information regarding the supply of water.

"The village receives water from the source that is in the mountains. A donor from Holland put the infrastructure in place. There is no government contribution in this system. We just pay the MOROWASA (Morogoro Water Supply Authority) money to continue receiving water from the source."

- Village chair of Changarawe

Water is provided to the people through taps. 50 percent households have their own taps, while the rest use public taps or go to their neighbor's homes to fill water. There is one public tap in each hamlet. A piped water distribution system is considered to be an improved source of water. However distance to source and time taken to fetch water are important parameters to consider in the JMP service ladder.

Figure 5.2: Queue at a household tap to fill water

From the FGDs conducted, many households take more than 30 minutes to fetch

drinking water. Hence the service is 'limited' in terms of the JMP ladder. When costs are under consideration, households pay TSH 30,000 for installation of infrastructure followed by TSH 3000 monthly. Other households pay TSH 500 per month for accessing water. This money is used for maintenance of the infrastructure. Respondents believe the costs are fair and have no implications on their families.

Availability of water i.e. consistent supply is another parameter.

> *"Water does not flow everyday. We get water once per week. If we get water on Sunday, then we won't get it again through the week."*
>
> - FGD respondent (water treater [WT])

> *"We could have used that time to do our economic activities like going to the farm. On the day we get water, we can't even cook, because we need to get enough water to last us a week."*
>
> - FGD respondent (WT)

When questions regarding **quality** were asked, the VEO responded that no standards regarding water quality were adhered to and there were no checks.

Redress mechanisms

The main issue according to the residents and duty bearers of Changarawe is the unreliable access to water.

> *"Just like we said before, we don't get water everyday. And when we get it, a lot of people come together to collect it. If the volume of water is increased, this problem can be solved. If we could get a project to help increase the amount of taps in the community that would be a great help. And us community members can also provide labor force for the project."*
>
> - FGD respondent (non-treater [NT])

Residents approach the water committee first in case of any issues. If the committee is unable to provide solutions, they approach the VC and VEO and a solution is sought jointly.

This is the same for the other two locations of the study.

5.1.2. Vitonga

The village is comprised of 5 hamlets and a total of 276 households.

Access to water

The people have access to water through three boreholes (BH).

> *"We fetch at the borehole. Most of the people in the village fetch water from the borehole."*

> *"There are some people who are living in the village who only use water from the boreholes for household chores. Water for drinking they fetch either from Mlali or Mzumbe. One jerry can is 500TSH."*
>
> - FGD respondents

Regarding **time** taken, for some respondents it is less than 30 minutes, but for others it depends on the **distance** and queue at the source. BH are considered to be improved sources of water, but since the collection time for certain households is more than 30 minutes it will be considered as a 'limited' source on the JMP ladder. And since some households buy water from vendors, which is an improved source but time taken is more than 30 minutes, it is a 'limited' source.

Regarding **costs** for water respondents contribute TSH 1000 per month.

> *"The implication is in buying drinking water (from Mzumbe or Mlali). We can order 5-6 jerry cans and have to pay 3000TSH for that. But water from the borehole does not have any implications."*
>
> - FGD respondents

Regarding **availability**, the VC, VEO and FGD respondents say that supply is constant.

When enquired regarding the standards of **quality** adhered to, the VEO said there is no such criteria. The VC said that the water quality is not checked because the boreholes are covered and so it is protected. During the FGD it was revealed that water from the boreholes is salty. Respondents articulated,

> *"For me personally, that's not the case. Because we use the water and we don't see any effects. No one gets stomach problems or anything."*
>
> *"We are used to this water. We drink it, wash utensils and cook with it."*
>
> *"I only use this water for washing clothes and cooking, but for drinking I fetch from Mlali. Just like she has said before, we are not natives of this place. I moved here from Mgeta. We used to have cold water, but here its salty water. When you drink it you get stomach problems."*
>
> - FGD respondents

Redress mechanisms

In Vitonga, the major issue according to respondents is the breaking down of the boreholes and lack of more water sources. Issues of access to water are more pressing than the quality of water supplied.

5.1.3 Peko Misegese

This village is located high up in the mountains. There are 643 households with a total population of 2420.

Access to water

This village does not have any infrastructure to access water. The residents access water from streams, springs and the main river (Kibundi) that flows through the village.

> *"I fetch water from the river but from different points for drinking and household chores. We have 2 points because one has clear water and the other one the water is a bit dusty. In the place with clear water we use for drinking."*
>
> *"I use the same river water from the same point for both."*
>
> -FGD respondents

This constitutes as surface water in the JMP service ladder for drinking water provision. There are no **costs** incurred by residents. Regarding **availability**, during the dry season the flow of water reduces due to farmers diverting water for irrigation, creating some problems for other residents who use it for drinking and chores.

The **quality** of water, the VEO said, was not checked. The respondents said:

> *"I fetch from the river. So people who live up have already made it dirty. Sometimes they wash clothes and do other chores. So the water I get is not clean. They also use pesticides in their farm."*
>
> *"The water from the spring is clean because it comes directly from the ground. Specialists came and checked the quality and said that it's clean for human consumption. But the problem is*

that it is not covered/protected so even animals can go and drink water from there."

- FGD respondents

Redress mechanisms

The residents have collectively decided the need for taps in their village to access water.

"We had meeting in our hamlet and we agreed that for us to have access to safe and clean water we should install tap water. We wrote the minutes and sent the information to the village office."

"We wanted them to help us install tanks at the water source and supply water to us through taps. In the taps, unlike streams, water will be passing through pipes so it won't get contaminated. We have sent our request to the regional commissioner's office requesting him to help install taps in the village."

- FGD respondents

5.1.4 Discussion

In a study conducted by Jiménez et al., (2010), in Kigoma rural (located at the western border) and Same district (located at the eastern border), they identify factors hampering the success of the Rural Water Supply and Sanitation Program (RWSSP) in Tanzania. The first challenge is the quality of water provided and the reliability of supply. Enhanced Water Point Mapping Technology was used for analyzing these. The quality of water was not satisfactory especially due to coliforms. About 40 percent of the ground water points were found polluted together with 30 percent gravity-fed systems. Their study demonstrated that more than 50 percent of the improved water points could be expected to have quality or seasonality problems. They attribute this to poor management of services rather than infrastructure failure or natural sources of pollution (Jiménez et al., 2010). In some cases, water was naturally polluted i.e. saline, as is the case for Vitonga. In other cases seasonality was related to depletion and bad

use of sources due to inappropriate land use around the source and poor allocation to different uses of water abstracted from the same source (Jiménez et al., 2010). This has been observed in Peko Misegese where people complained that water flow reduces during dry season as the same sources is used for irrigation and household chores and drinking. This also adversely impacts the quality of water and increases conflicts related to water availability and use. Peko Misegese was the only village of the chosen sites that showed signs of conflict related to water. There were no apparent signs of conflict regarding water in the other villages, including on the basis of marginalization or other social aspects (more in Section 3.)

The second issue is of low sustainability. Jiménez and Perέz-Foguet (2009) conducted a study on water point functionality-time relationships in three regions of Tanzania. Functionality was disaggregated by technology category and administrative structure, and showed that only 45.3 percent hand pumps, 48.6 percent of gravity-fed systems and 44.4 percent of motorized systems were functional. In all categories only between 57 to 72 percent water points continued working after five years (Jiménez et al., 2009). Examples of this are seen in Vitonga where the major issue for residents is the breakdown of the boreholes that supply water. Their study finds that hand pumps are the least sustainable over time.

