

**DRINKING WATER SECURITY IN RURAL GHANA: THE IMPLICATIONS OF
COMMUNITY EXPERIENCES FOR POLICY**

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DEDICATION

To the rural poor who continue to suffer from water security challenges, and my wife and kids who have been enormously supportive.

ABSTRACT

Notwithstanding its rise in use, the term water security lacks a consensus of how it is conceptualized and applied in different contexts and disciplines. Drawing on a conceptual framework that involves a plethora of several dimensions, this study examines how water security is conceptualized and applied in rural Ghana. Using mixed methods, this study assesses households' water security experiences in three rural communities. The analysis of cross-sectional data provides a deeper understanding of the importance of these dimensions in defining rural water security. On this basis, the dissertation makes two interrelated arguments. The first is that rural dwellers suffer from biases that make them vulnerable to water insecurity. Second, despite the general effects of water insecurity on rural households, women, girls, and people with physical disabilities constitute the most marginalized population in the communities. The dissertation concludes with the need to adopt welfare approaches to enhance rural water security.

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LIST OF ABBREVIATIONS

AMCOW	African Ministers Council on Water
CBD	Convention on Biodiversity
CONIWAS	Coalition of NGOs in water supply and sanitation
CSPro	Census and Survey Processing System
CWSA	Community Water and Sanitation Agency
CWSD	Community Water and Sanitation Department
FGDs	Focus Group Discussions
GLSS	Ghana Living Standard Survey
GoG	Government of Ghana
GWL	Ghana Water Company
GWP	Global Water Partnership
GWSC	Ghana Water and Sewage Corporation
ICWE	International Conference on Water and the Environment
IHP	International Hydrological Program
IWRM	Integrated Water Resource Management
MDA	Ministries, Departments and Agencies
MDGs	Millennium Development Goals
MMDAs	Metropolitan, Municipal and District Assemblies
NCWSS	National Community Water and Sanitation Strategy [
NDPC	National Development Planning Commissions
NGOs	Non-governmental Organizations
OECD	Organization for Economic Corporation and Development
SGS	Sustainable Development Goals
SKDA	Sekyere Kumawu District Assembly
SKDHD	Sekyere Kumawu District Health Directorate
SPSS	Statistical Package for the Social Sciences
SWDA	Sunyani West District Assembly
SWDHD	Sunyani West District Health Directorate
SWP	Source Water Protection
UN	United Nations
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Program
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children Emergency Fund
UNW-DPAC	United Nations Water-Decade Program on Advocacy and Communication
WATSAN	Water and Sanitation Committee
WHO	World Health Organization
WSPs	Water Safety Plans
WSTs	Water and Sanitation Teams
WWAP	World Water Assessment Program

CHAPTER ONE

BACKGROUND OF THE STUDY

1.1 Introduction

This dissertation addresses rural households' water security experiences through the lens of a reconceptualized framework of rural water security. This framework consists of several elements that are useful for examining water security at the community level, namely availability, access, safety, management, preferences, and sustainability. Using prevailing concepts and frameworks from the literature, this reconceptualized framework captured the socio-cultural, economic, political, and environmental conditions of rural water security and was developed specifically for application in rural Ghana. To ensure the variables that constitute the framework are independent of the multiple definitions of water security and other natural resources, the framework was also based on the core elements of the human right to water and the baselines for the United Nations Sustainable Development Goals (SDG 6) (Howard et al., 2020; UN, 2003) which include availability, quality, safety, accessibility, affordability, and protection of ecosystems, among others.

Thus, this dissertation's analysis constitutes a reconceptualized framework that incorporates both the anthropocentric elements of rural water security and the sustainability of water resources and systems based on households' experiences and the policy implications of these water security experiences. Given that the term water security is at best an emerging concept (Aboelnga et al., 2020; Bakker, 2012; Cook and Bakker, 2012; Gerlak et al., 2018; Hoekstra et al., 2018), this dissertation is based on the premise that rural water-related issues can best be tackled by understanding the basis for which rural water security is conceptualized.

The importance of water for human survival cannot be overlooked. Water occupies a prominent place in the imagination and is one of the crucial components of life. Water flows centrally through human lives and hydrates our bodies and all the organic species essential for human survival. It also sustains the ecosystems which provide habitats for humans and enables our agricultural and technological developments (Strang, 2015). Water is considered a basic need – a necessity which should be made universally available for everyone and not as a privilege for only the rich and urbanites (World Health Organization [WHO], 2015). The Millennium Development Goals (MDGs), which came to an end in 2015, brought significant gains in access to basic water services for many people worldwide. Most people now report access to water from improved sources (Graham et al., 2016). Notwithstanding much progress, an estimated 844 million people worldwide still lack access to safe water (WHO, 2017). In particular, rural dwellers remain the highest among the underserved populations, which is highly evidenced in Sub-Saharan African countries (WHO/UNICEF, 2017). Clearly, there is still work to be done in this regard.

The bedrock of the Sustainable Development Goals (SDGs), which represents the post-MDGs, is to leave no one behind by ensuring universal access to safe drinking water by 2030 (WHO/UNICEF, 2017). Consequently, there is global attention to water security, including the need to understand the underlining circumstances which make people water insecure. One of the critical issues constitutes how to conceptualize drinking water security within a specific context. Though critical in policy decisions, framing water security at the community, municipal, and national levels remain vaguely done and is usually based on certain contextually (social, economic, political, and environmental) and disciplinary factors (Aboelnga et al., 2020; Cook and Bakker, 2012; Gerlak et al., 2018). With its emergence in the early 1990s due to the impact of water on human security, the way water security is conceptualized has evolved from its anthropocentric

focus to considerations on the sustainability of the ecosystems (Cook and Bakker, 2012; Goldhar, 2013; GWP, 2000). Despite its vague definitions, it is generally recognized that while water security contributes significantly to the quality of life and sustainable development goals, water insecurity is associated with significant health risks, even death (Howard and Bartram, 2003; Patrick, 2011). Given this, the dissertation takes a critical view of reconceptualizing water security in rural settings by reconciling households' experiences with the redefined dimensions of rural water security.

With a focus on rural Ghana, this dissertation is based on the fact that despite the recognition of access to safe drinking water as a human right by the United Nations, there are about 2.1 billion people who lack readily available drinking piped water services in their homes with 84% of them living in rural areas (WHO, 2017). Rural Ghanaians are among the world's most water insecure populations, despite recent policy initiatives (Sun et al., 2010, Awuah et al., 2008; United Nations Development Program [UNDP], 2015). Rural water security has been on the policy agenda of successive governments in Ghana. Government policy interventions have resulted in improvements in rural access to drinking water (Alagidede and Alagidede, 2016). This effort, however, has not been well translated into meaningful rural water security in Ghana as there still exists unresolved issues that impede access to potable water (UNDP, 2015), a situation that has been attributed to various factors, including non-functional water infrastructure (Fisher et al., 2015); poor source water protection and contaminated groundwater (UNDP, 2015); lack of community participation in the provision of water infrastructure (Sun et al., 2010); and limited local capacity to provide, maintain and manage safe and reliable drinking water services (Sun et al., 2010; UNDP, 2015).

Recent studies have highlighted rural Ghana's challenges, and many recommendations for enhancing rural water security have emerged (Adank et al., 2013; Braimah et al., 2016; McNicholl et al., 2017; Sun et al., 2010). However, there is little emphasis on using community experiences to inform the national policies that help shape water (in)security in rural Ghana. This dissertation seeks to fill the gaps regarding how rural water security is defined and how community experience could shape drinking water policy in Ghana using an environmental justice lens. Thus, the assessment of the community experience was based on a reconceptualized framework of rural water security.

Before delving into the community water security experiences, I open the discussion by examining the conceptual framework in the form of water security concepts, which serve as epistemological constructs underlining rural water security. Based on a review of existing literature, I reconceptualized rural water security within six defined dimensions, including availability, access, safety, community preferences, management, and sustainability. I argued that these six dimensions are independent of the multiple definitions of water security and other natural resources. Similarly, these dimensions are not affected by the influences of the environmental, socioeconomic, and political forces that do not contribute to drinking water management in rural Ghana.

To enhance the understanding of how rural water is managed in the study context, I have also provided a general overview of rural water management in Ghana. Through data analysis, I identified some of the key capacity challenges that affect effective rural water management. Arguing from the urban bias perspective, I posit that rural communities, compared to urban areas, lack the political power to influence rural water infrastructure and the concentration of agencies and policymakers of rural water management in urban areas. Following this, I argued through an

environmental justice lens on why access to water constitutes human rights and should be universally made available for everyone regardless of their geographical location, income status, sex composition, and physical conditions.

Recognizing that rural households are already marginalized due to their geographical locations, I take a more in-depth look at the experiences of vulnerable populations, including those with physical disabilities, women, and children, particularly girls. Using mixed methods that employed community surveys, in-depth interviews, focus group discussions, and observations, this study also assessed the experiences of rural households from the perspectives of water collection and use, water supply and management, and the challenges of water insecurity. Thus, I argue that the nature of water access and use in rural Ghana intersects with geographical location, gender, and physical conditions. This has also been propelled by the labor-intensiveness of rural water collection coupled with the gendered nature of water access and use. Considering that access to adequate water quantities has been identified as the most pressing problem to solve (White, 2018), I hope that the insights gained from this study will help provide in-depth understandings of community experiences in drinking water security in rural Ghana. Assessing community experiences in the past has been successful in responding to community challenges and advancing environmental justice (Leung et al., 2004; Petersen et al., 2006; Sun et al., 2010). Thus, this dissertation makes two significant contributions to knowledge. The first constitutes a reconceptualized framework that involves the elements of rural water security and incorporates the sustainability of water resources and systems and a consideration of cultural preferences. The second contribution involves the need to assess rather than assume the experiences of marginalized populations such as rural residents, indigenous groups, and people with disabilities in policy considerations on water security.

1.2 Research Question and Objectives

This dissertation aims to contribute to the development of a framework for rural water security towards policy development. The research answered the key question, how is rural water security re-conceptualized through community experiences? This question has been answered by reconciling the prevailing water security concepts with rural households' experiences associated with water access and use. It also explores the policy implications of these experiences and how they might shape or reshape policy. Pursuant to this goal, the dissertation addressed the following objectives:

1. Assess the decentralized rural water management framework in Ghana and the capacity gaps associated with it.
2. Re-define prevailing concepts of rural drinking water security using households' experiences from rural Ghana.
3. Determine how three marginalized populations (women, children, and the people with physical disabilities) experience water in/security in rural Ghana. Pursuant to this objective, the study met the following sub-objectives:
 - Identified the general factors which impede the attainment of rural water security.
 - Assessed women's and children's experience in drinking water security and the barriers faced by people with physical disabilities in accessing drinking water.
4. Identify policy directions, programs, and initiatives to promote drinking water security in rural Ghana.

1.3 Context

1.3.1 Global Overview of Drinking Water (In)security

Potable drinking water is fundamental to health, growth, and development and is, therefore, a basic human need. However, millions of people lack or have limited access to safe drinking water and depend on unimproved water sources for consumption and daily activities (WHO, 2017). This has raised concerns among world leaders aimed at finding lasting solutions to the global deficiencies on the number of people faced with water insecurity (Gorre-Dale, 1992; Pangare, 2006). The main concern of the 1992 International Conference on Water and the Environment (ICWE) in Dublin, Ireland, for instance, was that scarcity and misuse of freshwater pose a serious threat to sustainable development and the environment (Gorre-Dale, 1992). Therefore, the global water resource was identified as critical if social and environmental sustainability is to be achieved (Mehta et al., 2014). The conference concluded with the Dublin Statement¹, a document setting out four principles establishing new approaches to assess, develop, and manage freshwater resources (Gorre-Dale, 1992). These principles were accepted at the Rio de Janeiro Conference on Environment and Development in 1992, also known as the "Earth Summit." It was resolved that the translation of Dublin recommendations into urgent action programs will ensure water and sustainable development (Pangare, 2006).

The basic principles enunciated in the Dublin Statements were reinforced in the Beijing Declaration (1996), the Habitat-II Agenda (1996), the Paris Statement (1997), and in the

¹ The Dublin Statement consists of four main principles, including 1. Freshwater is a finite and vulnerable resource, essential to sustain life, development, and the environment; 2. Water development and management should be based on a participatory approach, involving users, planners, and policymakers at all levels; 3. Women play a central part in the provision, management, and safeguarding of water; and 4. Water has an economic value in all its competing uses and should be recognized as an economic good (Gorre-Dale, 1992).

Millennium Development Goals (MDGs) in 2000, all of which address the urgency of water and sanitation problems in the world. Owing to this global attention to water security, the United Nations Human Rights Council in 2010 declared access to water as a human right (WHO, 2015). Thus, human rights to water were derived from the right to an adequate standard of living, embedded in international human rights treaties (Mehta et al., 2014).

Despite recognizing the problem, drinking water insecurity is still pronounced in many countries (Bain et al., 2014; Gong et al., 2012). Aside from the billions of people without access to safe and readily available piped water services in their homes (WHO/UNICEF, 2017), there are about 844 million people who do not even have a basic drinking water service. It is also estimated that 263 million people spend more than 30 minutes per trip to collect water from sources outside their homes, and 159 million people still rely on unmonitored sources of water, such as streams or lakes (WHO/UNICEF, 2017). Coupled with this is the lack of reliable data on safely managed drinking water services in many countries, and as many as 96 countries fall within this category (WHO/UNICEF, 2017).

The UNICEF/WHO Joint Monitoring Program (2015) posits that Sub-Saharan African countries are the most vulnerable to drinking water insecurity, especially in West and Central Africa, where no country has universal access to safe drinking water. Out of about 159 million people collecting water from unmonitored sources, about 58% of them live in Sub-Saharan Africa (WHO/UNICEF, 2017). This situation is more pronounced in rural areas where rural dwellers are five times more likely to be water insecure than those in urban areas (Baur and Woodhouse, 2009; WHO/UNICEF, 2006). Rural Africans have the least access to improved water facilities compared to other developing areas of the world (UNESCO-WWAP, 2003). The rural-urban divide also exists in the provision of drinking water services where two out of three people with safely

managed drinking water live in urban areas. About 150 million people out of 161 million people using untreated surface water (from lakes, rivers, or irrigation channels) live in rural areas (WHO/UNICEF, 2017). Therefore, it is not surprising that access to water and sanitation by the rural poor has been identified as one of the most pressing problems to solve in the twenty-first century (White, 2018).

Drinking water insecurity is associated with a host of adverse health, social, and economic outcomes (Mercer and Hanrahan, 2019; Loucks and van Beek, 2017; WHO, 2017). Absent, inadequate, or poorly managed drinking water services expose individuals to preventable health risks. Contaminated water is associated with the spread of cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Of these diseases, diarrhea is widely recognized to be associated with unsafe drinking water (Clasen et al., 2010; Clasen et al., 2006; WHO, 2017). Diarrhea is among the main contributors to global child mortality, causing one in ten child deaths (Liu et al., 2002, WHO, 2017). About 842 000 people are estimated to die each year from diarrhea due to unsafe drinking water, sanitation, and hand hygiene (WHO, 2017). While contaminated water is commonly associated with diseases, drinking water insecurity in a broader context also has other adverse health effects, including mental health (Sarkar et al., 2015; Mercer and Hanrahan, 2019).

As people spend more time and energy accessing water, productive hours for other social and economic activities are lost. Huge expenditures are also required to be made on health due to negative health implications associated with water insecurity (WHO, 2017). This means that access to potable water has social and economic benefits as there will be less expenditure on health, less time spent on collecting water, and a reduction in risks associated with water collection.

The available evidence suggests that recognizing water as a human right is not enough since there are several unresolved issues (Bakker, 2007; Howard et al., 2020; Mehta et al., 2014; UNDP, 2015;

WHO, 2015) that make such global recognitions a mere statement of intent rather than something to enforce to enhance the water security experiences of the numerous marginalized populations. For instance, despite its stakes on global health, the World Health Organization does not directly recommend nationally enforceable water quality standards but instead recommends guidelines for drinking water quality (Gadgil, 1998). Even where such guidelines are followed, the difficulty may exist regarding measuring the indicators to ascertain an accurate picture of the situation within a context. For instance, the WHO classifies drinking water to be basic for everyone when water collection from an improved source takes an average of not more than 30 minutes for a round trip, including queuing time. However, this fails to make provision for the aged and people with physical disabilities in society who may be challenged to have physical access to improved water (Geere and Cortobius, 2017). Also, under the MDGs, the target of reducing by half the proportion of the world population without sustainable access to safe water was measured by the indicator of the number of people using improved drinking water sources. However, this failed to consider the location, availability, or quality of the water and water sources (Coles and Wallace, 2020; 2005; WHO, 2017). It also failed to incorporate a gendered perspective despite women's role in domestic water collection (Coles and Wallace, 2005).

There have been growing calls that argue that the human right to water should go beyond just making the right quantity of water available to people (Sultana and Loftus, 2013) – moving beyond water coverage to access (Coles and Wallace, 2020; 2005). To achieve this involves understanding the context within which water security is conceptualized. This calls for a tailored definition of water security, which captures the social, economic, cultural, and institutional variables within a particular context (Cook and Bakker, 2012). For this reason, this study defines

the dimensions within which drinking water security will be assessed. These dimensions serve as indicators towards measuring the drinking water security experience of households in rural Ghana.

1.3.2 Drinking Water Security within the Context of Ghana

As a member of the United Nations (UN), Ghana recognizes water as a human right and essential for public health (Government of Ghana, 2015). There has been a concerted effort by the Government of Ghana to enhance access to potable water. In recent decades, significant progress has been made; compared to the recent past, many more people now have access to safe and secure drinking water (Government of Ghana, 2015). Data from the UNDP (2015) show significant progress made between 1990 and 2013, signifying the fruitfulness of global attention to drinking water security. The proportion of the urban population with access to improved water sources increased from 57% in 1993 to 93% in 2008, while that of the rural population rose substantially from 54% in 1993 to 77% in 2008 (Figure 1.1). Ghana achieved an estimated water coverage of 78.6% in 2013 (UNDP, 2015, 54), achieving the MDG target before 2015.

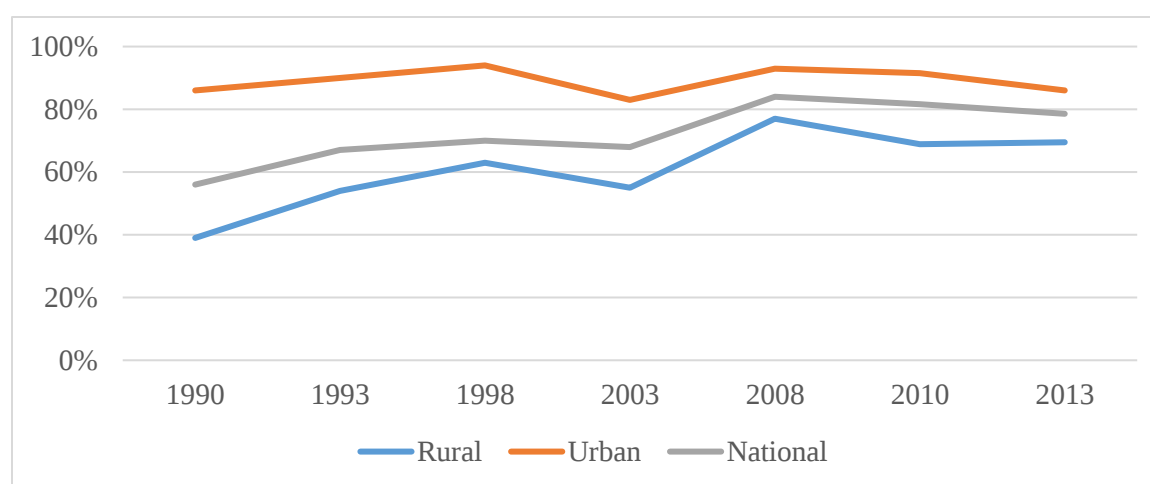


Figure 1.1: Drinking Water Coverage from 1990-2013

Source: Ghana Statistical Service (2013 cited in UNDP, 2015)

The changes and inconsistencies in the trend have been attributed to population growth (Mba and Kwankye, 2007) and the inability to match investments in the water subsector with population increase (Braimah et al., 2016). This is particularly so for regions experiencing higher growth rates, such as the Greater Accra region (NDPC/UNDP, 2010). In addition, a dip in 2003 resulted from a change in the political administration after Ghana transitioned into democracy in 1992. Some of the policy interventions carried out over the past years include rehabilitation of existing water infrastructure and completion of new water projects, including over 1000 borehole projects out of 20,000 in some selected rural communities (UNDP, 2015).

Despite considerable progress, rural water security remains a challenge, as over 30% of the rural population still lack access to improved water compared to 16% in urban areas. The number of people who are even considered to have access to improved water sources represents a mere coverage (Adank et al., 2013) and does not accurately picture rural access to safe and secure water in Ghana. Rural access to water goes beyond coverage since several factors impede the adequate and reliable supply of safe water² (Braimah et al., 2016; Sun et al., 2010; UNDP, 2015).

The World Health Organization classifies drinking water sources as either improved or unimproved (Table 1.1) (WHO, 2017). However, this categorization fails to address the contamination issues associated with bringing drinking water from the source to the usage point (Awuah et al., 2009; Ghana Statistical Service, 2014). It is estimated that more than a third of the populations in Sub-Saharan African still rely on bringing drinking water from the source to their homes (Geere and Cortobius, 2017), and this experience is predominantly higher in rural areas

² Coverage does not imply a reliable supply of safe water. A breakdown of water infrastructure for days will affect people's access to safe water even though such a location will be considered as having water coverage.

(WHO/UNICEF, 2015). Contamination of domestic drinking water during and after collection from the source has been recognized as a problem for households in Ghana, even where the water sources are uncontaminated and considered safe for domestic use (Awuah et al., 2009; Ghana Statistical Service, 2014).

Table 1.1: Classification of Water Source

Improved Water Sources	Unimproved Source
Borehole	Unprotected dug well
Public standpipe	Unprotected spring
Piped household water connection	Surface water (river, dam, lake, pond, stream, canal, irrigation channel)
Protected dug well	Vendor-provided water (cart with small tank/drum, tanker truck)
Protected spring	Bottled water (bottled water is considered improved only when the household use another improved source for cooking and personal hygiene)
Rainwater Harvest	Tanker truck water

Source: WHO/UNICEF (2017)

Water fetching poses a significant barrier to household water security, especially those in rural areas (Geere and Cortobius, 2017). The off-residence locations of potable water mean that households usually have to make several trips to ensure access in their various homes. Even though it is recommended that a trip to collect improved water should be 30 minutes or less (WHO/UNICEF, 2017), many people continue to travel long distances to access water. Even where the trip distance falls within the acceptable average time, it takes much energy to carry water from the source to the usage point (Geere and Cortobius, 2017). This has been considered a crucial issue that compromises households' health and safety (Geere, 2015; Sarkar et al., 2015; WHO/UNICEF, 2017). For instance, the aged, people living with long-term ill health, and the people with physical disabilities may be less able to access and carry water. Therefore, they are

particularly vulnerable to household water insecurity (Geere and Cortobius, 2017). Access to improved water alone does not guarantee water security.

Another critical factor affecting rural water security in Ghana involves water pollution at the source, especially by illegal and poorly regulated mining activities (UNDP, 2015). Coupled with this is the lack of source water protection (SWP) plan in most communities to ensure that drinking water sources are protected from contamination. According to Awuah et al. (2009), groundwater remains the most important water supply source to rural communities in Ghana, covering about 95% of this source. Although the groundwater deposits are not exposed to surface water threats, there are challenges of potential contaminations associated with groundwater, which affect the quality of drinking water from this source (Awuah et al., 2009). For instance, there are saline intrusions into shallow aquifers along the coastal zone, while high levels of metals and fluoride compounds in groundwater reserves in concentrations above the permissible limits are common in Western, Northern, and Upper East regions (Government of Ghana, 2007). Furthermore, contamination from point sources, including refuse dumps, latrines, and unprotected water points, including abandoned hand-dug wells, compromise water quality from groundwater sources. In addition to the groundwater contamination, there are frequent occurrences of "dry boreholes" in the Northern, Upper East, Upper West, and parts of Brong-Ahafo regions. This affects water availability in the affected communities despite the availability of drinking water infrastructure (Government of Ghana, 2007).

Limited capacity for the effective management of rural water systems has also been considered a major challenge affecting rural water security (Brimah et al., 2016; Sun et al., 2010; UNDP, 2015). Through neoliberal reforms, the water became commodified, particularly in urban areas where incomes are generally higher and more stable than those in rural areas. Monetary value

was assigned to water, just like other commodities on the principle of full cost recovery (Acheampong et al., 2016). Community-based water management was, however, introduced in rural water management. This places responsibilities on rural communities to be in charge of the operation and maintenance of drinking water facilities (Braimah et al., 2016). The community-based water management approach is associated with two major outcomes: reduced resources for community water supply and the transfer of expert responsibilities to amateur communities, often without training (Chowns, 2015; Mascarenhas, 2007). Even where training has been received, it is woefully inadequate to the extent that maintenance of water facilities remains either undone or poorly done (Chowns, 2015).

Similar to most decentralized institutions in other countries (Hanrahan, 2017; Hanrahan and Dosu, 2017; Kot et al., 2011), most metropolitan, municipal, and district assemblies (MMDAs) in Ghana are faced with budget constraints, low revenues, and shortfalls in operation and maintenance, which result in an insufficient expansion of the system and failure to satisfy rural water needs (Braimah et al., 2016; Chowns, 2015; Engel et al., 2005; UNDP, 2015). Additionally, many rural communities lack the technical and financial capacity to contribute to the supply and management of drinking water (Braimah et al., 2016). Limited rural financial capacity stems from the high capital cost of providing and maintaining water infrastructure and rural poverty, limiting the abilities of communities to contribute financially to support drinking water provision. The lack of rural capacity limits their involvement in the provision and maintenance of water facilities. Rural communities usually are excluded from decisions involving the planning, design, and implementation of water projects. The evidence also suggests that this problem extends beyond developing countries to even developed countries such as Canada (Kot et al., 2011; Hanrahan and Dosu, 2017; Rawlyk et al., 2013).

Since access to water is deeply connected to virtually all aspects of sustainable development, particularly those involving the environment, education, gender equality, and the reduction of child mortality and poverty (WHO/UNICEF, 2015), rural water insecurity in Ghana poses a major challenge relative to achieving sustainable development. Inadequate drinking water results in more sicknesses and deaths in rural Ghana and increases health expenditures, lower worker productivity, and school enrollment (WHO, 2017). It is argued that rural communities are more likely to experience an outbreak of waterborne illness in their drinking water supplies than urban areas (Hunter et al., 2009).

An additional matter of concern is that due to the social context in Ghana, and most Sub-Saharan African countries³, strict gender roles mean that the women and girls in rural Ghana are the most affected amid water insecurity (Geere and Cortobius, 2017; Zhang and Xu, 2016). According to the WHO and UNICEF (2017), about three-quarters of households in Sub-Saharan Africa bring water from a source located away from their home, with women and girls bearing the primary responsibility for collecting water in 73.5% of the households. There is the likelihood that this may increase as more water is needed for domestic activities (Sorenson et al., 2011). The picture is not different from the rural setting in Ghana, where such responsibilities fall on the female members of a household. Women and girls' sole involvement in household water collection affects their participation in productive activities such as employment activities and education and have negative impacts on their physical and mental health (Hanrahan and Mercer, 2019; Harris et al., 2017; Koolwal and Van de Walle, 2013; Stevenson et al., 2012; Zhang and Xu, 2016).

³ In most African and Ghanaian societies, the female members of households are generally responsible for domestic activities that mostly involve the use of water. These include cooking, washing, and laundry activities. Rural areas, unlike the urban counterpart, have females mostly involved in domestic activities.

Target 6.1 of the global Sustainable Development Goals (SDG) calls for universal and equitable access to safe and affordable drinking water for all by 2030 (UNICEF and WHO, 2017). The need to achieve this target in poorly served communities calls for scaling up water availability to meet domestic needs, improve water quality, and bring about change in water use and water management systems (Hunter et al., 2010). To achieve this, there is a growing emphasis on incorporating development values into water policy, a re-emphasis on meeting basic human needs, including access to potable water, and a conscious breaking of the economic barriers to water use (Gerten, 2008; Matthews et al., 2011). This emphasis will undoubtedly contribute to universal access to safe and affordable water as targeted by the United Nations through the 2015 Global Goals. The gaps in water security cannot be closed without focusing on water security policies for every population.

The human right to water imposes a major responsibility on each country to work towards the progressive realization of universal access to water (as the SDG seeks to achieve). To achieve this does not only constitute paying attention to the underlining policies behind water security but also what is meant to be water secure. For this to happen successfully, community capacity must be assessed rather than assumed (Bradshaw, 2003), which has been the case with water policy development and implementation in many countries. Assessing household's water security experiences allows policymakers to identify and delineate problems that affect rural water security.

1.4 Dissertation Structure and Outline

This dissertation comprises eight chapters. Chapter One has provided a general introduction to the thesis, has highlighted some of the gaps in rural drinking water security literature, thus establishing the need for the study, and has outlined the research objectives. It also provided a global overview

of drinking water security by narrowing it down to the Sub-Saharan African sub-region and then to the scope of the study – Ghana. Chapter Two focuses on the conceptual framework of the study. This framework constitutes conceptual dimensions of how water security was defined and applied in rural Ghana within the context of this dissertation.

Chapter Three outlines the research design and methodology employed for the study. It provides a detailed explanation for the type of research design and the philosophical stance of the study. The chapter also explains the need to adopt mixed research methods and how they have been employed for data collection, analysis, and reporting. Moreover, the chapter justifies the selection of the study communities, including a brief profile of these communities. Owing to the socio-cultural, economic, and other factors that sometimes differentiate between the researcher and the researched, the chapter further identifies how positionality and power relations were handled during the data collection.

Chapters Four, Five, Six, and Seven provide the results and discussions of field data. These chapters combine evidence from the conceptual frameworks and field data. Chapter Four seeks to provide a background of rural water management in Ghana. It assesses the rural capacity challenges for decentralized water management from the perspectives of households, community water managers, and government agencies tasked with rural water management responsibilities. Having assessed the capacity gaps in the decentralized water management in Ghana, Chapter Five assesses the predictability of rural water security based on household experiences. The assessment of these experiences was based on conceptualized dimensions of rural water security, namely access, availability, safety, management, preferences, and sustainability. Chapters Six and Seven narrow the analysis to marginalized populations' experiences, including women, girls, and people with physical disabilities.