> *"We charge for water because when you have such type of infrastructure, it needs maintenance. If something needs to be sustainable, it must be maintained well. That's the reason people need to contribute because when there is a breakdown you cannot go to the District Executive Department's (DED) office and ask for maintenance money. You have to do it yourself. They (DED) always have their own plans and they always have insufficient budgets. They need to serve so many places."*
>
> - VEO of Vitonga

Sustainability is therefore threatened by many factors such as limitations of community management of funds, difficult relationship between users and village representatives,

limited role of decentralized government regarding monitoring, regulation and technical support (Jiménez et al., 2010; Jiménez and Peréz-Foguet, 2008) and lack of funds due to inability of residents to pay and non-functional water committees that are in charge of collecting user fees (in Changarawe).

The third factor is the lack of pro-poor targeting. Since the model is demand-based, district councils allocate projects based on a combination of needs, demand from users (expressed in cash) and political influence. Evidence suggests allocations are targeted at wealthier, politically connected and better-served communities, therefore perpetuating existing inequalities (AMCOW, 2011; Jiménez et al., 2010). An example of this lack of pro-poor targeting is from Peko Misegese where the residents are pooling money to build infrastructure for taps for water supply. Each household has contributed money and given it to the village leader, but the VC says that the contribution is not enough. When the VEO was asked about the people's demand for taps, he said:

> *"It's too difficult because we talk in the meetings every 3 months and the agenda concerns water. The politicians and leaders come here and we speak to them, they give appointments, but they do no do what they said. Once you take appointments and go to them, they just promise you. The MP also comes here for the meeting and he gives appointments and asks us to wait for the budget. It is just politics."*
>
> - VEO of Peko Misegese

As Jiménez et al. (2010) have articulated villages and councilors are not aware of programs and only select villages are assisted by RWSSP to complete applications. Villagers too are unaware of processes and decision-making procedures.

5.2 Factors affecting water treatment at POU

For analyzing the first sub-question, the FGDs and in-depth interviews have been coded as per the conceptual framework (section 3.4.1). This provides insights into the different factors and their importance in affecting attitudes and behaviors towards HWT. The section is divided on the basis of the three villages with the findings on each dimension explained, followed by a discussion section.

5.2.1 Changarawe

Contextual Dimension

Community level: Many citizens have agreements with tap owners and pay them to access water, which is a coping mechanism on behalf of residents.

Household level: Fetching water is the responsibility of children/grandchildren (below 15) and mainly women. The responsibility of water treatment lies with the women, but the decision regarding method of water treatment is mutual among family members. This is true for all the villages (including Vitonga and Peko Misegese).

Habitual level: Many respondents said that they were only provided information when there was an outbreak of diseases within the community. One of the respondents suggested

> *"Health authorities should improve their contact with the society instead of showing up only after the eruption of diseases."*
>
> - HH04C

This can be a barrier to the formation of household water treatment habits since information is not provided on a regular basis. This sends a message to the community that water treatment needs to be taken seriously only when there is an outbreak of diseases.

Psychosocial Dimension

Community: Discussions regarding water treatment take place only during meetings

(every 3 months) or during an outbreak of diseases. There are no cultural norms or religious beliefs that have an impact on water purification.

Household level: Responses regarding vulnerability to illness is mixed. FGD respondents (NT) said that they have cases of illness in the family but cannot attribute it to water with certainty. Whereas, water, was considered to be a source of risk by those who treat it.

Individual level: Respondents say it is personal experiences that drive them to treat water.

> *"Until we don't get sick we don't realize that this is the effect of drinking untreated water."*
>
> *"There are some who get stomach problems with treated and some who get with untreated. So it depends on personal experiences."*
>
> *"It is a person's decision whether or not to take the information seriously. It depends on the willingness of the people. People interpret the information given differently and it depends on their perception whether to treat water or not."*
>
> - FGD respondents (NT)

For respondents (WT), perceived threat from drinking untreated water is high. One of the interviewees (HH04C) stated that they treat water for assurance since they do not know what might enter the water at the source. The VC shared that he treated water throughout the year so that he and his family won't suffer from water-borne diseases. The ability (knowledge and confidence) of respondents who treat water is high since they have been doing the procedure for a while now.

Habitual level: When enquired if all the family members drank treated water,

> *"Yes, because there is a permanent place where we keep drinking water. If a person enters they know where to go for drinking water.*

They can't go somewhere place."

"In the family, I have to teach my kids. If I ever travel and they don't know, they might not boil it. In my home everybody knows how to boil water."

- FGD respondents (WT)

Respondents (NT) articulated that people are lazy with the whole process of boiling hence they drink it without treatment. When it comes to **self-regulation** (i.e. action planning, control and barrier planning), respondents who treat water have a process in place and mechanisms to ensure that their families continue drinking treated water in their absence. One respondent (FDG WT) said

"For me in my HH when I travel my kids use WG to treat water, because kids will not let water boil to the boiling point. So when I travel I give them water guard to use when I come back we continue to use boiled water."

Technology dimension

Societal level: The government distributed WG pills once, but they did not last for too long. Once the pills were over, people began to drink untreated water again.

Individual level: Respondents (NT) said that the taste changes completely and they dislike it. They also perceive the cost of WG pills to be too high and would prefer to receive them for free. The interviewees (WT) also share the same opinion

"Everyone in the family is using boiled water now because they also did not like the taste of WG."

- FGD respondent (WT)

With respect to attitude towards water treatment, one of the respondents' shared

"I met people who said that they do not trust WG. There was an experiment where they soaked colored clothes with the WG pill. The

colored clothes had been bleached. If WG changes the color of our clothes, what will happen in our stomach?"

In general there was a negative stance towards the use of WG by all the respondents. Boiling water was the preferred method for all of them who did treat water, including the VC.

Habitually, boiling water seems to be the easiest for the respondents.

Barriers

The major barrier for many respondents (NT) was children drinking untreated water.

"I like to treat water but I see my children drink untreated water at school. So I don't see the point of treating water at home."

"I know but if I treat water at home my children will go to school or the neighbor's place and still drink untreated water."

- FGD respondents (NT)

Respondents (WT) also echoed this sentiment, although they do not consider it a reason to not treat water at home before consuming. For them the challenges to water treatment were concerning planning in advance and having enough charcoal to boil water required for the whole family.

The VC added:

"There are still some stereotypes that if you put WG in the water, it will affect your health. Others say that boiling water will change the taste."

Enablers

Respondents articulated that provision of water treatment tools for free would motivate residents to treat water at home.

> *"Sometimes we budget for water treatment tools, but if something else comes up that requires money, we will solve that first and not buy tools for water treatment. Low incomes contribute to people not paying attention to important things. If tools were given to people, it would have helped."*
>
> - FGD respondent (NT)

According to the VC the people need to be educated regarding the benefits of water treatment. He also recommended:

> *If we have a medical officer for ourselves he/she can supervise the citizens directly in their households. I am not allowed to go into a person's house and check but a MO has the authority to go and check whether people are treating water or not.*

He implied that he does not have the credibility to convince people to start treating water in their homes and can only speak to them during village meetings regarding the issue. Supervision by the MO will increase adoption of water treatment at POU. Another suggestion he provided was educating children at school. He believes children can be influenced and they can convince their parents to treat water at home. This recommendation is important since children drinking untreated water at school is a source of worry for many respondents.

5.2.2. Vitonga

Contextual dimension

Community level: Residents have access to markets at the nearest towns. Coping mechanisms in this case are:

> *"There are some people, even me, I do not use water from this place for drinking. When I drink it, it affects me and I get stomach problems. So I order from Mlali and we are so many of us who order from there."*
>
> - FDG respondent

Figure 5.3: Residents draw water from the BH

Habitual level: FGD respondents opined that if they had received WG continuously from the government, they would have continued treating water and would have gotten use to the taste over time. This would provide, according to them, a favorable environment for habit formation.