Chapter Eight concludes the dissertation. It summarizes the key insights and findings, identifies the research's empirical and conceptual contributions, and assesses the dissertation's strengths and limitations as a whole. It closes by outlining future research directions, including further investigations into the six re-defined rural water security dimensions.

CHAPTER TWO

CONCEPTUAL FRAMEWORK

2.1 Introduction

The conceptual framework is the soul of every research project. It provides direction on how the research problem is formulated, investigated, and meanings attached to the data accruing from such investigation (Imenda, 2014). Given this, the chapter provides the framework that conceptualizes rural water security and other concepts within which the study has been situated. To enhance the understanding of a contextualized concept of rural water security, I begin the chapter by defining what constitutes rurality in Ghana to define the geographical scope of this study. Furthermore, I explain why rural Ghana remains water insecure compared to urban areas by drawing on perspectives offered by urban bias theorists. I further argue that women, children, the aged, and people with disabilities are considered the most vulnerable in rural water insecurity. Situating the argument within the intersectionality context, I assert that the vulnerability of these marginalized populations intersects with their geographical locations, gender, and social class.

In the next section, I provide the challenges of defining water security, the contextual meanings, and the scope in which the concept is framed in this study. Thus, the chapter discusses the six conceptualized dimensions of water security and the contextual meanings, explanations, and applications of these dimensions in the study. I argue that though water security is vaguely defined, which calls for the need to establish context-specific issues that define rural water security in Ghana.

Since water management serves as a major bottleneck to achieving rural drinking water security in most rural communities in Sub-Saharan Africa, this chapter also provides comprehensive information on Ghana's rural water management approaches. These include the

legislative and regulative frameworks, as well as the service delivery models at the community levels. Finally, I provide the theoretical framework that underpins the need to consider marginalized populations' experiences in policy decisions regarding drinking water supply and management.

2.2 What constitutes Rurality?

Defining what constitutes rurality is widely ambiguous, although rural areas are much recognized. Although many policymakers and researchers would prefer one standardized, all-purpose definition, "rural" is a multifaceted concept with no universal agreement (Hart et al., 2005). For instance, in the United Kingdom, there are more than 30 definitions by different government departments of what constitutes a rural area (Scott et al., 2007). Despite the lack of evidence to support the existence of rural areas or lack of standard measurement of what constitutes rurality, rural research has been widely recognized across disciplines (Miller and Luloff, 1981). In this study, the purpose is not to define what constitutes rurality but to define the geographical local that has been generally accepted as rural, especially within the context of Ghana. For a particular location, community, or context to be considered rural and differentiated from urban areas, there are key features that exist in addition to the contextual and political classifications.

The term "rural" is conventionally employed to represent a delimited geographical area characterized by a lower population that is unconcentrated and relatively isolated from metropolitan centers (Miller and Luloff, 1981). The term also suggests pastoral landscapes, unique demographic structures and settlement patterns, isolation, low population density, extractive economic activities, and distinct socio-cultural milieus (Hart et al., 2005). Ritchey (2006) re-echoed this definition by including low population densities, limited resource bases, relative

isolation but added cultural or ethnic homogeneity, local-based independence, a connection to nature, and shared values or collective responsibility as aspects of rurality. Beyond the core features, rural areas can also exhibit features such as places where most people spend most of their working time on farms; where land and land resources are cheaper and in abundance; a place which is associated with long-distance and poor infrastructures (Abdulwakeel, 2017) and a place based on homeliness shared by people with common ancestry or heritage (Chigbu, 2013). However, population size or density is the most widely used criterion in many countries (Bogdanov et al., 2008).

In Ghana, what defines rurality is still contested despite the dominant use of the low population as a major indicator between rural and urban areas. For instance, places with a population of less than 5000 are considered rural in Ghana (Ghana Statistical Service, 2012). However, Woods 2002 criticized the use of the population as a major indicator for determining rurality. As the author noted, the use of the population neither provides the functionality of the location, nor a clear distinction between rural and urban areas. For instance, if an area with a population of 5000 is urban, then it means that a population of 4999 is rural (Buaben, 2016). Pizzoli and Gong (2007), therefore, recommend the use of variables such as agriculture and economic specialization, human resources and skills, land cover, and spatial dimension of social life in combination with or as an alternative to population size.

For this dissertation, rural Ghana is defined by considering three variables - population size, economic activity, and socio-cultural characteristics. For the purpose of rural water management in Ghana, this study considers the key features of a rural community and the Community Water and Sanitation Agency (CWSA) 's population threshold of less than 2,000 inhabitants. Therefore, a rural community is defined as an area with a low population size (less

than 2,000) dominated by primary economic activities, mostly farming and fishing, and has poor infrastructure such as schools, clinics, potable water, and access roads.

2.2.1 Why Rural Ghana remains Water Insecure – The Urban Bias Theory (UBT)

Rural-urban inequality predates the urban bias theory – something economies were aware of in the 1950s (Myrdal, 1958). The Urban Bias Theory (UBT) came as one of the concepts that support reducing social inequalities to maximize distributive justice. Primarily proposed by Michael Lipton (1977) and associated with Robert Bates' (1981) works, the UBT has contributed to understanding the uneven development levels in rural areas, particularly in the developing world. The urban bias theorists argue that the development policies of many third-world countries disproportionately favor urban areas at the expense of rural dwellers. Basing the argument on two propositions, Lipton (1997) posits that the development process in most developing countries is systematically biased against the countryside, and this is hugely influenced by the dominance of urban groups in the political structures of those countries. In other words, the third-world's rural areas are mostly politically powerless, which affects their involvement in policies and decisions that can positively benefit them (Ades and Glaeser, 1995). In the polemical but influential words of Lipton,

"the most important class conflict in the poor countries of the world today is not between labor and capital. Nor is it between foreign and national interests. It is between the rural classes and the urban classes. The rural sector contains most of the poverty, and most of the low-cost sources of potential advance; but the urban sector contains most of the articulateness, organization, and power. So, the urban classes have been able to 'win' most of the rounds of the struggle with the countryside; but in so doing they have made the development process needlessly slow and unfair" (Lipton, 1977, 13).

Bates (1981) advanced Lipton's argument on the realities of urban bias and its proportionate disadvantages in rural areas in developing countries. Bates' arguments center on three fronts; the first involves setting higher prices by state institutions for resource extraction that tend to hurt

those in the countryside. Second, there is a selective distribution of resources and projects. These divisive tactics constitute those who benefit from state actions (supporters) and opponents who suffer deprivations as a way of punishment. Third, it is difficult to establish rural collective action due to the challenges of communication that result from the physical locations and dispersed nature of rural areas. This poses cost barriers to forming pressure groups and can affect group effectiveness even if it exists (Binswanger and Deininger, 1997). Besides, each rural peasant has a smaller share of agriculture products, making each farmer's contribution insignificant (Varshney, 1993). Making cases for post-World War II agricultural policies in Sub-Sahara Africa, Bates (1981) concludes that those policies were heavily biased against rural development. This was because the rural producers of exportable cash crops were usually forced to sell their products at low prices to national marketing boards. After generating substantial profits on international markets, these crops' revenues were usually used to provide public goods, control inflation, and provide industrialization projects in urban areas.

Theorists of urban bias, therefore, posit that there is evidence of rural poverty in most developing countries that results from governments' distinctly anti-rural development policies. The theorists argue that such policies include the transfer of economic resources from the countryside to urban centers, economic regulations that inhibit investment, political repression, and the concentration of infrastructural development and economic opportunities in urban areas (Ades and Glaeser, 1995; Bezemer and Heady, 2008; Chambers, 2014, 1983; Collier and Collier, 2004; Paine, 1978). Consequently, there is evidence of mass rural-urban migration, mainly the movement of young and the economically active population into the major cities in search of employment and other opportunities in most third-world countries. This has been exacerbated by the concentration

of rural development policymakers, including those responsible for finding lasting solutions to rural poverty, in urban areas (Chambers, 1983).

Similar to other developmental theories, the urban bias theory has suffered criticisms (Byres, 1987; Muscat, 1990; Corbridge, 1982; Varshney, 1993). Varshney (1993), for instance, launched four criticisms against the theory. First, he argues that the theory neglects political institutions and systems and tends to be society-centered. He opines that political systems in most countries exist with different approaches, some that focus on the interests of rural areas. The governments of South Korea and Taiwan, for instance, implemented land reforms that favor agricultural production for rural farmers from the 1950s onwards (McGuire, 2001). Besides, theorists of urban bias failed to explore state organs' roles in anti-rural development policies but instead relied on the power of interest/pressure groups.

Second, UBT fails to account for the contribution of technical changes to the development of rural agriculture in the future. The emergence of agro-industries has resulted in the availability of seeds, fertilizers, and agricultural machinery that enhance large-scale production. This enhances agricultural commercialization making it easier for farmers to organize themselves for collective action. Third, rural development can be hampered by a lack of cohesion resulting from ethnic or religious differences (Corbridge, 1982). This may obstruct the economic progress of rural areas more than the power of the city. However, the urban bias theory is strictly focused on economic issues with limited emphasis on rural class differences. Finally, there are difficulties in detecting rural-urban boundaries. Using cases of Cote D'Ivoire and China to explain this criticism, Varshney (1993) argues that i) the rural-urban linkages such as peri-urban areas make it difficult to detect under-development in some rural areas, ii) there is still an ongoing debate about whether rural-

urban migration affects the fortunes of rural areas which make an argument on migration inconclusive.

Despite these criticisms, Bezemer and Heady (2008) argue that urban bias continues to persist and remains a major barrier to sustained growth and poverty reduction in most developing countries. In answering the question of whether there is empirical evidence on the influence of contemporary political economy factors on continued urban biased policy outcomes in the least developed countries, one of the authors' measurements is the percentage difference between urban and rural populations with regards to access to safe water. Presenting their findings to demonstrate the dimensions of urban bias, the authors conclude that the theory is still valid today and constitutes the largest institutional impediment to growth and poverty reduction in rural areas in most third-world countries.

As in Ghana's case, for instance, over 30% of the rural population lack access to improved water compared to 16% in urban areas (UNDP, 2015). The number of people who are even considered to have access to improved water sources represents a mere coverage (Adank et al., 2013; CWSA, 2016) and does not depict an accurate picture of rural access to safe and secure water in Ghana. Besides, it is estimated that more than a third of Ghana's rural populations rely on bringing drinking water from the source to their homes. This means that water haulage can result in contamination of drinking water even when the water sources are uncontaminated and considered safe for domestic use (Awuah et al., 2009). In addition, rural dwellers are likely to have their water sources polluted by poorly regulated mining or other industrial activities (carried out by urban dwellers) compared to urban areas (UNDP, 2015). Despite these challenges, most agencies (both government and non-government) charged with rural water supply and management in Ghana are concentrated in urban areas. This has been exacerbated by a lack of

political voice (except during elections) to lobby for rural water infrastructure. Even though this study does not seek to prove the urban bias theory, the study focuses on how the biases against the provision and management of rural water affect households by assessing their water security experiences.

2.2.2 The Intersectionality of Women, Girls, and People with Disabilities within the Marginalized Rural Water Users

This section's argument is based on how geographical locations, gender, ability, and social class intersect with sections of already marginalized rural water users in Ghana. Described as an analytic tool to solving problems related to equity, the term intersectionality, with its varied definitions, has been widely accepted by human right activities and policymakers beyond the scopes of North America and Europe to the Global South (Collins and Bilge, 2020; Overstreet et al., 2020). As Ferguson (1998) argues, while some feminist scholars insist that intersectionality refers to subjects that are fundamentally related to race, gender, sexuality, and class, most intersectional scholarship has centered on the positions and experience of multiply marginalized subjects. Accordingly, Overstreet et al. (2020) recommend intersectionality as the core of social issues that seek to move toward social justice, equity, and liberation.

Thus, in this dissertation, I argue that intersectionality provides the best approach to understanding the multilayered forms of marginalization and injustice. Therefore, intersectionality explains how water insecurity concerns, rooted in socio-cultural, political, environmental, and economic conditions, are pitted against women, girls, and people with disabilities. Borrowing from Collins and Bilge's (2020) words, I define intersectionality as a way of understanding and

explaining the complexity of intersecting power relations in the world, among people, and their experiences.

While agreeing that intersectionality is broad (McCall, 2005) and beyond this dissertation's focus, I argue that the intersection of gender, age, ability, and social class serves as exacerbating factors for women, girls, and people with physical disabilities in water security in rural Ghana. My focus is based on how these factors worsen the water security experience of these groups rather than on the definition or representation of such groups per se. Thus, in this dissertation, gender is binary involving women and men, while class and ability involve the socio-economic characteristics and physical conditions, respectively. Ultimately, the use of intersectionality is to yield a deeper understanding of how the intersecting factors of geographical location (rurality), class, gender, and ability are interwoven with everyday water security experiences and life trajectories of women, girls, and PWDs to reinforce their marginalization.

In Ribeiroa and Khamisa's (2016) words, marginalization of these groups frequently constitutes exclusion from or underserved by mainstream society. According to the United Nations, factors, including social status, geographical locations, sex, among others, can serve as barriers to participating in the social, economic, political, and cultural spheres of society and thus reaping these benefits (UN, 2016). Thus, by their geographical locations and social status, I assert that rural Ghanaians are marginalized and usually cut off from mainstream society. Like the rest of the world, rural dwellers' enjoyment of socio-economic and political benefits is often close to nonexistent than the people in urban areas. This has created societies that commonly face disproportionately high levels of inequalities, which, in turn, limits the abilities of marginalized populations to achieve equal opportunities (Ribeiroa and Khamisa, 2016).

This dissertation emphasizes a range of factors that serve as an impediment for women, girls, and PWDs within the marginalized group in meeting their drinking water requirements towards achieving the SDG targets by 2030. According to the United Nations, marginalized groups include persons with disabilities, youth, women, lesbian, gay, bisexual, transgender, and intersex people, members of minority groups, indigenous people, internally displaced persons, and non-national, including refugees, asylum seekers, and migrant workers (Celaya, 2014). Of these groups, people with disabilities, women, girls, and the elderly are recognized to be marginalized on drinking water security issues (Howard et al., 2020) in rural Ghana.

For instance, women and girls are more deprived across most countries, particularly in Sub-Saharan Africa (Mazrui, 1993), including Ghana. According to the Atlas of Gender and Development, Ghana, among other Sub-Saharan African countries, is highly rated on discrimination and inequalities against women (OECD, 2010). A key measure of this gender inequality is embedded in power differences to influence decision-making within households and the community at large, weaker access to productive resources, and discriminatory social norms (Farnworth and Colverson, 2015; Mikell, 1997; Mukherje et al., 2017).

Like most Sub-Saharan African countries, gender differentiation in Ghana involves differences in biological makeup and society's impacts on gendered identity (Mikell, 1997). These social processes and interactions define binary roles for both males and females (Mikell, 1997). Thus, gender constitutes a social construction that is used to describe those characteristics of women and men. Although many different social constructionist perspectives exist on gender, there is a common idea among all social constructionists that becoming female or male is a social process that is learned through culture within the family and more generally through social interactions (Connell, 2002; Wharton, 2005). These differentiations with attached roles assign

females the bulk of domestic activities, including water collection, use, and management. As Van Houweling (2016) puts it, for instance, water is inextricably linked to women's roles, making it imperative to have women and girls at the forefront of policy discussions involving water security.

Thus, gender disparities in domestic chores tend to affect African women more than men in many parts of Sub-Saharan Africa and other parts of the world (Mikell, 1997). The United Nations Development Program (UNDP) Human Development Report (2015) shows that women dedicate about 75% of their time to unpaid household work in developing countries. This reduces the allowable time available for women and girls to engage in other productive activities (Mukherje et al., 2017). Besides, other researchers report risks of domestic violence meted out to women and girls for their inability to perform their domestic roles, including water collection, use, and management. Despite their significant involvement in domestic water security, women and girls' plights have been exacerbated by limited power and voice to make or contribute to community water management decisions in Ghana (Harris et al., 2017).

Considering that household water collection, use, and management in rural Ghana is mostly associated with women and girls, assessing these socially disadvantaged groups' experiences is important for developing culturally informed evidence-based reproductive water management interventions; hence, the focus on these marginalized groups in this dissertation. Even though Ghana's gender-based framework has a broader context in policy discussions, this dissertation's work does not delve into those details. The focus is to bring to bear evidence-based household experiences in water collection, use, and management that have large women's and girls' involvement compared to men and boys. This is not to say that rural water insecurity does not affect men and boys but rather highlights the marginalization of those at a disadvantage on water security issues based on socially and culturally constructed norms.

Thus, my argument is based on the intersection of poor people (women, girls, and PWDs) living in remote locations with limited opportunities and infrastructure such as water facilities. These could even be worsened with the aged and women with disabilities. While it is necessary to focus on meeting the SDGs' objective on drinking water by 2030, such focus should go beyond meeting just the SDGs' targets. Attention must be given to those who have been *extremely marginalized* in drinking water as part of meeting human rights conditions. Even though rural areas are already marginalized on the basis of water security, it is important to make efforts to ensure fair distributions of the little water services available for the general rural population devoid of exclusion by one's physical condition(s).

2.3 Conceptualizing Water Security

2.3.1 Water as Human Security

The United Nations considers water vital to human security (United Nations Trust Fund for Human Security, undated). With water at the center of security, water issues must be placed within the existing human security (Bigas, 2013). This thinking gave attention to the use of the concept of "water security" in the 1990s. There is a shift in the limited focus of security on military and conflicts to a broader dimension involving a wide range of security threats. Security has now come to mean human security and its achievement through development (Wouters and Leb, 2013).

The level of human security depends on achieving an individual's sense of well-being, including socio-economic, cultural, and environmental needs. Scarcity and individuals' quest for such needs pose threats to peaceful co-existence and, therefore, the achievement of human security. The achievement of human security depends on meeting the conditions of several individual securities. These include a good level of health and well-being, adequate and safe food,

a secure and healthy environment, means to a secure livelihood, and protection and fulfillment of fundamental rights and liberties, among others.

Water is needed to meet these required conditions of security (Bigas, 2013). Water holds interconnected dimensions that fit within this broader definition of human security, ranging from access to the water supply at the individual or community level to the peaceful sharing and management of transboundary water sources. It embraces political, health, economic, environmental, and other concerns and acts as a central link between them (Bigas, 2013; van Beek and Arriens, 2014). Water and its benefits serve as major components of individuals' well-being, which makes its availability to the needs of individuals an aspect of development and, therefore, human security.

Water security is linked to the threats of water sustainability and future water scarcity (Falkenmark, 2001). According to the UN-Water (2013), the total usable freshwater supply for ecosystems and humans is less than 1% of all freshwater resources. In addition to the limited supply of freshwater, there are issues of shifting demographics, such as population growth, increasing urbanization and migration, and changing consumption patterns and their potential of increasing demand for water resources. Again, there are other factors such as a changing hydrological cycle due to human influences such as deforestation, land-use changes, and the effects of climate; increasing demands and competition for water resources across sectors, such as food, energy, industry, and the environment and pollution of water resources (Bigas, 2013, 6). With these developments, there has been a growing use of water at a rate of more than twice the population increase in the last century. Water withdrawals are also predicted to increase by 50% by 2025 in developing countries and 18% in developed countries (UN-Water, 2013). Within the same period, it is expected that about 800 million people will be living in places with absolute

water scarcity, and two-thirds of the world population could be under stress conditions (UN-Water, 2013).

To reduce the risks, threats, and vulnerabilities associated with human securities, addressing the challenges of water has been considered an important issue to consider in dealing with human security – hence the use of water security together with other threats of human security such as food security, energy security, and military security. Water security is now prioritized as a global risk since it now serves as the thin line that links together the web of food, energy, climate, economic growth, and human security challenges that the world economy faces over the next decades (World Economic Forum Water Initiative, 2012).

2.3.2 Framing Water Security in Rural Ghana

The term water security, which has been recognized as part of human security, often lacks a clear definition (Aboelnga et al., 2020; Grey and Sadoff, 2007). Some of the questions asked include: What is water security? What does it mean in practice? What are its dimensions? How do we operationalize these dimensions? And how do we measure targets? The answers to these questions remain crucial to making informed policy decisions about national, regional, and international water management, yet there have not been concrete answers regarding these questions and more of such related questions (van Beek and Arriens, 2014; Thomas, 2015). There have been strong arguments aimed at situating water security within the Food and Agricultural Organization's (FAO) definition of food security⁴ (Goldhar et al., 2013). However, unlike food security, water

⁴ The Rome Declaration on World Food Security and World Food Summit Plan of Action (Rome, 13-17 November 1996) defines food security in the following way, "food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."

security goes beyond just the mere presence of water. Grey and Sadoff (2007) argue that the presence of water can also create water insecurity.

Water security exists in multiple dimensions in academic and policy discourses since the inception of the Global Water Partnership's definition in 2000. According to the GWP (2000, 12),

"water security, at any level from the household to the global, means that every person has access to enough safe water at an affordable cost to lead a clean, healthy, and productive life while ensuring that the natural environment is protected and enhanced."

GWP in 2014 reinforced this definition by including two factors, which involve mitigating water-related risks such as floods, droughts, and pollution, and addressing the conflicts that may arise from disputes over shared waters (van Beek and Arriens, 2014). GWP's definition underscores the need for water not just for human life but to protect the quality of the environment. This was a move away from the anthropocentric approaches to water security that characterized the UNDP's dimensions in the 1990s (Lankford et al., 2013). The addition of environmental sustainability has helped articulate the inseparability of societal welfare and ecosystems and the need to pay attention to each of these variables in policy decisions (Hassan et al., 2005). To further move away from the anthropocentric definition of water security, the UN-Water (2013, 1) defines water security as,

"the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability."

Just like that of GWP's in 2014, this definition adds something beyond the mere absence of the right quantity of potable water. The definition includes the risks associated with water presence, which can be a security threat to people. These include flooding and other water-related disasters.

To add to the definitions above, Cook and Bakker (2012) note that different meanings and interpretations exist for water security by scholars and policymakers. These interpretations have

been characterized by biases based on fragmentations, sectoral, and discipline specifics (Falkenmark, 2001). Defining water security is now based on one's perspectives and different contexts, scales, and disciplines. In addition, framers of water security have focused on broader water security dimensions, which complements integrated water resource management (IWRM) (Bigas, 2013; Cook and Bakker, 2012). Given this, a broader framing of water security with similar features of IWRM will result in evidence of some or all the challenges of IWRM at the implementation level (Cook and Bakker, 2012). Water security is different from the IWRM and, therefore, needs not to complement the IWRM.

Although the broad definition of water security is applicable at all scales, it is reasonable to focus on specific issues and contexts within which water security is described (van Beek and Arriens, 2014). This means that the definition of water security should be narrowed down to the focus and specific interests within which such definition seeks to achieve. The narrowed definition can provide the basis for the objective of the issues in context and a possible move away from integrative approaches central to the IWRM (Cook and Bakker, 2012). Context-specific definitions focus on specific issues of concern, making it easier for operationalization (Cook and Bakker, 2012). For example, in instances where water resources are shared between or among countries, considering water security at the national level helps to clarify transboundary issues. In the same way, applying the concept at the community level puts more emphasis on individual water users and their social and environmental contexts (van Beek and Arriens, 2014).

Since the concept of water security has been rarely used in drinking water research in rural Ghana, this study focuses on identifying a more tailored definition. It does not seek to narrow the concept of water security but to identify dimensions of the concept that are connected and can serve as indicators for measuring households' drinking water security in rural Ghana. It seeks to

identify dimensions of water security, which is not just about having enough water but also addresses the "too little," "too much," and "too dirty" issues of water management while considering the sustainability of water resources and water infrastructure.

It can be inferred from most definitions of water security that the concept operates at all levels, from individual, household, and community, to local, sub-national, national, regional, and international settings. These definitions also take into account the variability of water availability, access, affordability, quantity, quality, human needs, and environmental considerations (Bigas, 2013; Grey and Sadof, 2007; GWP, 2000; Rijsberman, 2006; UN-Water, 2013). This is particularly so in definitions involving water security at the community, household, and individual levels. These variables of water security are also in line with the United Nations' indicators for assessing the human rights to water, which include the following dimensions: availability, quality, safety, accessibility, affordability, and protection of ecosystems, among others (Bigas, 2013; United Nations General Assembly Human Rights Council, 2010).

However, some of these dimensions of water security overlap, implying that the achievement of one or two can result in the achievement of other(s). For example, access to water is measured by the proportion of the population with access to the right quantitative of safe drinking water within a convenient distance to the users' dwellings (WHO/UNICEF, 2017). However, to access drinking water, individuals must be able to afford it. This makes affordability a part of access to water. Again, water availability can be subdivided into "quantity" and "supply," making "quantity" as part of availability. Water may be available in the required quantity but may not be sufficiently supplied to meet household or community requirements. For instance, Canada has abundant freshwater resources compared to many countries, but some communities are still struggling to have access to water that is sufficiently required for daily needs (Hanrahan and Dosu,

2017; Sarkar et al., 2015). Based on these overlaps, I have summarized four dimensions that characterize water security at the community levels, including access, availability, quality, and environmental sustainability.

Although management is central to IWRM, it is conspicuously missing from the literature definitions of water security (Cook and Bakker, 2012) at the community and household levels. Van Beek and Arriens (2014), in support of the omission of management from the dimensions of what defines water security, argue that governance can best be seen as a means to an end and not as an end in itself. According to the authors, since water security is defined as a goal, conditions and processes should not be included in outcome statements. However, the current crisis associated with water has been associated with management failures (GWP, 2000). Good water management exists where government bodies responsible for water establish an effective policy and legal framework to allocate and manage water in ways responsive to national social and economic needs and the long-term sustainability of the resource base (Cook and Bakker, 2012; GWP, 2000).

Therefore, good management is necessary to achieve water security at the community level (Cook and Bakker, 2012). For example, accessibility, availability, and water quality will not have a bearing on the individual's water security experience if they lack the means to manage the water resources and infrastructure, signifying the importance of management in water security analysis (Lankford et al., 2013). The addition of management not only focuses on the presence of policies and institutions in enhancing people's access to safe water but also building the capacities of the beneficiaries to ensure effective contributions to the provision and management of drinking water (Lankford et al., 2013). This brings management to issues to the fore in addition to the four key dimensions already identified.

Another important consideration missing from the concept of community water security includes community perception and acceptability (Goldhar et al., 2013). The current paradigm of developments requires making provisions for the communities' preferences where such developments will take place. Such considerations will help identify religious and cultural beliefs that can affect the impact and usage of water facilities (United Nations General Assembly Human Rights Council, 2010). Therefore, community preferences that include perceptions, acceptability, and desirability remain an important dimension to consider in assessing community drinking water security (Goldhar et al., 2013). Given this, Goldhar et al. (2013) stress the need to include preferences (desirability, perception) in the dimensions of drinking water security in addition to the components of access (affordability and allocation); availability of water (supply and distribution); and quality of water (safety).

Based on this analysis, water security for this study involves six main themes, namely access, availability, quality (GWP, 2000; Rijsberman, 2006; Witter and Whiteford, 1999), preference (Goldhar et al., 2013; United Nations General Assembly Human Rights Council, 2010), sustainability (GWP, 2000; UN-Water, 2013), and management (Cook and Bakker, 2012; GWP, 2000). Since water security has many disciplinary, sectoral, ideological, and geographical roots, a more tailored definition must be adopted without losing sight of the bigger picture (Lankford et al., 2013). To meet the objective of this research, these six dimensions provide a framework for analyzing the water security experience of residents in rural Ghana. This restricted definition makes water security independent of multiple definitions of water security and other natural resources, environmental, socio-economic, and political forces that do not contribute to drinking water management in rural Ghana.



Figure 2.1: Dimensions of Rural Water Security

Source: Author's construct (2018)

Although all the dimensions contribute to the achievement of rural water security, management is considered the most substantial challenge that runs through all the other dimensions (de Boer et al., 2013). Thus, water management is regarded as a major factor to consider in achieving rural water security (Rogers and Hall, 2003) and can provide the vehicle within which each of these five other variables operates.

2.3.3 Instruments for Drinking Water Security

Several instruments tend to promote water security at the global, regional, and national levels in various countries. In addition, several multilateral environment agreements (MEAs) that may not have water management as their focus promote water security nevertheless (Leb and Wouter, 2013). This section identifies some of the instruments that contribute to the promotion of water security, especially in developing countries where water insecurity has been a major challenge.

At the international level, several instruments focus on water security. International water laws set the rules that apply to international watercourses management (Wouters and Leb, 2013). According to the UN (2014, 3), a watercourse is defined as a system of surface waters and groundwaters constituted by their physical relationship with a unitary whole and normally flow into a common terminus. The principles of international instruments on water security are codified in the 1997 UN Convention on the Law of the Non-navigational Uses of International Watercourses, which came into force in August 2014. The scope of this Convention covers the uses of watercourses other than navigation. It aims to strike a balance between equitable use of the watercourses (including ground and surface waters) by riparian states. It also focuses on meeting growing human needs and protecting riverine ecosystems (Chiussi, 2017). This Convention addresses some of the core elements of water security, including water availability and access.

The Convention sets the rules for equitable and reasonable water use, which provides the cornerstone for promoting water availability and access by the various states without compromising water use by the future generation (Wouters et al., 2009). These rules put obligations on water users not to cause significant harm against instances that can potentially undermine water security for other users, especially in the transboundary system. States are obliged against significant pollution or over-abstraction of shared waters to protect shared states' water

security (Wouters and Leb, 2013). Even though this Convention is regarded as an important step towards establishing international law for water governance, many countries are not signatories to it.

There is also the international human rights law that promotes individual water security (Wouters and Leb, 2013). Human rights law requires states to guarantee their individuals' fundamental rights within their jurisdictions (Wouters and Leb, 2013). The definition of any human right presents a daunting task (Salman and McInerney-Lankford, 2004). However, the difficulty of defining a human right to water is compounded by the fact that water is both a vital and a minimum need, and indispensable for leading a life in human dignity (UNESCO, 1998). The human right to water is a prerequisite for realizing other human rights; therefore, denying people water is to deny them the right to life (Salman and McInerney-Lankford, 2004).