Psychosocial dimension

Community level: It is a norm to drink untreated water. There were no cultural or

religious norms that impacted water treatment behavior. Although there are discussions regarding the need for water treatment and the different methods, it does not have much influence on the people since they are used to the water and have been drinking it without treatment.

"Even if you ask the VEO for water he will give you untreated water."

Upon enquiring if there was any stigma attached to drinking untreated water, one of the FGD respondents said,

> *"May be when we get visitors from town, they ask if we have treated water. If we say no they go and buy bottled water from the shops. When they are going back to town they influence us that we should be boiling water."*

This response indicates that there is a need for interventions to change community norms to influence behavior.

Respondents from the in-depth interviews (WT) who obtain water from rainwater harvesting or vendors in nearby towns said that they try to convince others to treat water so that they can avoid health problems.

> *"Yes, I talk about it. Those who will listen to me will follow. When we meet during women meetings we talk about it. Because we meet very often."*
>
> - HH03V

Household level: Responses to perceptions of risk are mixed. Many respondents said that water is not a source of risk to them or their families since they have been using the water from the borehole for all purposes and have not witnessed any issues due to it. They cleaned the buckets before pouring water and use it without treating it since the borehole has filters that clean the water, according to them.

"We are already confident that if we drink untreated water nothing will happen to us."

- FDG respondent

Other respondents said that the water gave them and their family members stomach problems, so they stopped using it for drinking. Although they buy water, they do not treat it. They had an issue with the salinity of the water, not its safety, because when they buy water, they consider it to be safe and do not treat it before consumption. This is true for the FGD respondents but HH01 and HH03 buy/harvest water because they have personal experiences of sickness or are habituated to drinking treated water.

It was interesting to note that in some households (in-depth interviews) where water was being treated before consumption, only the member who had health issues was consuming treated water. The rest of the family continued drinking water from the boreholes.

"My stomach is different. If I try treated water, I get diarrhea."

- Husband of HHO1V

Even within the household, vulnerability differs and behavior related to water treatment is not uniform.

Individual level: Perceived threat is high for those who have had issues due to drinking untreated water. In the FGD the responses revealed that although knowledge was high, self-efficacy in performing water treatment was low. Respondents suggested medical officers must visit the households to check if the water was treated or not and then advise on what needs to be done.

For those who were treating water (in-depth interviews), their knowledge of water treatment and confidence in performance (coded as ability) was high.

"Because I was suffering from typhoid frequently. The doctor told me it was because I was drinking untreated water. Ever since I have been following the doctor's instructions my health has been good."

- HH01V

Structural level: Medical officers and doctors visited the village once a month and provided information regarding water treatment. Methods such as boiling and the use of WaterGuard (WG) are the promoted an all cases.

Self-regulation (RANAS) coded at the **habitual level** reveals that water treaters never forget to do so.

"If I move out of my house, I always carry my own water. Even when I'm far away, I boil water."

- HH01V

Technology dimension

Community level: WG can be accessed only in shops in Mlali, which makes distance a challenge to obtaining it.

At the **individual level** when the perceived cost, strengths and weaknesses of the methods were explored, majority of the FGD respondents preferred WG due to ease of use, while boiling is time-consuming.

"One pill of WG costs TSH 100 in Mlali in the pharmacies. It should be cheaper than that, at least one pill for TSH 50."

- FGD respondent

Attitude towards water treatment revealed that FGD respondents believe that treating water is time-consuming and expensive, which is closely allied to their low perception of risk to their families and perceived threat.

"They don't know the benefits. That's why I said we should focus on education to give them more information. They will understand."

- VC of Vitonga

In contrast, households that treat water responded differently. Investments in buying water/rainwater harvesting and treatment are considered important. Another respondent said water treatment is a must to avoid sickness.

Barriers

Overall some of the barriers mentioned by people to habitual water treatment were the distance and cost to access WG and time taken to boil water.

Enablers

Respondents said that easy availability of WG and provision by government would provide them with the impetus adopt water treatment. Some also said that increased education regarding water treatment must be provided to people.

"The government should provide more information in different methods, provide brochures explaining to citizens that treating water is a very important thing for the health."

- VC of Vitonga

The FGD respondents also add that rather than providing knowledge, there needs to be a greater effort to influence them to treat water.

"They (medical officers/doctors) come for the village meeting, provide education and then they leave. To influence us they are supposed to come to our households."

"Yes because if specialists come to your HH and tell you to boil water then you start boiling."

"Yes, when a person comes to direct you personally, it influences you to start doing it. If they tell you to put WG in drinking water then you put it and it becomes continuous."

- FGD respondents

The VC also articulated that messages from persons of importance, such as the District Commissioner, would have higher impact on people's behavior. These recommendations from the VC and the respondents depict that there needs to be a stronger focus on leadership and advocacy by sources that hold high positions within the government. There is also a need for intervention at the household level since respondents are of the opinion that visits to their family and constant follow-ups are required to increase adoption and sustenance of water treatment behavior, demonstrating low perceived self-efficacy and ability in terms of confidence of performance.

5.2.3. Peko Misegese

Contextual dimension

Household level: Husbands make decisions regarding expenditure for household activities.

Habitual level: The VC is of the opinion that the government is not well equipped to provide education and water treatment methods, therefore preventing habit formation among the people. Another reason is that information is provided during an outbreak of diseases, similar to responses received from Changarawe.

"Yes, when there is an outbreak of disease, health officers come to check the situation and advice us to treat water. They say if we can't put WG then at least to boil it."

- FGD respondent

Psychosocial dimension

Community level: Concerning **norms,** there are none that impact water treatment behavior and respondents say that most households do not treat water.

One respondent says

"Cleanliness is not about culture or customs it a personal decision"

- HH02PM

Household level: It is interesting because majority respondents believe that the water they drink can be a source of **risk** to their families, yet they do not treat water. One respondent articulated

"You can cook a certain kind of food for the family and want everyone to eat, but one kid may be allergic. So you won't let your kid go to sleep with an empty stomach and will cook something else. It's the same with treated water. If they don't like the taste, we don't do it."

- FGD respondent

Her argument is essentially about being a good mother (nurture), but by catering to her child's tastes instead of focusing on health vulnerabilities.

Individual level: Perceived threat from drinking untreated water seems to be low from the responses received. Those who treat water demonstrate confidence in their **ability** to perform the task.

Figure 5.4: Pot of water treated with WG at a respondent's home

Habitual level the respondents' belief that the water is dirty only during the rainy season is a barrier to forming a habit of water treatment.

> *"We only treat water during rainy season because the water isn't clean then. After rainy season we find the river water to be clean, so we don't continue*."
>
> - FGD respondent

For self-regulation, one respondent (HH01PM) said that she forgets to boil water but remembers to do it when she sees the empty pot. Another respondent (HH02PM) said that she sets aside money every month to buy WG pills. This is to be considered as action planning for water treatment, which is integral to sustenance.

Technology dimension

Household level: Government provides WG only when there is an outbreak of diseases. The VC added that the pills were not enough for all the households in the village.

Most of the FGD respondents prefer boiling to WG, at the **individual level.** They believe WG changes the taste and family members do not like it. There are some who prefer the stand and settle method too[5]. And some do not have time to boil water so would prefer WG. With regard to **attitudes** towards the behavior, those who treat water are positive and perceive water treatment costs to be lesser than when someone falls ill.

Barriers

Overall the barriers to water treatment are dislike for the taste of treated water, inability to afford the material required for water treatment (WG, firewood), lack of time to treat water and low perceived threat or vulnerability to issues arising from drinking untreated water.