Although the United Nations Committee on Economic, Social, and Cultural Rights adopted human rights to water in 2010, its debates can be traced to the 1997 UN Mar del Plata conference in Argentina (Salman and McInerney-Lankford, 2004). The conference's second resolution declared that all people, irrespective of the stages of development, and economic and social conditions, should have the right to adequate quantity and quality of water according to their basic needs. Owing to this, the 1992 Dublin International Conference on Water and Environment reinforced Human rights to water. Even though the fourth of the four principles of the conference treats water as something with economic value, the principle further stipulates that it is vital for all human beings to have access to clean water at affordable prices (Gorre-Dale, 1992). However, what constitutes affordability is still debated in the literature (Salman and McInerney-Lankford, 2004).

The 1999 UN Resolution on the Right to Development constitutes the final resolution that gave birth to the human rights to water by the UN General Assembly in 2010. In this, the United Nations declared the rights to development as universal and, therefore, ensuring its promotion, protection, and realization constitute an integral component of promoting and realizing all human rights. This bestows moral imperative on the national governments and international communities to promote human rights to water (Salman and McInerney-Lankford, 2004).

In addition to these international instruments, which have direct relationships with water resources, there are other instruments related to multilateral environmental agreements (MEAs). These MEAs do not have their primary focus on water but go a long way to enhance water resource availability and quality. For example, both the 1971 Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, and the 1992 Convention on Biodiversity (CBD) do not directly focus on water but contribute towards ensuring the quality of water resources. The Convention on Wetlands of International Importance, Especially as Waterfowl Habitat, for instance, promotes the conservation of ecosystems, which play important roles in the protection of both ground and surface water. Convention on Biodiversity (CBD) also focuses on protecting biodiversity, which requires interventions on achieving water quality towards the protection of biodiversity (Wouters and Leb, 2013).

2.4 Water Governance and Management

Management of water resources and water services has become a contentious and divisive issue throughout the world. With the world's populations likely to increase by four times its current figure by 2050 (Coopers, 2017; Kirk and Ian, 2004), water management has become an issue to contend with to meet the increasing demand for the required quantity and quality of water.

Governance goes beyond the narrow perspective of government to include the overall social system of governing (Rogers and Hall, 2003). Governance recognizes the capacity to get things done, which does not rest on the government's power to command or use its authority (Stoker, 1998). Governance involves an increased consideration of nongovernment actors in the decision-making process and the extension of the stakeholder range along with the institutional and jurisdictional levels (de Boer et al., 2013). The governance process includes a combination of economic, political, and administrative authorities to manage affairs, resources, and systems at all levels (Rogers and Hall, 2003).

Governance has been extended to the management of environmental resources, hence, the creation of the integrated water resource management (IWRM) with the focus on the equitable management of water, land, and related sources to maximize benefits without compromising sustainability (GWP, 2000). Thus, water governance is defined as "the range of political, social, economic, and administrative systems that are in place to develop and manage water resources, and the delivery of water services at different levels of society" (Rogers and Hall, 2003, 16). Water governance brings onboard allocative and regulatory politics and how they are exercised in water management. It thus embraces both the formal and informal institutions by which authority is exercised to manage water resources (Rogers and Hall, 2003). This establishes a relationship between water governance and management, which is defined as the processes that enhance water resources development and utilization, including water-related services (de Boer, 2013). Water governance includes policies and institutional frameworks to support policy formulations and implementations, including resource mobilization to ensure water resources management (Rogers and Hall, 2003). Thus, water governance sets the rules of operation for water management (Rogers and Hall, 2003; UNESCO-WWAP, 2003).

Governance has been a major bottleneck to achieving drinking water security in most developing and even some developed countries (de Boer et al., 2013). According to UNESCO (2006), water governance constitutes the main challenge to the current water crisis and not water supply or technology. The Organization for Economic Cooperation and Development (OECD) (2015) posits that future water challenges do not only involve finding answers to "what needs to be done?" but also "who does what?" and "at what level should it be done?" and "what are the means of doing it?" To overcome water challenges involves integrating all the good governance variables that set the ball rolling for effective water management (OECD, 2015). This is necessary to create an enabling environment that facilitates efficient public sector initiatives and stakeholder involvement in articulating needs in drinking water management (Rogers and Hall, 2003).

Some of the necessary conditions for effective water management include participation, accountability, capacity, responsiveness, and predictability (OECD, 2015; Rogers and Hall, 2003). Of these conditions, participation is widely recognized in rural drinking water management (UNCED, 1992). The participation in water management can be traced to the 1990 Dublin Conference that brought about what is widely known as the Dublin Principles. One of the principles posits that water development and management should be based on a participatory approach, involving users, planners, and policymakers at all levels. Both the Rio and Johannesburg Declarations also encourage public participation at all decision-making levels to enhance successful policy formulations and implementations (UN, 2002; UNCED, 1992). The Aarhus Convention grants citizens and beneficiaries of environmental decisions the right to be actively involved in environmental decisions. These include having adequate information about such decisions and being able to participate in any kind right from the onset of the decision up to the implementation levels (UNECE, 1998). Given this, community-based water management has been

accepted as the means of delivering rural water supply and management in most countries in Sub-Saharan Africa, including Ghana – the scope of this study.

2.4.1 Privatization of Rural Water Supply

Water management norms are currently undergoing rigorous and dramatic transformation through a process of privatization: the introduction of markets or private-induced decisions and the participation of private companies and capital in water resource development, supply, and management (Bakker, 2003). The introduction of the market in water management in most African countries started in the 1980s through the implementation of "Economic Recovery Programs" spearheaded by the World Bank and the International Monetary Fund (IMF) (Obeng-Odoom, 2012). The underlying assumption is that the market is more efficient than the government in providing basic drinking water services (Bakker, 2003; Budds and McGranahan, 2003). This brought about huge reductions in subsidies in areas considered sacrosanct, including drinking water services (Obeng-Odoom, 2012). Therefore, water became commodified, particularly in urban areas where incomes are, in fact, more stable compared to those in rural areas. This assigned monetary value to water just like other commodities on the principle of full cost recovery (Acheampong et al., 2016).

The 1992 Dublin Principles reinforced the re-conceptualization of water as an "economic good," which can be loosely defined as a good that can command a market price (Budds and McGranahan, 2003). The principle further argues that failure to recognize water's economic value as done in the past has resulted in wasteful and environmentally damaging uses of water resources. Scarcity is, therefore, deployed as a justification for marketization (Bakker, 2003). Even though the principle gives credence to recognizing the fundamental right of all human beings to have

access to clean water at an affordable price, what constitutes "access" and "affordability" remains vaguely defined. Regardless, the principles reinforced the Bretton Woods institutions' position that the most efficient means to manage service delivery in the water sector is to leave it to the market. This brought about a shift from treating water as a public good to a commodity that requires payment before usage (Budds and McGranahan, 2003). With a community-based water management approach unable to deliver on its promise due to lack of or limited capacities in most African rural communities, privatization has been suggested as a better alternative to achieving efficiency in the rural water supply (Burke, 2013; Sun et al., 2010). This forms a major shift under consideration in some water policies in Sub-Saharan Africa.

However, the underlining assumptions of and the available evidence from water privatization cases indicate that such policy shifts serve as a major hindrance to providing potable drinking water to rural households and, therefore, meeting universal access to water by 2030 targeted by the Sustainable Development Goal 6. Starting from the efficiency argument on water privatization, this ignores the fact that not all private operators make profits from being efficient (Budds and McGranahan, 2003). The scale of privatization of drinking water services also remains limited in many countries despite being considered an efficient means of managing drinking water. Available evidence shows that the formal private sector currently serves just about 5% of the world's population. Additionally, the privatization of drinking water services has not achieved the intended results anticipated by the proponents. Privatization has chalked successes only in urban areas with a high population. Many countries have worsened the water insecurity situation of the rural poor due to water privatization (Budds and McGranahan, 2003). This is because private investments find it unattractive to invest in rural areas for fear of not making gains from their investments. The result is that the rural poor have been cut off from improved drinking water

services (Sun et al., 2010). Instances of aborted privatizations in Cochabamba in Bolivia and Dar-es-Salaam in Tanzania are highlighted as water privatization failures (McClanahan, 2014).

The costs associated with implementing the cost recovery programs also exceed the revenues generated (Francis, 2005). The cost of administrative expenses, meter installations, and legal fees required to operate such programs far exceeds the revenues usually generated from low-income communities. This excludes the costs of coping with water-related illness, medical expenses, and the economic costs of productive activities, which have been estimated to be more than the cost of providing water infrastructure (Francis, 2005). This juxtaposes the arguments against and defeats the arguments in favor of the commodification of water. The socio-cultural and economic benefits of equitable access to safe water by all in real terms far exceed the cost of denying such access. The most serious aspect of these negative implications of lack of access includes deaths that occur as a result of drinking water-related illness, which cannot, in any case, be measured in monetary value.

Water commodification also requires users to pay service tariffs. In most rural areas in Ghana, the tariff system is based on the volumetric tariff structure where users are required to pay based on the volume of water collected or consumed. This cost-based system tends to ignore the public benefits of water and favors the rich, who can afford to pay more on higher water volumes than the rural poor (Thobany, 1995). The rural poor are usually forced to either reduce their water uses for domestic purposes or resort to other water sources, usually unmonitored. Either of these has negative implications on the health of the rural poor. Reducing water usage limits the individuals from the required volume of water necessary to enhance an individual's adequate health, and resorting to contaminated water has profound health implications, including diarrhea and cholera with their attendant social and economic effects (WHO/UNICEF, 2015). An instance

is the massive cholera outbreak that swept South Africa in 2000/1 by infecting more than 100,000 people and killing over 200 (Francis 2005). This was directly linked to cost recovery policy and water service cut-offs in low-income communities and rural areas. Ironically, only the affluent in urban areas tend to benefit from subsidies on water instead of the rural poor in most African countries (Thobany, 1995).

Despite the market failures, it is important to note that other well-recognized factors make the commodification of water unacceptable, and this forms the basis of the argument in this study. The study posits that not all goods should be a subject of the market. As Sandel (2012) pointed out, before the market is even considered, we must reason about the nature of the goods and decide whether access to the good is a necessity or a matter of fundamental human rights or merely a source of pleasure, a matter of choice. Arguing from a distinction between fairness and corruption (based on water commodification), Sandel opposes the latter because putting markets on civic goods such as drinking water services would undermine, erode, or corrupt the purpose for which the service was provided. Aside from the corruption aspect, turning human needs such as water into a product for sale does not only make it accessible for the rich but also demeans and degrades it (Sandel, 2013). Given this, Sandel advocates that things that have civic values should consider meeting human needs rather than the market benefits.

Furthermore, the welfare approach should form the basis of human needs, which Sandel considers sacrosanct. Citing several cases to support his arguments, Sandel (2013; 2012) argues that the decision on whether to commodify a good must go beyond efficiency and fairness to include how market norms will crowd out nonmarket norms, and if so, whether this represents a loss worth caring about. Besides its human rights aspect, water is also considered a "public good," given its public health aspects. Given this, commodifying water rather than treating as a public

good puts water user in the category of customers rather than citizens, who have access to water through their purchase of water as a commodity, rather than the right to water supply service (Bakker, 2003).

2.4.2 Distributive and Procedural Justice in Rural Water Management

As complex as it may sound and be interpreted (Schlosberg, 2004), justice can be traced to John Rawls' theory, which gave meaning to what it means to have justice. John Rawls' objective was to provide an alternative to utilitarianism principles, which, according to him, was not doing enough to solve common social problems relating to the equal distribution of common resources (Plachciak, 2015). Utilitarianism seeks to maximize welfare without regard for its distribution (Sandel, 2013). In Rawls' advocacy for justice, the theorist argues that two principles could be reached through an agreement in an original position of fairness and equality. According to Rawls, the principles will be chosen behind a veil of ignorance (Rawls, 1971).

However, the Rawlsian concept of justice has been criticized for focusing on the distribution (in)justice. Young (2011), for instance, argues that despite the focus of distributive justice theories on the models and procedures which can improve distribution, none of them thoroughly examines the fundamental conditions, including the socio-cultural, economic, environmental, and institutional factors which form the basis of poor distribution. This argument is based on the fact that there are key reasons why some people get more than others. The danger in emphasizing distributive justice alone is that while policymakers sort out the scope of the problem, the actual causes, and implications of those patterns of injustice that exist remain understudied (Deacon and Baxter, 2013). The central question of distributive justice is not about "*what* is the best distribution model?" but "*how* does the current maldistribution get produced?" This

brought about the need to pay attention to procedural justice, representing the underlining conditions within which distribution is done. This has resulted in a shift from just distribution to include procedural issues recognized as the second phase of social justice research.

Distributive and procedural justice are generally considered to be conceptually and operationally distinct constructs (Brashear et al., 2004). Both can be described as outcome and process, respectively (Cutter, 1995; Shepherd et al., 1992). While the former refers to patterns over space and time (e.g., the provision of drinking water services to marginalized communities within a particular point in time in service allocations), the latter pertains to the procedures and social structures that form the basis of such allocations (Cutter, 1995). The perceptions of distributive justice are considered to result in three outcome components, which include equity, equality, or needs (Deutsch, 1985). Of these, equity is the most studied facet of distributive justice.

The achievement of equity in distribution is based on the principles of proportionality, egalitarianism, need, self-interest, and efficiency. These principles define how the available common resources should be distributed among the beneficiaries. For instance, the distribution of drinking water services in rural Ghana depends on the need and efficiency rules where a community's access to water infrastructure is based on its needs and how efficient the community has been in mobilizing local resources. The argument against distributive justice is that the equity principles inherent in such distribution have no intrinsic meaning and, therefore, do not exist. Even if it exists, it is highly subjective with no concrete criteria for assessing the means of distribution (Syme et al., 1999). For example, who determines the water needs of various rural households?

Justice is primarily about securing a fair distribution of goods. It should be achieved not just for the distribution aspect but also for the processes and procedures involved in such distributions (procedural justice). It has been widely recognized that distribution injustice does

occur based on differences among individuals or groups of people. Such differences may be based on disability, gender, geographical location, and social status (Smith, 2000). A lack of recognition of such differences in the justice system forms the foundation of distribution injustice (Schlosberg, 2009). An aspect of procedural justice constitutes identifying those differences that are usually significant in distributing benefits and burdens (Schlosberg, 2009). It also involves recognizing each group's existence within a particular community, ensuring that their capabilities needed for their functioning and flourishing are developed, and including them in decisions that involve the distribution of common resources (Smith, 2000).

The critical components of procedural justice pertain to the fairness of policy procedures and processes (Brashear et al., 2004). This fairness in the allocation process provides equivalency for public participation in resource allocation decisions. In rural Africa, drinking water management represents a shift from the centralized approach (distribution) to community-based water management (procedural). The central idea of this approach goes beyond the distribution of water services but also the involvement of the poor and the marginalized in rural drinking water management. Rural communities may judge the fairness of the water distribution not only by considering the number of water infrastructure constructed but also by considering the allocation procedures involved (Folger, 1977).

The central premise is that the outcome of the final distribution of water services is more likely to be accepted as just or fair, even by the communities/households who get less than they expected, if the way the decision was made is deemed to be fair by the affected parties (Smith, 2000). Questions regarding procedural justice in rural water supply should, therefore, focus on who gets to allocate drinking water services and why? How was the allocation done? What was

the degree of participation in decision-making exercised by each household/community during the allocation?

It is important to note that distributive and procedural justice are interrelated and interdependent - one cannot pursue one dimension of justice in isolation (Schlosberg, 2009; 2004). There is no clear consensus on the causal ordering of distributive and procedural justice other than agreement that the concepts are positively related (Brashear et al., 2004). This means that we should evaluate the justice of arrangements not only in distributive terms but also in how those distributions are done and how they affect the ultimate well-being and functioning of people's lives (Schlosberg, 2010). This implies that it is not just enough to provide drinking water services; however, such provisions should be participatory, involving the beneficiary communities and the development of community capabilities to manage the drinking water services.

To tighten the fit between the capability approach to water management and justice, particularly for rural Africa, we must expand the frame of justice to address the capabilities and functioning of individuals and communities as well. Such empowering water managers at the local level is necessary to enhance meaningful participation in drinking water management. Empowerment seeks to provide the technical, institutional, and financial muscles needed to provide and sustain rural water projects. Capacity building at the community level on post-construction activities for water managers, such as cleaning water tanks, conducting minor repairs, and managing maintenance funds raised by households, for instance, is crucial in ensuring the sustainability of drinking water projects (Sun et al., 2010). It is when beneficiaries are empowered that procedural justice can be achieved during the distribution of drinking water services.

2.4.3 Rural Water Management in Ghana

Institutional and Regulatory Framework

The provision of potable drinking water in rural Ghana was historically the central government's responsibility under the Ghana Water and Sewage Corporation (GWSC). However, following the economic recessions of the 1980s, Ghana adopted economic recovery programs grounded in neoliberal ideas as a condition of receiving financial assistance from the World Bank and the International Monetary Fund. This brought about huge reductions in subsidies in previously considered sacrosanct areas, including drinking water services (Obeng-Odoom, 2012). As a consequence, water became commodified, particularly in urban areas where incomes are more relatively stable compared to rural areas (Acheampong et al., 2016). However, community-based water management was initiated in rural areas to reduce governments' involvement in drinking water management and increase communities' role (Obeng-Odoom, 2012; Harvey and Reeds, 2007). Ghana became one of Africa's first countries to introduce community-based approaches to rural water management in 1983 (Sun et al., 2010).

The period between 1983 and 1993 witnessed the widespread adoption of neo-liberal policies by the government of Ghana, especially in the areas of social and economic policy (Obeng-Odoom, 2012), and in the context of water management marked what deLoë et al. (2002) refer to as a shift from government to governance. The first post-reform National Community Water and Sanitation Program (NCWSP), launched in 1994, involved enhancing community participation in the planning, implementation, and management of water and sanitation facilities (National Community Water and Sanitation Strategy [NCWSS], 2014). This has been influenced by the concept of demand-driven approaches such as a community's ability to support the initial provision

of water infrastructure and community ownerships as the backbone of sustaining drinking water facilities (African Ministers Council on Water [AMCOW], 2011). Under this program, rural water management was detached from urban-water management and placed under the Community Water and National Agency (CWSA). The CWSA discharges its rural-water management responsibilities through the various metropolitan, municipal, and district assemblies (MMDAs) (Figure 2.2).

Table 2.1: Key Events in Rural Water Reforms in Ghana

Year	Event	Purpose
1948	Creation of Rural Water Department	To oversee the supply of rural water
1965	Establishment of Ghana Water and Sewerage Corporation (GWSC)	To produce and distribute urban and rural water supply
1983	Economic Recovery Programs	Introduced decentralized approaches to rural water management
1994	Kokrobite Conference	Endorsed the National Community Water and Sanitation Program (NCWSP)
1995	Creation of Community Water and Sanitation Department (CWSD)	Separation of urban and rural water supply
1997	Establishment of Water Resources Commission—	To manage water resources, including both surface and underground water
1998	Autonomous agency—Community Water and Sanitation Agency (CWSA) created by Act 564	To coordinate and facilitate the implementation of the NCWSP
2003	Establishment of Coalition of NGOs in water supply and sanitation (CONIWAS)	To coordinate the activities of NGOs
2008	Launched the National Water Policy of 2007	Provides a framework of sustainable development of Ghana's water resources
2009	Abolition of community contribution to the capital cost of rural water projects	Re-allocation of responsibilities to metropolitan, municipal, and district assemblies (MMDAs)

Source: Modified from AMCOW (2011)

The NCWSP also outlines the overall strategy to achieve the government's vision in the rural-water service delivery, enshrined in the Water Sector Strategic Development Plan (NCWSS, 2014). This policy sets out the regulatory and institutional frameworks for rural water management

from the central government to the institutions at the local levels. The regulatory frameworks of rural water management are derived from the Community Water and Sanitation Agency Act, 1998 (Act 564), the Local Government Act, 1993 (Act 462), and the Legislative Instrument of the Community Water and Sanitation Regulations, 2011 (LI 2007). These regulatory frameworks define the various national and decentralized institutions charged with the responsibility of delivering rural water services (Figure 2.2).

The key institutions include the Ministry of Sanitation and Water Resources (MSWR), the Community Water and Sanitation Agency (CWSA), the various metropolitan, municipal and district assemblies (MMDAs), and the water and sanitation management teams in the various rural communities (Sun et al., 2010). The Ministry of Sanitation and Water Resources (MSWR), which was carved out of the Ministry of Water Resources, Works, and Housing (MWRWH), is the lead government institution responsible for water (Awuah et al., 2009). The CWSA, established by Act 565, coordinates and facilitates the implementation of the NCWSP through the MMDAs (Sun et al., 2010). MMDAs, which are the legal owners of communal infrastructures in rural communities and small towns, establish the Water and Sanitation Teams (WST) to manage the implementation of water projects in rural areas. The voluntary-based water and sanitation (WATSAN) committees, which are established at the community levels and mandated to be gender-balanced, ensure the day-to-day running and management of water facilities in their respective rural communities (Sun et al., 2010).

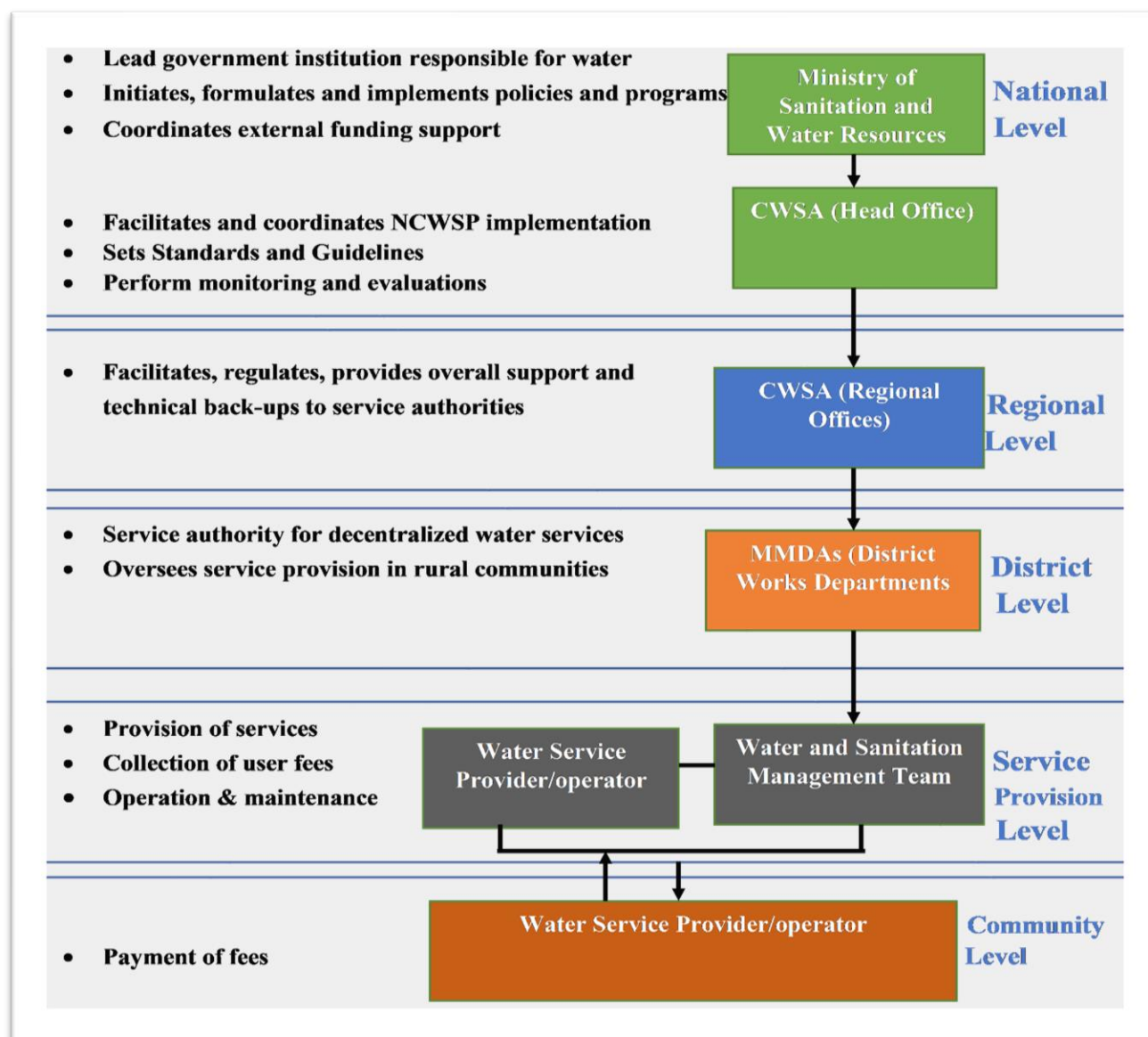


Figure 2.2: Institutional Framework for Rural Water Management in Ghana

Source: Modified by the author from NCWSS (2014)

In addition to the key institutions, other sector partners function to ensure the effective implementation of the NCWSP. This includes the Ministry of Local Government and Rural Development, the Ministry of Finance, the Ministry of Education, the Ministry of Gender, Children and Social Protection, the Water Resource Commission, development partners, and the Non-

governmental Organizations (NGOs), and the Civil Society Organizations (CSOs). The Water Resource Commission, which was established by the Water Resources Commission Act, 1996 (Act 522), for instance, seeks to harmonize water resources management and related issues concerning all consumptive and non-consumptive uses of water in the country (GoG 2007). This includes the regulation of water resources, licenses, water abstraction, and wastewater discharges (Awuah et al., 2009).

The NGOs, operating at various rural water management levels, represent both domestic and international non-for-profit organizations that focus on supplementing the government's efforts in providing drinking water services in rural communities. They work in partnership with sector players at the national and local levels to influence policies, remove barriers, and promote access to potable water for the poor and vulnerable. The Coalition of NGOs in Water and Sanitation (CONIWAS) coordinates the activities of such NGOs to influence policies, remove barriers, and promote access to potable water for the poor and vulnerable.

Community Participation

Rural water coverage is categorized into two main service delivery models, including the point source and piped water schemes. However, the principal service delivery model for rural water supply is the point sources, which include borehole and hand-dug wells fitted with hand-pumps. Boreholes are categorized into mechanized and handpumps. However, the handpump-equipped borehole (Figure 2.3) is the most common water supply technology used in rural Ghana.



Figure 2.3: Hand Pump Borehole

Source: Photo taken by the author (2019)

Other rural water systems include the hand-dug wells, small community pipe systems, and rainwater harvesting. The hand-dug wells require manual means of digging and are usually restricted to suitable ground types such as clays, sands, gravels, and mixed soils where only small boulders are encountered (WaterAid, 2013). Unlike handpump boreholes, hand-dug wells are relatively cheaper to construct and maintain but have a higher risk of contamination due to their exposure to inflow from surface runoff (Okotto- Okotto et al., 2015; WaterAid, 2013). A small community pipe system includes mechanized boreholes that provide water services through

standpipes. A mechanized borehole consists of a borehole, a motorized pump powered by electricity, an overhead tank, and points with spouts (Figure 2.5).



Figure 2.4: Hand-dug Well

Source: WaterAid (2013)



Figure 2.5: Mechanized Borehole

Source: Smits (2013)

Unlike boreholes and hand-dug wells, rainwater harvesting has not received much consideration from government and rural water managers. The infrastructure for treating and distributing that water is underdeveloped, even though it is favorably viewed as a response to water access difficulties.



Figure 2.6: Rainwater Harvesting System

Source: Andoh et al. (2018)

Based on the set regulatory frameworks for rural water services, the CWSA has set out standards and guidelines for providing and managing rural water supply. For instance, the basic standard for rural water supply stipulates that the design of drinking rural water supply should ensure access to at least 20 liters of water per person per day. In addition, no one should be required to travel more than 500 meters for water collection, and there is a maximum standard of 300 people per borehole. Finally, there should be a yearly provision of safe drinking water to the specified community (Table 2.2). Unlike the handpump borehole, the user threshold for hand-dug wells is limited to 150 people. To ensure that drinking water is safe, the quality of water provision should comply with the parameters set by the Ghana Standards Board (Adank et al., 2013). The CWSA

guidelines stipulate that water quality testing should be done twice a year – during the dry and rainy seasons by the respective MMDAs.

Table 2.2: Service Level Sub-indicators and Standards, as set by CWSA

Service level sub-indicators	Benchmark
Quantity	20 liters per capita per day
Quality	Ghana Standards Board water quality standards
Crowding: maximum number of people per facility	Point source / standpipe: 300 Hand-dug well: 150
Distance to the water point	Maximum of 500 meters
Reliability	The facility provides water for at least 95% of the year, interpreted as at least 347 days of regular supply

Source: Adank et al. (2013)

Rural water at the service delivery level is managed by a voluntary-based water and sanitation (WATSAN) committee (Adank et al., 2013). Gender-balanced WATSAN committees are to be established at the community levels to serve as a liaison between the various rural communities and their respective Water and Sanitation Teams (WSTs) in the MMDAs (Sun et al., 2010). The CWSA has set guidelines for the formation, reformation, and functionalities of WATSAN committees (Adank et al., 2013). WATSANs are to be formed and operated without political and chieftaincy interference and should be reconstituted once every four years. In addition, rural drinking water committees are required to keep audited financial records and accounts to ensure effective financial management (Braimah et al., 2016). To ensure that there are opportunities for all to participate at the community level, it is expected that all water interventions must recognize and should protect the specific needs and roles of women and people with physical disabilities. Women's roles must not be seen as just water collectors, but women should be involved in decision-making (Government of Ghana, 2007).

The community-involvement model also requires financial contributions towards operations and maintenance of water facilities. Communities set water fees to at least recover the

cost of operations and maintenance, which has remained a golden rule in support of rural water management. The fees, which are generally set by the WATSAN committees and approved by the MMDAs, are based on projected operations and maintenance costs, as prescribed by the CWSA guidelines (Adank et al., 2013). There are two main approaches to the collection and payment of water user fees. The first approach allows water users to make monthly contributions to the operations and maintenance of water facilities. These contributions may be fixed per household or may be based on household sizes. The second approach charges and collects water fees from the users based on water volume collected during water fetching. This is also known as the volumetric pay as you fetch approach (Boland and Whittington, 2000). This tariff strategy places a higher cost burden on high water consumers, thereby limiting the volume of water use by the poor.

Capacity Gaps for Rural Water Management in Ghana

Local capacity refers to the capability of a local authority (e.g., Water and Sanitation Committee) to perform its mandates, including its ability to meet established regulations, policies, or standards (Gargan, 2019; Rawlyk and Patrick, 2013). In other words, capacity is defined as the ability, or capability, of a local community to meet regulations, policies, or standards that have been established, which can be further broken down into technical, financial, social, and institutional.