[5] The microbial quality of water sometimes can be improved by holding or storing it undisturbed and without mixing long enough for larger particles to settle out or sediment by gravity. The settled water can then be carefully removed and recovered by decanting, ladling or other gentle methods that do not disturb the sedimented particles (Sobsey, 2002).

Enablers

There are two major points that respondents raise can enable them to treat water. One is the provision of education,

> *"Education should be provided through village meetings or village doctors. Or you can start by educating pupils at school. When they get educated they will start treating water at home."*
>
> - FGD respondent

The other point is regarding access to water. The residents believe that supply of water from taps will solve their problem of water treatment either because tap water is free from contamination or because they will save time of fetching water and can utilize it for boiling water.

> *"The difference is first that we waste time fetching water, but in town they have water in the house. The time that I was wasting collecting water will be used in boiling."*

> *"We have to wake up in the morning and go to the river to fetch water, but if we had taps we could have boiled water by that time."*
>
> - FGD respondents

5.2.4. Discussion

Studies conducted by Ojomo, Elliot, Goodyear, Forson and Bartram (2015) and Figueroa and Kincaid (2010) focus on the factors that play a role in behaviors connected to water treatment at POU. According to Figueroa et al. (2010) literature suggests that behavior change is difficult to instill, therefore understanding the audience well is important for designing interventions. And behavioral responses of populations are expected to vary depending on the level of disease burden, corresponding perception of risk, seasonal quantity and quality of water supply. Individual differences in knowledge and beliefs are important, including community norms and infrastructure availability for adoption of practices.

Majority of the detailed information received, from primary data collection, is focused on the psychosocial dimension, which is essential since behavior change is closely related to beliefs, values, norms, knowledge, self-efficacy and so on.

To summarize the findings, in Changarawe, lack of community norms regarding water treatment practices, mixed opinions associated with perceived threat that are greatly impacted by personal experiences, and misconceptions prove to be barriers in uptake of HWT.

In Vitonga, respondents perceive the quality of water to be safe for consumption. This opinion coupled with low vulnerability to diseases, difficulty in accessing water treatment methods and low perceived self-efficacy of performing water treatment at home reduces the scope of households to adopt and sustain HWT practices. Also those respondents who have faced issues due to the water have developed other strategies to access water.

In Peko Misegese, residents believe that the water is contaminated all through the year, but treat water only during the rainy season. Since information is only provided during outbreaks and perceived threat is low, adoption and sustenance of water treatment behavior is a challenge.

Personal risk perception, social norms as well as encouragement by the authorities and influential persons, and perceived self-efficacy have been found to be the most important factors affecting water treatment behaviors within the local context. (Lilje et al., 2015), corroborated by the case studies above.

Ojomo et al. (2015) conducted a study on the factors impacting sustainability of HWT practices through interviews with practitioners in over 25 countries. These factors were then grouped into different domains that include the factors identified most frequently. **User preference** is one of the domains' that focuses on demand for HWT practices and technology preference. In the study conducted in Tanzania, it is noted that the government/health officials promote only two methods: boiling and the use of WG. To begin with, these methods are promoted irrespective of the water quality (saline water

in Vitonga) and without understanding user preferences. Although boiling is certainly preferred over WG due to the change in taste of water, there needs to be an exploration of other methods that are effective, and can be easily adopted and incorporated into the routine effectively.

The second domain mentioned in the study is **integration and collaboration** (Ojomo et al. 2015). This stresses the importance of partnerships with community leaders and/or teachers and health workers to ensure diffusion of promotional messages. In the instance of the three villages, it was observed that the VCs are community leaders involved in spreading the message through the medium of village meetings, yet the results are mixed. There are recommendations from the VCs to have authorities from the government visit and influence people as they are considered to be more credible, which is also articulated by respondents in Vitonga. Involving prominent individuals in HWTS promotion at little or no cost has been shown to be effective (Figueroa et al. 2010). While residents of Peko Misegese believe the information provided by the doctors and medical officers is credible, they have low levels of perceived threat from water, therefore hampering adoption of water treatment practices.

This domain touches upon some of the recommendations that have been provided by the respondents. Partnerships, at the structural level, can be created to provide education through the involvement of NGOs and private entities, which can invest in HWT programs. These programs can also be extended at the school level (responses from Changarawe) and other institutions that can be important points of contact to spread the message. An example of a successful integrated approach is provided by the intervention in Malawi that targeted pregnant women (section 3).

Resource availability is another domain for Ojomo et al. (2015). One of the most frequently identified barriers, in their study, for the adoption and sustenance of HWTS behavior is cost. In this study too respondents have mentioned cost and access to material as a barrier. The solution for adoption and sustenance is user demand and affordability. According to Ojomo et al. (2015) different financing mechanisms can be applied such as free distribution, provision of subsidies, and provision of micro-finance loans. Although many respondents articulated that if WG was available for free, they would treat water, aspects such as low perceived threat, vulnerability and self-efficacy

are important. Focus on these needs to be coupled with policies that distribute treatment tools.

In addition to the distribution of tools, an equally important factor is user guidance. Irrespective of whether a particular technology is easy to use, many examples prove that incorrect use of technologies reduces the health benefits of adopting water treatment, which can in turn adversely impact user demand (Ojomo et al. 2010). Respondents from Vitonga recommend that they need someone to visit their households and demonstrate the use of technologies, which will improve self-efficacy.

The domains mentioned above touch upon aspects that are related to the contextual and technology dimensions of the IBM-WASH framework. The importance of psychosocial elements in BCC interventions cannot be underestimated. The study by Figeuroa et al. (2010) focuses specifically on social, cultural and behavioral correlates that are a part of the psychosocial dimension and are termed as intermediate outcomes in their study. Each level will be considered in detail to understand their importance for BCC.

At the **community level,** norms play a huge role in the adoption or hindrance to adoption of new behaviors. Placing a higher value on water quality is known to increase motivation to change behavior related to HWT (Figeuroa et al. 2010). In the case of Changarawe, Vitonga and Peko Misegese, emphasis was placed on access and reliability of water supply rather than quality. One way to shift their focus is through checking quality of water and sharing results with them. The knowledge that water can be contaminated at POU can provide an impetus to citizens to treat water at home.

Another aspect is community cohesion or integration that has a positive effect. This was gauged through questions regarding forums where HWT practices are discussed and whether individuals have influenced others in their community. In all the three communities, it seems that social integration is low. Most respondents were unaware as to which households treated water and refrained from theorizing the difference between the households that treat water and those who do not. Some respondents said that they spoke to others in the community and tried to convince them to treat water, but were unaware if the practice was adopted or did not follow-up. Increasing social

cohesion and changing community norms towards adoption and sustenance of water treatment at POU are elements that need greater attention in these cases.

Studies focusing at **household level** are scarce but some available literature provides insight into factors that impact HWT practices. One factor that needs to be taken into consideration is division of household chores (Figeuroa et al. 2010). In all the cases mentioned above women or children are the ones who fetch water, and women also work in the farms. Some respondents (especially in Peko Misegese) complain that they do not have the time to boil water due to all their responsibilities. A second consideration is support from household members. Although majority of the respondents said that they made the decision regarding water treatment, further probing revealed that they either stopped the practice or continue it due to acceptance from other family members (children and husbands) with regard to taste and costs. This provides insight that there is a need for interventions that include or target household members and focus on conveying the risks of drinking untreated water, changing misconceptions associated with water treatment methods and inducing feelings of pride for households adopting HWT. This will automatically impact the allocation of time and resources required, of which we have examples in Changarawe (from habitual treaters).