Capacity in water management is categorized into institutional, technical, financial, social, and human capacity (Rawlyk and Patrick, 2013; Timmer et al., 2007). Institutional capacity refers to the policies, regulations, legislation, protocols, and delineation of responsibility to provide safe drinking water. Technical capacity involves the physical and operational ability of an organization to maintain regulatory compliance and implementation, while financial capacity represents the ability to acquire adequate funds to pay for the operation and maintenance of planning and

management. The Social capacity includes social agents of capacity, public awareness, stakeholder involvement, community support, public and private partnerships, and communication among stakeholders (Rawlyk and Patrick, 2013). Human capital refers to the knowledge, skills, and experience available (Robins, 2007). The human resource dimension involves the recruitment of personnel needed to perform and includes training, utilization, and retention of human resources available at all times in response to an action (Grindle and Hilderbrand, 1995).

In addition to these five dimensions, there is the action environment, the task network, and the organization's resources. The action environment encompasses the social, political, and economic milieu and conditions that should be available for an organization or institution to perform (Robins, 2007; Grindle and Hilderbrand, 1995). The task network, on the other hand, involves the communication and interactions among all organizations involved in a particular task (e.g., water management) while the organization's resources constitute goals, activities, and leadership to support that particular task or activity. A local authority's ability to achieve its set objectives and goals in water management represents its capacity, whereas its inability will be seen as a lack of capacity.

Table 2.3: Community Capacity Indicators for Drinking Water Management

Capacity Component	Capacity Indicator
Financial	• Ability to maintain a balanced budget • Ability to obtain funding from external sources • Ability of water users to contribute to its management • Availability of funding to sustain rural water management
Human Resources	• Availability of employees dedicated to water management • Access to individuals with the requisite skills and training • Availability of educational and training opportunities • Access to external expertise
Institutional	• Availability of legislations and policies • Availability of local planning strategies and buy-laws to protect and manage water resources • Availability of local emergency plans • Availability of effective institutions and institutional coordination
Technical	• Local drinking water quality meets the established standards • Availability of data required for water management • Local source water areas are delineated in official plans • Potential water contaminated sources have been identified
Social	• Existence of clear leadership for drinking water management • Existence of active linkages between district/municipal and national institutions (Vertical linkages) • Existence of active linkages between local and district/municipal institutions (Vertical linkages) • Existence of active linkages between local institutions (Horizontal linkages) • Community participation in water management • Existence of community awareness strategies

Source: Modified from Timmer et al. (2007)

The growing interest in a local capacity to manage water was prompted by the 1991 United Nations Development Symposium held in Delft, the Netherlands. The symposium made a declaration that identifies three components of water management capacity. These include proper institutional arrangements, community development and participation, and development of human resources and organizations (Ivey et al., 2004). The Delft declaration also acknowledges the importance of interrelated characteristics of the broader social, political, economic, and

institutional environment, community-related factors, and the nature and resources of particular water management organizations. These factors play roles in local governance capacity.

Limited local capacity forces small and poorly resourced municipalities to be less proactive in planning to protect their drinking water sources instead of pursuing reactive measures such as investment in expensive water treatment technologies. For instance, the absence of local capacity in the dimensions of technical, institutional, financial, and social capability pose significant barriers to implement source water protection (SWP) plans in many local communities (Rawlyk and Patrick, 2013).

In the absence of comprehensive oversight, leadership, and assistance from senior governments, rural communities need to develop the ability to form horizontal and vertical linkages with external agencies, political leadership. They also need to commit to citizen involvement to develop their technical, financial, and institutional capacity (Rawlyk and Patrick, 2013). Horizontal linkages involve external organizations at the local level, such as other municipalities, conservation authorities, and non-governmental organizations. Vertical linkages involve connections with agencies in senior governments. Strengthening horizontal and vertical linkages and building partnerships are crucial steps for local governments, especially when there are limited financial and technical supports to the delivery and management of drinking water services (de Loe et al., 2002; Rawlyk and Patrick, 2013).

Many capacity frameworks for rural water management are based on the use of indicator questions to ascertain the financial, managerial, and technical capacity of local and rural organizations, with specific lines of inquiry focusing on training, infrastructure, reporting structures, and resources (Ivey et al., 2004; USEPA, 1998). A more common and most recognized approach is to address the myriad actors involved in local water management and planning rather

than focusing on the capacity of a single organization. It also involves considering the capacity of a watershed community, where a community is a social network of interacting individuals (agencies), usually concentrated into a defined territory (Johnston et al., 2000).

The community capacity and capacity building for water management can, therefore, be conceptualized in terms of citizen participation, community structure, and development instruments. Community structure addresses formal institutional arrangements and linkages with other communities and higher levels of government, while development instruments imply the degree to which communities use appropriate and effective policy tools. Institutional considerations such as institutional arrangements and institutional environment rather than technical limitations can be significant determinants of local government capacity regarding resource management. For instance, overlapping agency responsibilities, fragmented governance structures, and weak legislation can significantly undermine the local government's capacity (de Loë et al., 2002; Hamdy et al., 1998).

The absence of or limited local capacity affects the extent of community involvement in rural water management. According to the critics of community-based water management (e.g., Cerniglia, 2003; Harvey and Reed, 2007; Hope, 2015), while the approach constitutes a positive response to addressing the gaps in effective rural water management and the most efficient means of using local resources, there are several capacity gaps. As the critics argue, community-based water management tends to shift the central government's technical responsibilities to local amateur communities with little or no technical know-how to handle such responsibilities. This lack of technical know-how stems from limited rural financial capacity to replace missing parts and lack of locally trained mechanics to handle faulty water infrastructure.

As Braimah et al. (2016) noted, for instance, most MMDAs in Ghana are faced with budget constraints, low revenues, and shortfalls in operation and maintenance, which result in an insufficient expansion of the water system and failure to satisfy rural water needs. According to Cerniglia (2003), successful community involvement in water management must include some degree of financial autonomy from either the central authorities or through the communities' contributions. The communities' contribution often depends on establishing water user fees, users' commitments to pay such fees, and the efficient use of the proceeds towards the drinking water management (Mutondo et al., 2016). In rural Ghana, where incomes are generally low amidst cash-poor, subsistence households, access to financial resources to support water facilities' provision remains limited. Further, as most rural households are predominantly engaged in agricultural activities, income varies seasonally (Braimah et al., 2016).

These factors constrain most communities' ability to contribute to the initial capital for drinking water facilities or pay for their operations and maintenance. Where rural households are even able to contribute, the revenues generated are usually woefully inadequate to support drinking water management (Nyarko, 2007). In most cases, the volunteer water committees are faced with inadequate funds, both from internal and external sources, to handle major and minor challenges that affect the operations of drinking water facilities (Braimah et al., 2016; Sun et al., 2010). The limited financial capacity of the various MMDAs coupled with heavy reliance on central government funds affects community support for rural water management. Rural water managers also lack the required credits from the local sources to support water management operations. This places the cost burden on the rural poor who are forced to contribute to the operation and maintenance of water facilities or face an inability to access water. Since the sustainability of rural water facilities in Ghana is ensured when there is enough revenue to cover expenses (Braimah and

Jagri, 2007), limited rural financial support has negative implications on community involvement in water management.

Furthermore, limited rural technical and institutional capacities are detrimental to communities' active involvement in the planning, implementation, operation, and maintenance of drinking water projects. Consequently, the implementation of water projects is usually done devoid of community input. It also is usually characterized by a top-down approach through which rural communities know about projects after they have been completed. Rural communities also lack the requisite human capacity to sustain drinking water facilities after implementation. When there is a facility breakdown, for instance, few communities can undertake the necessary repairs themselves. Sometimes, communities have to wait for weeks or months for equipment and other infrastructure to be repaired, resulting in the use of alternative sources that are usually unmonitored for consumption (Adank et al., 2013).

To enhance the understanding of management approaches to rural water security, this study uses qualitative evidence from water management agencies and rural communities to assess Ghana's rural water management approaches. The study also identifies the capacity gaps for rural water management based on five dimensions: financial, human resources, institutional, social, and technical. These gaps bring to bear the extent to which rural communities can participate in water management decisions, including its provision, operation, and maintenance.

2.5 Water Availability

Water availability constitutes the presence of water at water sources that can be collected when needed at expected known times (usually every day) and without interruptions (Howard et al., 2020). The quantity involves water supply for all domestic purposes, including consumption,

bathing, washing, and food preparation at water users' disposals (WHO, 2017). The supply of improved water in the required proportions can benefit rural communities in various ways, including health (Mertens et al., 1990; WHO, 2011). The quantity of water delivered and used by households is an important aspect of basic and domestic needs, which influences hygiene and, therefore, public health (Howard and Bartram, 2003; Howard et al., 2020). In this study, the quantity and supply of water constitute water requirements for domestic purposes, excluding other needs such as agriculture, industry, commerce, transport, energy, and recreation.

Even though domestic water uses in most rural settings have been put into different categories, the physiological requirement for water to maintain adequate hydration, food preparations, and meet the basic hygiene requirement (WHO, 2011) has been considered for this study. Households' use of water for domestic purposes occurs at different levels and needs. This, therefore, needs to be borne in mind when ensuring that adequate quantities of domestic supply are available for these purposes and in interpreting and applying minimum values (Howard and Bartram, 2003). Estimates of water volume required to meet human needs and health purposes vary widely (Howard et al., 2020; WHO, 2017).

However, the water supply available for an individual should be sufficient and continuous for personal and domestic uses, which ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene (Howard et al., 2020; WHO, 2011). For consumption, Howard et al. (2020) recommend that approximately 5.3 litres (L)/person per day for adults depending on climate, activity level, and diet. WHO further indicates that a minimum volume of 7.5 litres per capita per day will provide sufficient water for hydration and incorporation into food for most people in most conditions. In addition, adequate water is needed for other domestic uses, including food preparation, laundry, personal and domestic hygiene, income

generation, and amenity use (WHO, 2011). Overall, between 50 and 100 litres of water per person per day is needed to meet the most basic and domestic needs, and few health concerns may arise (WHO, 2011).

In this study, the assessment of water availability is based on the users' ability to meet the required domestic water need for drinking, cooking, and sanitation purposes. This assessment involves the difference between the quantity of water required per day based on the stipulated standards and the quantity collected by households. The study also identifies the factors that lead to deficits in household water availability. These include the reliability of water sources and facilities as well as the demographic and socio-economic characteristics of households.

2.6 Water Access

The availability and supply of the right quantity of drinking water are meaningless if households do not have access to meet their basic domestic needs. Accordingly, access is defined as the distance and the time covered to collect drinking from the source (physical access/coverage) and means of acquiring it (affordability) (Howard et al., 2020; WHO/UNICEF, 2017; WHO, 2011). The ability to pay for services is equally important as the provision of the service itself. The WHO/UNICEF Joint Monitoring Program considers drinking water to be basic to households (Table 2.4) when such water is from an improved source and with the collection time not more than 30 minutes for a round trip, including queuing. However, limited water service exists when the average collection time exceeds 30 minutes, including waiting time (WHO/UNICEF, 2017). Furthermore, it is recommended that the ideal access should be safely managed water service level, where drinking water from an improved water source is located on-plot within the house, available when needed, and free from fecal and chemical contaminations.

Table 2.4: Service Level and Quantity of Water Collected

Service Level	Distance/time	Likely Volumes of Water collected	Public health risk from poor hygiene	Intervention Priority and Actions
No access	More than 1 km/ more than 30 min round-trip	Very low – 5 liters per capita per day	Very high Hygiene practice compromised Basic consumption may be compromised	Very high Provision of a basic level of service Hygiene education
Basic access	Within 1km/ within 30 min round-trip	Average approximately 20 liters per capita per day	High Hygiene may be compromised Laundry may occur off-plot	High Hygiene education Provision of improved level of service
Intermediate Water access	Water provided on-plot through at least one tap (yard level)	Average approximately 50 liters per capita per day	Low Hygiene should not be compromised Laundry likely to occur on-plot	Low Hygiene promotion still yield health gains Encourage optimal access
Optimal access	Supply of water through multiple taps within the house	Average 100-200 liters per capita per day	Very Low Hygiene should not be compromised Laundry will occur on-plot	Very Low Hygiene promotion still yields health gains

Source: Howard and Bartram (2003)

However, in Sub-Saharan Africa, about 6 kilometers on average is spent collecting water from the source to the point of usage. Coupled with this include the physical activities associated with water hauling. This affects the average water use per day, which is far below the standard requirements.

Communities' ability to afford water influences the use of water and the choice of water sources to use (WHO, 2011). Water affordability involves the amount that households can routinely pay for water within their available resources without causing hardship (Howard et al., 2020). It is not just enough to provide water if users have no financial means to access the service. Households with limited physical access to water tend to spend more on their drinking water than

those with good access. The households' inability to pay for water has two main effects: relying on unmonitored water sources and reducing the quantity of water consumed (WHO, 2011). Either way has implications on adequate sanitation or poses a significant health risk (WHO/UNICEF, 2017).

Drinking water services must be affordable for all. It is recommended that that water costs should not exceed 3% of household income (WHO/UNICEF, 2017; 2015). It is important to collect data at the point of purchase when assessing consumers' affordability. This will inform people's ability to pay for the service. Consumer's affordability evaluations should also reflect on the initial cost of providing the water infrastructure.

The assessment of water accessibility in this study considers the users' ability to pay for water, the distance covered for water collection, and the time traveled to retrieve water, including water time. The study argues that it is not enough to have drinking water available if users have no financial means of acquisition. Similarly, water accessibility could be called to question if its acquisition poses difficulties for users regarding distance and time. Affordability of water constitutes not only user fees but also the cost of water retrieval, including transportation expenses.

2.7 Water Quality

The water required for personal and domestic use must be safe. Water is considered safe when free from micro-organisms, chemical substances, and radiological hazards that can pose threats to a person's health (WHO, 2011). Safe water should be of acceptable color, odor, and taste and must strictly follow national and local standards recommended for either personal or domestic use (WHO, 2011). To ensure that drinking water is safe for use requires a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from the

source to the point of consumption. Drinking water safety practices seek to minimize contamination of source waters, reduce, or remove contamination through treatment processes, and prevent contamination during storage, distribution, and handling of drinking-water, especially from the source to the place of usage (WHO, 2011).

This calls for the existence of water safety plans (WSPs). WSPs provide means within which the quality of water can be achieved and maintained. These must reduce the risks associated with water contaminations at all levels, being large piped drinking water supplies, small community supplies, and household systems. One such plan is source water protection (SWP), which involves a land and water planning process designed to prevent contamination of untreated water at the source (Rawlyk and Patrick, 2013). SWPs consider assessment and characterizations of risks and hazards associated with drinking water, assessment of existing and proposed systems, identifications of control measures as well as defining the monitoring of control measures. It considers verifying the effectiveness of SWP, including meeting the health-based targets, developing supportive programs, and developing management procedures towards handling such plans (WHO, 2011).