Individual level factors have been classified into cognitive elements (knowledge, beliefs, attitudes), emotional factors (attitude towards water treatment, taste and self efficacy) and social interaction (Figeuroa et al. 2010). The interviews and FGDs reveal that lack of knowledge is not the major issue, in contrast with some studies that have been conducted (McLennen, 2000). Resistance to adoption and sustenance of HWT can therefore be attributed to low perceived threat from drinking untreated water. This is best illustrated by the example in Vitonga wherein only the individual with health issues drinks treated water, whereas the other members do not feel the need to do so. Another example is the need to treat water only seasonally or during outbreaks of epidemics, as observed in Peko Misegese. To deal with this, messages regarding water treatment need to be provided all round the year through different means therefore communicating the importance of habitual treatment.

With regard to the emotional factors, the most common is the dislike for taste of

treated water and the chemical effects of treated water i.e. harmful to the body, causes diarrhea. These misconceptions and ideas of changing taste can prove to be strong barriers to overcome in communities. These need to be prioritized and tackled through provision of correct information and suggesting locally appropriate and acceptable methods of water treatment.

5.3 Comparative analysis of factors affecting HWT behavior depending on access

Since the three villages chosen for the study have different water supply mechanisms, it is interesting to see if that has any influence on people's attitude towards water treatment behavior. Below are the responses for cleanliness perception with regard to the water source.

5.3.1 Changarawe

Participants of the FGD (NT) believe that water may be contaminated during rains. One respondent argues:

> *"There are 2 tanks, one for filtration and one for storage. The one with stored water is treated. So there is no contamination from source to point-of-use. The taps receive clean water."*
>
> - FGD respondent (NT)

Respondents, who treat water before use, opine that the water is clean but not safe. This could be interpreted as there are no visible impurities in the water, but it is not free from contamination. Water becomes contaminated during collection and transportation according to a respondent.

The VC agrees that there is a need to treat water before drinking because there have been many cases of typhoid in the area. Overall, there are mixed opinions regarding the cleanliness of the water supplied.

5.3.2 Vitonga

FGD respondents said that the water they access is clean because they maintain cleanliness around the borehole. When the VC was asked his opinion, he responded,

> *"Yes, there is a need to treat water before drinking. Because the water we are using here is not very good. The place where the water comes from is not very safe, though we say the water comes from the ground but we advice people to boil so as to kill the underground germs so as they can not get problems."*

For residents of Vitonga tendency to treat water is low. Those who are not used to saline water have developed strategies to deal with it such as buying or harvesting water.

5.3.3 Peko Misegese

Majority of the respondents agree that the water they access from the rivers is not clean, more so during the rainy season.

> *Yes there is a need for water treatment. Because the water we fetch from the river is not safe and is contaminated by different things. If it is not treated then one can get diseases.*
>
> - VC of Peko Misegese

They believe that the solution to their problems is the installation of infrastructure such as taps to distribute water to the households.

> *"I am not satisfied with the supply, I wish we had taps because water will not be contaminated just like the way stream water is contaminated."*
>
> - HH02PM

"We should get tap water. If we get tap water then we won't even bother boiling."

- FGD respondents

5.3.4 Discussion

In this section a link between the access to water, cleanliness perception and other factors (section 5.2) is established, allowing for a comparison to be made.

Respondents in Peko use an open water source but demonstrate low risk perception. They treat water during the rainy season, when they believe there is a high risk, or in case of a disease outbreak. They are of the opinion that tap water is safe and free from contamination. Therefore they are demanding piped water from their duty bearers.

In Vitonga, the residents have saline water from the BH and it is a norm to drink untreated water. Most respondents have a low perception of risk because they believe the water to be safe for consumption and are used to it. Adoption of water treatment practices is dependent primarily on personal experiences of illness and these individuals also buy water. Investments are required to access other water sources and treatment methods, which can prove to be a deterrent for citizens in rural areas.

In contrast, residents of Changarawe receive tap water; yet have demonstrated a greater tendency to treat water before use.

"I believe the water is clean because they put WG, but it's not safe. It gets contaminated on the way."

- FGD respondent

They also differentiate between water received in towns and in their village. There is a belief that water provided to towns and cities are treated, but it is critical for them to treat water because of the associated risks. Existing literature corroborates that women living closer to larger cities were more likely to understand the concept of hygiene and contamination (Figeuroa et al. 2010), as in the case of Changarawe. Also, education of mothers is a factor in increased adoption of positive health behaviors (Figueroa et al.,

2010). Although all respondents had completed primary schooling, water treaters (FGD) in Changarawe had higher levels of education (secondary, diplomas and degrees).

From the case studies above it can be concluded that type of source influences perceptions of risk, norms of water treatment, which in turn influences attitudes towards water treatment, but there are other factors that need to be accounted for. Relevant factors that emerge are personal experiences due to untreated water, education, knowledge provision (source, frequency), and access to resources for HWT.

5.4 What role does marginalized status play in adoption of HWT practices?

The SDGs have a strong focus on 'inequalities' and the agenda makes a commitment to 'leaving no one behind.' There is an emphasis on disaggregating indicators on the basis of sex, age, race, ethnicity, disability etc. Existing data suggests that there are differences between countries, among regions within countries, rural and urban areas and wealth quintiles (JMP-UNICEF, 2017).

This study was conducted in the rural region of Tanzania, which has poorer access to drinking water services (section two). This sub-question endeavored to identify other marginalizing factors that exist within the populations and understand their role in influencing water treatment behavior.

Marginalization has been defined as a process, and a condition, that prevents individuals or groups from complete participation in social, economic or political life. People can be marginalized on the basis of sexual orientation, gender, geography, ethnicity, age, religion, disability, displacement and conflict (DFID, 2019). People's inability to benefit from water services can also be the result of marginalization (Gimelli, Bos & Rogers, 2018). Based on this definition of marginalization, certain parameters were selected to define the sample population to be interviewed in the villages. The following were the criteria; house structure, ethnic minorities, low levels of education of HH, livelihood (subsistence), distance from water source, women-

headed households, religion and disability. These households were selected with the assistance of the VC in each community.

The experience in the field was very different as Tanzanian society is harmonious and marginalization on the basis of many of the listed parameters was virtually absent. Different parameters were then identified depending on the context.

5.4.1 Changarawe

Three of the four households that were interviewed were women-headed. Two of the respondents were old women living alone (HH01C, HH02C). All three fetched water from their neighbors. Only one of them (HH02C) boiled water habitually. HH01C said that they could not afford WG, and would treat water if it were provided for free.

HH03C was an interesting case since the respondent was the hamlet chair and provided information to others about water treatment, but did not treat water herself. Only HH04C had their own tap and boiled water before drinking.

5.4.2 Vitonga

A secondary educated male farmer headed HH01V. The respondent either harvested rainwater or bought water for drinking. It was interesting that although she treated water, the rest of the family continued to drink untreated water as they were unaffected by it. HH02V was an old woman who lived alone and is therefore categorized as marginalized. She had difficulties in accessing water. She does not treat water due to the costs involved although she displayed willingness to treat if resources were available. Respondent of HH03V was a woman who lived alone in the village, while her husband worked in town. They were economically well off. She does not use water from the BH for drinking due to its salinity. She harvests rainwater or buys water for drinking and boils it before use. She was habituated to treating water when she lived in town and continued her practice here.

Figure 5.5: Rainwater harvesting tank (HH03V)

A woman headed HH04V. She lived far from the borehole and that was the parameter for marginalization in this context. She bought water (which she boiled) from vendors since saline water caused her health problems.

5.4.3 Peko Misegese

HH01PM was male-headed. The family had three children below the age of 15. She received information regarding treatment from the doctor when there was an outbreak of diseases and began boiling water to protect her family. HH02PM was male-headed too. The respondent had low cleanliness perception, and used WG which she found affordable. HH03PM was male-headed, consisting of 9 family members (with 6 below the age of 15) and economically weaker. The family treated water when there was an outbreak of disease but has stopped since. HH04PM was a woman-headed household with 9 family members. The respondent did not consider the water safe, but treated water only occasionally.

5.4.4. Discussion

In this section, inequality will be considered at three levels. First is inequality between the three villages, second is inequalities within residents of the same village and lastly, inequalities within households.

To begin with, the first level of inequality can be linked to the type of water source that people have access to. The study sites with different water sources provide a general

idea regarding the location, socio-economic characteristics and political networks of the residents (section 5.1.4). It is proven that poorer households generally access water from unimproved sources (UNICEF, 2011), as in the case of Peko Misegese.

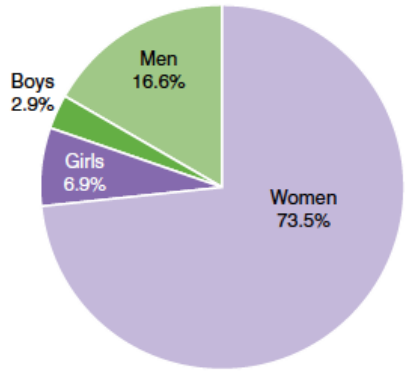
Focusing on inequalities within the residents of a village, there are certain indicators like household type (an indicator for socio-economic status), access to resources, methods of treatment and age that need consideration. In Changarawe, social inequality (rich versus poor), generational inequality (age cohorts) and perceptions of cleanliness are factors. HH01C does not treat water due to the costs and old age, while HH03C has low risk perception. HH02C treats water due to high-risk perception. HH04C has a tap, is economically better off and has high-risk perception.

In Vitonga, HH01V and HH04V have high-risk perception, but also have the economic means to buy or harvest rainwater and therefore invest in water treatment. The same is true for HH03V. The head of HH02V is marginalized due to her age, which hampers her access to water and adoption of water treatment is adversely affected by costs.

In Peko Misegese, HH01PM and HH02PM treat water due to high risk-perception. HH03PM and HH04PM are economically weaker and larger in size. Households with these characteristics do not to treat water due to the costs, which is corroborated by Figeuroa et al. (2010) in their review.

While considering inequalities within households, gender is a critical factor. All the respondents said that women and children were responsible for fetching water.

Figure 5.6: Person primarily responsible for water collection across 61 countries



*Source – UNICEF, 2017, pg. 30

This means that women spend considerable amount of time in fetching water and doing other household chores, contributing to marginalization by preventing participation in other activities. Lack of time was cited by HH04PM as a reason to not treat water, a factor that needs to be deliberated by water treatment promotion interventions (Figeuroa et al., 2010).

The small sample that was covered in the study reveals economic condition to be the main factor influencing adoption of water treatment. Age and gender of head do not seem to be important factors. According to a study by Daniel, Pande, Rietveld and Marks (2018) behavioral determinants such as high-risk perception from water and ability to pay for HWT are essential to motivate adoption. And the authors suggest focusing on these within interventions.

Section Six: Conclusion and recommendations

Section 6.1 Conclusions

Studies, in the WASH sector, highlight the need for formative research to fill knowledge gaps and design interventions tailored to fit local needs and demands. This study has endeavored to do that in the Mvomero district of rural Tanzania. The conceptual frameworks applied have been helpful for identifying crucial factors to design BCC interventions related to adoption and sustenance of HWT.

A focus on the supply side provides in-depth information on the realities of access to water for rural populations. It brings forth issues of reliability, quality and infrastructure that citizens grapple with on a daily basis. This conveys the existence of a wide gap between recognition of water as a human right, water policies on paper and gaps in actual service provision and on-ground implementation.

The use of the IBM-WASH and RANAS model for data collection and analysis has revealed interesting findings in all the three dimensions. It has highlighted the need to focus on psychosocial factors for inducing behavior change, but also that the importance of institutional structures (formal and informal), policies and technologies for water treatment cannot be discounted.

The analysis of factors on the basis of different sources of water reinforces that attitudes and behaviors do not exist in isolation. It is interesting that residents with access to tap water have low perceptions of cleanliness since literature demonstrates that even improved sources are prone to contamination. And those who use BH and surface water have higher cleanliness perception. The need to focus on all three dimensions is truly important to grasp this difference in perceptions which can be further explicated by education levels, perceptions of risk, attitudes towards treatment and descriptive norms.

With regard to the marginalized status of households shaping attitudes to HWT, the most pertinent factor is economic status. The process of selecting respondents raises the challenges of defining and identifying groups. Potentially disadvantaged subgroups

should therefore also be identified regarding access to technology, as well as other environmental factors, to tailor interventions aimed at reducing existing inequalities (Lilje et al., 2015).

Section 6.2 Recommendations

At the sector level the field of water, sanitation and hygiene lacks a theory-based approach to designing and evaluation of interventions (Figueroa et al., 2010). The first recommendation for designing interventions is to base it on the health theories mentioned in the literature review (section three). Theory-based planning proves to be advantageous for identifying and targeting the causal determinants of behavior change, investigating mediators to understand their effects and understand success or failure, allows for contextualized information and knowledge building, and lastly, the testing of theories (Michie et al., 2015).

Secondly, with the data collected, certain factors prove to be more crucial than others from the framework. This provides a direction for the designing of interventions, which need to focus on cleanliness perception, vulnerability to diseases, reinforced messaging from credible and important authorities and improving self-efficacy. It also underscores the need to understand user preference and attitudes regarding treatment methods, which allows for considering other alternatives that may be more appealing in the local context. The findings convey the importance of targeting the household rather than community-wide interventions since community cohesion was found to be low. Household members influence decision-making regarding HWT, displaying considerable bargaining power. If members with greater bargaining power (husbands and children) are included in interventions, it will allow for social norms and habits to be brought into the bargaining arena within the household (Agarwal, 1997), which could lead to increased chances of adoption of HWT practices. Once its benefits are experienced at the household level, these can catalyze change in community-wide norms.

Lastly, the need for emphasis on broader structures, along with local interventions, through partnerships and collaborations is recommended. Government policies geared towards providing a conducive environment can prove crucial for habit formation

regarding HWT. Advocacy for easy provision and accessibility to treatment methods along with information provision through schools and other institutions (health clinics) is vital. And complementing these is the need to advocate for provision of improved and safe water sources to all populations in Tanzania, therefore fulfilling the human right of access to water.

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Annex

Annex 1: Key Informant interview (Village Chair)

Name:
Age:
Village:
Position held:
No. of years worked in this position:

1. Water supply
    - How is water supplied to the people of this community?
    - Is the quality of water supplied regularly checked? If so, how often? By whom? Are the results shared with you or the committee?
    - If yes, what were the most recent results? Has there been a change in quality over time? Why?
    - Do people have to pay to access water? How much? Why? Can everyone in the community afford it? Why? What happens when they cannot?
    - Does everyone in the community have equal access (in terms of infrastructure) to the water source? Why do you think so? What types of households/persons do not have equal access, if any?
    - Are there any community dynamics (differences of ethnicity/education/landowners vs pastoralists, religion) that impact equal access to water source? What are they? How do they impact the community according to you?
    - In case of issues regarding water, whom does the community approach? Why?
    - What kinds of issues have arisen in the past? How were they resolved?

2. Household Water Treatment
    - Is there a need for household water treatment before use? Why?
    - Does the government have any policy/scheme for purification/treatment of water? What? Why?
    - Which methods are promoted? Why?
    - How does the government provide access to material for water treatment at household level? How is it distributed?

- Is information provided to people regarding household water purification by the government? Through what means? Why?
- What is the content of the messages provided? Why? Who is the target audience? Why?
- Is there data regarding the households that avail these services? How is it captured? Do you think the scheme is a success in this area? Why?
- What do you think are the barriers people in the community face in taking advantage of the government scheme? Why? How can this be resolved? (Access to markets, costs, culture, tradition, low perception of risk)
- What do you think about the scheme? Is there scope for changes? What would you recommend?
- Do you know if people in the community think they need to treat water at home? Why? How is this known? Are these specific households? If yes, which ones?
- Do you think cultural; normative or religious aspects impact the household treatment of water in this community? Why? In what way?
- How do you think households can continue to treat water habitually before use? What steps can the government take for that?

Is there are anything else you would like to add?

Annex 2: Key Informant interview (Village Executive Officer)

Name:
Age:
Village:
Position held:
No. of years worked in this position:

3. Questions on policy aspects
    - Are you aware of the sustainable development goals?
    - What is the government's policy regarding water supply? Does it align with the SDGs?
    - How is water supplied to the people of this community (drinking + for other purposes)? Who was involved in building the water supply system? Does it align with the government's policy on water supply? How?
    - How would you term the current water source in terms of the JMP ladder (JMP ladder[6] – surface water, unimproved, limited, basic, safely managed)?

[6] In order to meet the standard for safely managed drinking water, a household must use an improved source type that meets three criteria.[21] First, the facility should be accessible on premises (located within the dwelling,

- Has there been any change in the method of water supply? What kind? Why? When was it done?

4. Issues of access – Quality, reliability and cost (Beyond access to water)
    - What standards of water quality are adhered to? Why?
    - Is the quality of water supplied regularly checked? If so, how often? Is it checked at the source and/or at point of use?
    - What technology is used? What were the most recent results? Has there been a change in quality over time? Why?
    - Is there water free from fecal and/or chemical contamination at source? At point-of-use?
    - Is the supply of water consistent? Why? If not, how do you think it could be improved?
    - Do people have to pay to access water? How much? Why? Can everyone in the community afford it? Why? What happens when they cannot?
    - Do you think charging money for water is required? Why?
    - What is the money then used for?
    - Is water provision privatized? Who is in charge of supply? Who regulates the cost?
    - Does everyone in the community have equal access (in terms of infrastructure) to the water source? Why do you think so? What types of households/persons do not have equal access, if any?
    - Are there any community dynamics (differences of ethnicity/education/landowners vs pastoralists, religion) that impact equal access to water source? What are they? How do they impact the community according to you?
    - Which actors could help solve this issue of unequal access? Why?
    - How do you think the issue of unequal access can be solved? What recommendations would you give?

5. Redress mechanisms
    - Are there any provisions for grievance redress? Does the government mandate them? What are they?
    - Do you meet the community members/village committee? How often? What is discussed in these meetings?
    - What kind of issues does the community bring forth? Whom do they approach first in case of issues regarding water?

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yard or plot). Second, water should be available when needed (sufficient water in the last week or available for at least 12 hours per day). Third, water supplied should be free from contamination (compliant with standards for faecal and priority chemical contamination). As the three criteria are interrelated, the JMP calculates the population using safely managed drinking water services based on the minimum value for each domain (rural, urban, national)

- Are there other informal grievance mechanisms that have been used to solve community's issues with water supply? What were the issues? How were they resolved?

Annex 3: Focus Group Discussion (Non-treaters)

1. What is your source of drinking water? Is the water provided by the government? Are there any difficulties faced in accessing the source? What are they? (Contextual)

2. Is there unlimited access throughout the day? If it needs to be collected elsewhere, how many times a week is the activity done?

3. Who goes to collect/fill the drinking water in the household? (Their age and gender)

4. How much time does it take in total to complete the chore? (in a day)

5. How far is the source from your house? (in terms of time taken to access/or distance if known).

6. Do you need to pay for water? How much? Is it fairly priced according to you? Why? Does this have any implications for your family? Why?

7. Is the water you access clean? Why do you think so? (Contextual)

8. Do you believe that the water you access can be a source of risk to you and your family? Why? What type of risk? (Psychosocial) Do you have any past experiences that you can share?

9. Do you feel your family is vulnerable to problems related to water? Why? (RANAS)

10. Are there any cultural norms, beliefs about water purification? What are they? How do they impact people's perception regarding water treatment? (Psychosocial + RANAS)

11. Are there any traditional methods of water treatment within the community? What are they? Are they still in use? Why? (Contextual + RANAS)

12. Do you use methods to purify the water at home before using it? Why? Whose decision is it to not treat water? Why? (Technology RANAS)

13. If you are aware of the risks of drinking untreated water, why don't you treat water at home? (RANAS)

14. Are you aware of other methods to treat water? Which ones? Which ones? Who told you about these methods of water treatment? (Technology RANAS)

15. Which method would you want to use from the methods you know about? Why? Why don't you use it? What stops you? (Contextual + Technology + RANAS)

16. Is there any difference you/your family feels when drinking (un)treated water? Why? What does your family think about treatment of water? Why? (Psychosocial)

17. Have you ever tried any different method of water treatment before that you discontinued? Why? Whose decision was it? (Contextual + Psychosocial + Technology)

18. Do your neighbors/others in the village treat water at home? What methods are used commonly within the community? Why are these methods more popular than others? (Contextual + Psychosocial)

19. Are there people who drink only treated water? Who? Why do they treat it? (Contextual + Psychosocial)

20. Does anyone provide information regarding water treatment methods within the community? Who is it? Do you think they are credible sources of information? Why? (Psychosocial + Technology)

21. Do you discuss HWTS methods with others in the community? When? What do you discuss? (Psychosocial + Contextual)

22. Has anyone tried to influence you to treat water before drinking? Who? How? Why were you not convinced? (Psychosocial + Contextual)

23. What according to you would be the factors that influence you to start treating water at home? How would this message be most effective for you and your family? (RANAS + Technology + Psychosocial)

24. What would make it easier for you to treat water at home? What are the gaps that need to be filled? (Contextual + Psychosocial + Technology)

25. Are there any issues you face regarding access to water? What kinds of issues? Whom do you speak to about it first? Why? (Contextual)

26. In case of issues with access to water does the community deal with it together? Whom do you collectively approach? And why? What are some of the issues regarding water that the community has come together over? Any examples? (Social network)

27. Are you aware if the government has any policies regarding water treatment? What is it? Do they provide any technology for the same? What are they? Do you avail them? Why? (Contextual)

28. Why do other households in the community avail them according to you? (Technology)

29. Do you think the government (local) could do anything to improve the situation regarding quality of water/access/treatment? Why? What would your recommendations be? (Contextual + Technology)

Annex 4: Focus Group Discussion (Water treaters)

1. What is your source of drinking water? Is the water provided by the government? Are there any difficulties faced in accessing the source? What are they? (Contextual)

2. Is there unlimited access throughout the day? If it needs to be collected elsewhere, how many times a week is the activity done?

3. Who goes to collect/fill the drinking water in the household? (Their age and gender)

4. How much time does it take in total to complete the chore? (in a day)

5. How far is the source from your house? (in terms of time taken to access/or distance if known).

6. Do you need to pay for water? How much? Is it fairly priced according to you? Why? Does this have any implications for your family? Why?

7. Is the water you access clean? Why do you think so? (Contextual)

8. Do you believe that the water you access can be a source of risk to you and your family? Why? What type of risk? (Psychosocial) Do you have any past experiences that you can share?

9. Do you feel your family is vulnerable to problems related to water? Why? (RANAS)

10. Are there any cultural norms, beliefs about water purification? What are they? How do they impact people's perception regarding water treatment? (Psychosocial + RANAS)

11. Are there any traditional methods of water treatment within the community? What are they? Are they still in use? Why? (Contextual + RANAS)

12. Do you use methods to purify the water at home before using it? Why? Which ones? Who told you about these methods of water treatment? Whose decision is it to treat water? Why? (Technology RANAS)

13. Are you aware of other methods to treat water? Which ones? Why do you prefer the one you use to others? Whose decision is it to use this method? Why? (Technology RANAS)

14. Is there any difference you/your family feels when drinking (un)treated water? Why? What does your family think about treatment of water? Why? (Psychosocial)

15. Do you treat water daily? How do you make sure that you don't forget to treat it before use? (Contextual)

16. Do you think it is easy to use this method of water treatment? Why? How did you learn to do it? Have you taught anyone else in the family? Who? (RANAS)

17. From where do you access the material required for treating water? Are there any barriers faced in obtaining them? What are the barriers you face? (Contextual + Technology)

18. Have you ever tried any different method of water treatment before that you discontinued? Why? Whose decision was it? (Contextual + Psychosocial + Technology)

19. Do you ensure that you drink treated water everywhere you go? How? What are the risks of not doing so? (RANAS)

20. Do your neighbors/others in the village treat water at home? What methods are used commonly within the community? Why are these methods more popular than others? (Contextual + Psychosocial)

21. Are there people who do not drink treated water? Who? Why do they do not treat it? (Contextual + Psychosocial)

22. Does anyone provide information regarding water treatment methods within the community? Who is it? Do you think they are credible sources of information? Why? (Psychosocial + Technology)

23. Do you discuss HWTS methods with others in the community? When? What do you discuss? (Psychosocial + Contextual)

24. Do you try to inspire others to treat water before drinking? What are the methods you use? What else can be done according to you to ensure that others treat water before use? (Psychosocial + Contextual)

25. Are there any issues you face regarding access to water? What kinds of issues? Whom do you speak to about it first? Why? (Contextual)

26. In case of issues with access to water does the community deal with it together? Whom do you collectively approach? And why? What are some of the issues regarding water that the community has come together over? Any examples? (Social network)

27. Are you aware if the government has any policies regarding water treatment? What is it? Do they provide any technology for the same? What are they? Do you avail them? Why? (Contextual)

28. Why do other households in the community not avail them according to you? (Technology)

29. Do you think the government (local) could do anything to improve the situation regarding quality of water/access/treatment? Why? What would your recommendations be? (Contextual + Technology)

Annex 5: In-depth interviews

Household Profile:

Name:
Age:
Gender:
Household head Name:
Gender of head:

Age of head:
Education of head:
Employment of head:
Monthly income (Approximate):
Number of family members:
Number of children (Below 15): Boys: Girls:
Religious affiliation:
Ethnic community:
Type of house:

1. What is the division of labor in the household? (Different activities and who does them) (Household chores – in detail, livelihood activities – farming, cattle herding etc.)
2. Who takes decisions regarding expenditures for different activities within the household? Describe in detail (if different decisions taken by different members).

Access to water

3. Where do you access water for drinking? If within the household, is there unlimited access throughout the day? If it needs to be collected elsewhere, how many times a week is the activity done?
4. Where do you access water for other household chores? On what basis do you decide to use the same/different source of water for drinking and other chores?
5. Who goes to collect/fill the drinking water in the household? (Their age and gender)
6. How much time does it take in total to complete the chore? (in a day)
7. How far is the source from your house? (in terms of time taken to access/or distance if known). Do you think something else could have been done in the time taken to fill water? What?
8. Do you need to pay for water? How much? Is it fairly priced according to you? Why? Does this have any implications for your family? Why?
9. Does anyone/anything hamper your access to water? What? Why do you think so? (water mafia, infrastructural barriers, disability, physical barriers, affordability, quality etc.)
10. What do you think about the quality of water that you have access to? Why do you think so?
11. Have there been any issues within your family due to water? If yes, what kind? And why do you think so?
12. How do you feel about these issues? How do they impact your family?
13. Do you feel your family is vulnerable to problems related to water? Why?

Water treatment

14. Do you do anything to the water before you drink it? Why/why not?

Questions for households that treat water

15. Can you tell us the process (or processes) of water purification you currently use? Since when have you been using this/these methods? What prompted you to do so?
16. How did you learn about this method? Who told you? What did they tell you? And why do you trust them?
17. Did they tell you about other methods? What other water purification methods did they tell you about?
18. Are there any cultural norms or religious beliefs regarding water in your community? What are they? Do they influence your decision regarding water treatment? How?
19. Have any methods been practiced in your household from previous generations? What were the methods? Have they changed over time? If there are changes, what are they? Why?
20. Have you tried different methods of water purification? If yes, which do you prefer and why?
21. Does your family prefer this method to others? Whose decision is it regarding the methods to be used? Why?
22. Do you and your family like the taste of treated water? If not, why do you continue to treat it?
23. Are there any issues you face in doing it repeatedly? What are they? And how do you overcome them?
24. Do you at times forget to treat water before use? Who reminds you to do it? Or how do you remind yourself?
25. Do others in the family know the steps to treat water correctly? Who? And how do they know?
26. Do you check if water has been treated before drinking it? How? Why?
27. Do you drink water that has not been treated in other places (houses, workplace etc.)? How do you feel about that?
28. Where do you obtain the material from (chlorine tablets, solution)? Is it difficult to access the material in terms of time/distance/costs? Or any other barriers that need to be overcome?
29. Do you need to invest money for water purification? How do you feel about that?
30. How much does it cost? Do you keep money aside for the same in your monthly budget? Who provides this money? Whose decision is it to spend money on this?

Questions for households that do not do it

31. Were you using some methods earlier and have you stopped doing so now? If yes, which ones? And why did you stop? What are the issues you faced?
32. Did anyone provide you information regarding needs/methods for water purification? Who? Do you trust them? Why?
33. What are the reasons for not using any methods of water purification?
34. Are there any cultural norms or religious beliefs regarding water in your community? What are they? Do they influence your decision regarding water treatment? How?
35. Whose decision is it to not use any methods of water purification? Is there anyone in the family who thinks differently? Why?
36. Do you feel any type of social pressure to purify water before use? From whom? And how?

Community information

37. Do you know if others in the community treat the water before using it? Who? Do your neighbors do it? What are the common methods used? Why do you think they use them?
38. How are these households different from the ones who do not treat water? (Household profile – livelihood, education levels, family size, appreciation by others)
39. How do you feel when others in the community do not treat water?
40. Has water purification been discussed within the community? Who has held these discussions? Have you participated in these discussions?
41. Do you discuss water purification with members in the community? With whom? What are the occasions? And what are the discussions like?
42. Have you been able to convince other households to take up methods of water treatment? Which households? How did you do it? (For those who do it).
43. Why, according to you, do people do it/or not do it? Do culture, customs, beliefs play a role? (Cultural, normative answers)
44. How do you think households would take up water purification? What could enable them/you to take that decision?

Contextual information

42. How is the water supply in the community? Are you satisfied with it? (Explore issues if they are not satisfied)
43. If you have any issues in water supply, who is the first person you discuss it with? Why?

44. Who does the community approach in case of such issues with water supply? Why?
45. Does the government provide any means to purify water? Are you aware?
46. Do you avail this? If yes, why? If no, why not?
47. How do you think access to water purification methods could be improved so everyone could avail them?
48. Do you think the situation regarding provision of water needs to be improved for your community? How could that be done?
49. What recommendations do you have for the government? If any?
50. Is there anything else you would like to add or say?