In rural Ghana and some urban areas, groundwater remains the most critical water supply source for personal and domestic uses. This covers about 95% of rural portable water in addition to other sources such as rainwater. Groundwater from the deep and confined aquifers is usually microbially safe and chemically stable in the absence of direct contamination (WHO, 2011). However, the quality of such water has been called to question in recent times in some parts of Ghana due to high levels of metals and fluoride compounds in groundwater reserves in concentrations above the permissible limits (Awuah et al., 2009). The contamination of groundwater can also occur through the ingress of contaminated water into the boreholes and

leaching of microbial contaminants into aquifers. Birds and other animal droppings found on the roof or guttering can also be major sources of contamination to rainwater (WHO, 2011). Tekpo et al.'s (2017) study to determine groundwater's bacteriological safety, for instance, revealed that groundwater source does not meet the WHO's guideline and Ghana's standard for drinking water. The study also found contamination to be higher in the rainy season and water sources closer to pollutants such as septic tanks.

The quality of any surface or groundwater is a function of either natural influences or human influences. Human influences tend to affect drinking water, even where natural influences have been controlled. Water fetching is a common practice in Sub-Saharan Africa, which is estimated to be among over 75% of the population (Geere and Cortobius, 2017). This experience is predominantly higher in rural areas (WHO/UNICEF, 2015), including rural Ghana. The contamination of domestic drinking water during and after collection from the source has been recognized as a problem for households even where the water sources are uncontaminated and considered to be safe for domestic use (Awuah et al., 2009; Gundry et al., 2006). One major means of such contamination involves water storage, including contamination of water reservoirs, unsuitable intake location, and depletion of reservoir storage (WHO, 2011).

This study uses water's organoleptic properties to assess the quality of drinking water, including appearance, taste, and smell, to determine users' perceptions. The study also assesses local water managers' ability to protect water sources from contamination and carry out water quality testing twice a year as stipulated by the CWSA's guidelines. Finally, since water can be contaminated through haulage and storage, the study identifies how water is collected and stored in rural Ghana. These include whether water is covered during collection or storage, how long water is stored, and the safety of water collection containers.

2.8 Users' Preference, Perception, and Desirability

Understanding the preferences and perceptions of rural water users is another consideration that should be factored in assessing the drinking water security of a community (Daemane, 2015). The United Nations posits that all drinking water facilities and services must be culturally appropriate and sensitive to gender, lifecycle, and privacy requirements, without which beneficiaries may not participate (UNDESA, 2014). Most indigenous people worldwide hold deep relationships with natural resources, including lands, forests, and water resources. Considerations must be given to such indigenous cultural values and beliefs when providing water facilities and services (Jiménez et al., 2014).

Water's life-giving and destructive capacities have had powerful symbolic meanings for diverse cultures and societies (Strang, 2015). As Strang (2004) recommends, there is a need to pay attention to people's relationships with water, which is considered meaningful and mediated through learned cultural experience (Strang, 2004). These experiences with water and the meanings attached have altered how people relate to their waters (Strang, 2005; 2004). Humans' engagement with water is experienced and interpreted within different cultural contexts - the meanings from people's experiences with water are socially constructed and culturally specific.

The interactions between humans and water are manifested through water usage and contact with water flow. From the healing wells of prehistoric societies to contemporary water uses, it provides direct sensory experiences, compelling visual images, and the creation of cross-cultural meanings. For example, water in different societies is believed to cure the infertility of the barren, provide healing for the sick, hold the "image" or "spirit" of a person, or even worshiped as a god with the power to invoke punishments, including deaths for wrongdoers (Strang, 2004; 2005). These cross-cultural meanings hold water not just as a mere physical resource but as

something that is densely encoded with social, spiritual, political, and environmental meanings that can shape the lives of those who engage with it. An understanding of the relationship between the physical, sensory, and cognitive potentialities that people share with water, and the specific sociocultural contexts that different groups inhabit and construct from the engagement with it, can affect the patterns of water use and the relationships between water users and suppliers (Strang, 2005; 2004).

People's subjective experience with water, therefore, creates multidimensional meanings, and these play critical roles in the way water is perceived, valued, and managed in different societies. This has implications not only for how water is used and managed but also for the protection of water resources. For instance, the cultural and spiritual meanings attached to water by some indigenous communities perceive water as sacred. In some places, water is considered a god and is mostly worshipped (Strang, 2004). In such places, responsibilities lie on water users to keep it clean and holy. For instance, the meanings attached to water and other natural resources in Ghana have implications on the use and management of such resources.

In some cases, people who are considered unclean are even banned from going near water sources for fear of invoking contaminations (Wagner, 2013). This has implications for water use, conservation, and protection of water resources. There are also meanings encoded in the physical properties of the water source in some communities. The sense of smell, along with the taste of water, for example, enables people to evaluate water quality (Strang, 2005). Such meaning encoded in water gives local communities a sense of responsibility to protect their drinking water sources from pollution.

The meanings embedded in water also influence the daily practice of rural water management (Mollinga, 2011). They exert a powerful influence over every decision involved in

water use and form an in-depth rationale for increasing usage levels. They shape human actions towards water resources and vice versa (Ingold, 2000). Contemporary management practices are, however, couched in western and scientific knowledge. This can be explained by Ingold's (2000) "etic" viewpoint, where water is managed based on its physical (biological) properties separate from its local contexts. This view implies that people's actions should be judged by how they use water resources. The result is that there are new ways of water management, including commodification, privatization, and different forms of water grabbing with its associated effects on local water users.

Considering the meanings encoded in people's experience with water, a dialogue between expert and local knowledge can be crucial for implementing effective community water management. As the Aarhus Convention declares, local judgments are as good as experts' judgments and, therefore, should be rightfully considered in environmental decisions (UNECE, 1998). This places responsibilities on policymakers to look at water management from the "emic" viewpoint where people's interactions with water resources and meanings encoded in local knowledge are considered in water management decisions. This implies that water cannot be managed as organic nature, but rather the diverse ways in which the constituents of water are imagined or are cognized in the worlds of cultural subjects.

Incorporating societal values into the provision of water facilities and services does not only contribute to the usage of such services but also solicits community support and participation in planning, implementing, and managing such facilities. In cases where personal preferences are not considered in providing water services, consumers tend to rely on alternative sources for their water needs, including relying on unmonitored sources and sometimes purchasing from expensive sources (Goldhar et al., 2013). In order to meet the preference of communities in providing

drinking water services, the location of water facilities, the color, and taste of water should be factored into the design and implementation of such water facilities and services (Goldhar et al., 2013).

Inasmuch as it is important to consider community desirability in providing drinking water services, it is equally necessary to understand the beneficiaries' perceptions. Understanding public perceptions, just like preferences, determines the extent to which the communities are willing to support the proposed water project or service. Public perceptions affect the extent to which policies, programs, and projects designed to solve drinking water challenges operate. Daeman (2015) suggested three principles that guide the appreciation and understanding of public perceptions.

First, local communities understand their contexts better than outsiders, which implies that any external assistance that does not make use of community experience and perception will face challenges and be less effective. For example, communities know places that are held for cultural purposes and, therefore, will not recommend such locations for providing water facilities. The provision of water projects or services in such locations may affect the usage of such a project. Second, understanding perceptions reveal processes that help communities respond to external interventions to address drinking water challenges. Finally, appreciating local perception avoids the challenge of imposing inappropriate programs and projects on beneficiary communities. Such may also affect community participation in the implementation and management of the project. It also affects the usage of such facilities.

Divergent local perspectives on water exist, which makes it imperative to consider that for effective water management. An excellent point to start with is to consider what kind of arrangement would cohere rather than conflict with the meanings and values encoded in water.

Water management practices should be adapted to specific cultural, social, spiritual, political, and environmental conditions as they constitute distinct systems of knowledge and behavior. Water resources management strategies must take such conditions fully into account, considering people's relationship with water. For most indigenous communities, such relationships go beyond the physical properties of water. As the essence of all life, water is sacred, and its control by external profit-making agencies, for example, is a violation, and in some societies, a loss of control over water resources implies a loss of something that is symbolically integral to their own identity (Strang, 2005; 2004). A lack of access to water indicates poverty, social exclusion, and loss of power. The exclusion of indigenous people from collective ownership of water can, therefore, result in resentments and resistance from those affected (Rasmussen and Orlove, 2014).

2.9 Sustainability of Water Resources and Systems

The sustainability of rural water supplies remains problematic in most Sub-Saharan Africa countries, including Ghana (Adank et al., 2013). Sustainability in rural water security involves whether water resources and infrastructure continue to meet the users' requirements over time (Lockwood and Smits, 2011). This means that for sustainability to be achieved, emphasis should be on paying attention to water resources and water systems components.

To enhance the achievement of sustainability, water resources must be managed sustainably to ensure that people's requirements in terms of social, economic, and environmental needs are sufficiently met (MDGMONITOR, 2016). Investing in environmental assets and management is vital to cost-effective and equitable strategies for achieving natural resources' sustainability (Sachs and Reid, 2006). Investment in an improved and safe water provision

practices, for instance, has positive effects on water resources and the health and safety of households (WHO, 2017).

Ensuring the sustainability of water resources and water systems remain vital to achieving sustainable development. Water is fundamental to the three dimensions of sustainable development, which include social needs, economic development, and environmental limits. It also serves as a cross-cutting driver across different sectors (UNESCO-IHP, 2014). Water is also considered a finite and irreplaceable resource that is fundamental to human well-being, with the notion that misuse and scarcity of freshwater resources pose a major challenge to achieving sustainable development (Gorre-Dale, 1992). The human use and pollution of freshwater resources have reached a level that threatens water resources' sustainability.

Water scarcity and water quality degradation can potentially limit food production, reduce ecosystem functions, and hinder economic growth (UNESCO-IHP, 2014). It is estimated that more than 1.7 billion people live in river basins where depletion through use exceeds natural recharge, and a trend in this occurrence has been projected to result in two-thirds of the world's population living in water-stressed countries by 2025 (UNDESA, 2014). In addition, depletion of groundwater levels in weathered aquifers coupled with an insufficient recharge of fractured aquifers often results in dry boreholes in most rural communities in Ghana (Harvey, 2004).

The past decades have seen much pressure mounted on freshwater resources. Policy experts attribute this change to demographic growth, urbanization, higher consumption levels, and climate change. These changes have increased the global demand for water resources, with withdrawals estimated to have tripled within these past decades (UNESCO-IHP, 2014). Agricultural remains the highest demand for freshwater resources aside from industrial and domestic use and accounts for about 70% of the total global freshwater use (WWAP, 2012). Freshwater required for domestic

needs constitutes minor proportions (10%) in the overall total water withdrawals (UNDESA, 2014; UNW-DPAC, 2015). Despite this minor proportion, many countries are still faced with water stress and unable to meet the drinking water needs for domestic purposes. For instance, in 2011, 41 countries experienced water stress, and ten of these countries were closed to depleting the supply of freshwater renewal (UNDP, 2018). There is a projection that the number of people likely to be hit by water shortage will increase in the coming years, and by 2030, half of the world population will be living in high water-stressed areas (UNEP, 2007). At least one in four people will be affected by recurring water shortages by 2050 (UNDP, 2018).

Protecting and restoring water-related ecosystems such as mountains, forest areas, wetlands, and water bodies is essential to mitigating water scarcity and achieving sustainable development (UNDP, 2018). This is critical to achieving drinking water security for the present and future generations. What has been common in an attempt to promote water security is the focus on meeting the needs of households without adequate considerations of the water resources which are being used (Lankford et al., 2013). A global vision and worldwide commitment are consequently needed to tackle the world's current and emerging water problems, especially water resource sustainability. This calls for serious attention to overexploitation of freshwater resources, the growing water pollution problems worldwide, and water-related risks. Achieving sustainability of water resources will help articulate the inseparability of societal welfare and ecosystems and the need to pay attention to each of these variables in policy decisions (Hassan et al., 2005).

Aside from the limited attention to water resources in water security discourses, limited rural capacity affects how water infrastructure is sustained in Sub-Saharan Africa. Similar to Adank et al.'s (2013) approach, this study measures borehole sustainability based on a borehole's ability to provide an indefinite water service with specifically agreed characteristics over time.

Even though no internationally agreed indicators exist for measuring the sustainability of rural water supply systems, Adank et al. (2013) note that this is usually affected by a range of factors that contribute to the likelihood of water service to exist over time. These include the technical attributes of the system, the financial, institutional, and managerial capacities of water managers. These factors affect effective supervision that is further downloaded to the quality of workmanship on operation and maintenance of handpump boreholes, hence their sustainability (Harvey, 2004).

Lockwood and Smits (2011) estimate that just a little over one-third of handpump boreholes function in most rural communities in Sub-Saharan Africa. Harvey (2004) describes this non-functionality as borehole failure. According to the author, the term refers to a situation in which a borehole, which is deemed successful at the time of drilling, subsequently fails to deliver a sufficient yield of safe water throughout the year. Borehole failure may occur because of depletion of aquifers or insufficient recharge of fractured aquifers, corrosion of casing and screens, sand pumping due to siltation, and structural collapse of casing and screens (Driscoll, 1986; Harvey, 2004).

2.10 Summary of the Chapter

The chapter has provided the conceptual framework guiding this dissertation's analysis, focusing on three main areas. First, the chapter outlined the context of defining rurality to form the basis of selecting this study's geographical scope. To distinguish between the rural and urban level of development, the chapter argues from the perspectives of Urban Bias Theory to make a case for why rural Ghanaians are more water insecure compared to urban households.

Second, the chapter provided a comprehensive analysis of how rural water security is conceptualized for this study. This assessment outlined six pre-defined dimensions: availability,

access, safety, management, sustainability, and preferences. Considered as the most crucial factor in water security, I discussed water management by focusing on how water is managed in rural Ghana, including the historical trajectories and challenges. I made a case for the need to enhance water security, particularly for rural dwellers, with less emphasis on market benefits and more emphasis on distributive and procedural justice during rural water infrastructure provision. In addition, I provided a detailed assessment of each of the five pre-defined dimensions of water security, which helped provide the basic indicators for data collection and analysis.

Finally, the chapter identified those who constitute the marginalized population in this study. As part of this, I explained why women, girls, and PWDs are regarded as the most marginalized populations in rural water collection, use, and management in Ghana.

CHAPTER THREE

COMMUNITY PROFILE, RESEARCH DESIGN, AND METHODOLOGY

3.1 Introduction

This chapter provides detailed descriptions of the study communities, the choice of research design, and the study's methodology. The chapter explains the framework through which the study has been organized from the design stage through the stages of data collection, analysis, and reporting (Figure 3.1). It also justifies the chosen research methods, types, and sources of data, as well as the processes and procedures for data collection, analysis, reporting, and management.

Considering the study requires collecting and using qualitative and quantitative data, the chapter explains the mixed methods approach and how it was employed in the study. These include the distinct type of qualitative or quantitative data, sources, and approaches for data collection, the analytical procedures, and means of achieving reliability and validity. Furthermore, the chapter outlines and defines the procedural issues for both the study's quantitative and qualitative methods, which include prioritization, timing, or implementation of the strands and integration decisions.

Finally, to ensure that the study participants are protected and achieve a power balance between the researcher (myself) and the research participants, the chapter provides detailed descriptions of the ethical procedures adopted and the interplay of positionality and power relations during the field data collection.

3.2 Geographical Scope and Selection of the Study Communities

The research took place in three (3) rural communities in Ghana: Esereso and Wabrease, located in the Sunyani West District in the Bono region, and Wioso in the Sekyere Kumawu District in the Ashanti region (see Figures 3.1 and 3.2).

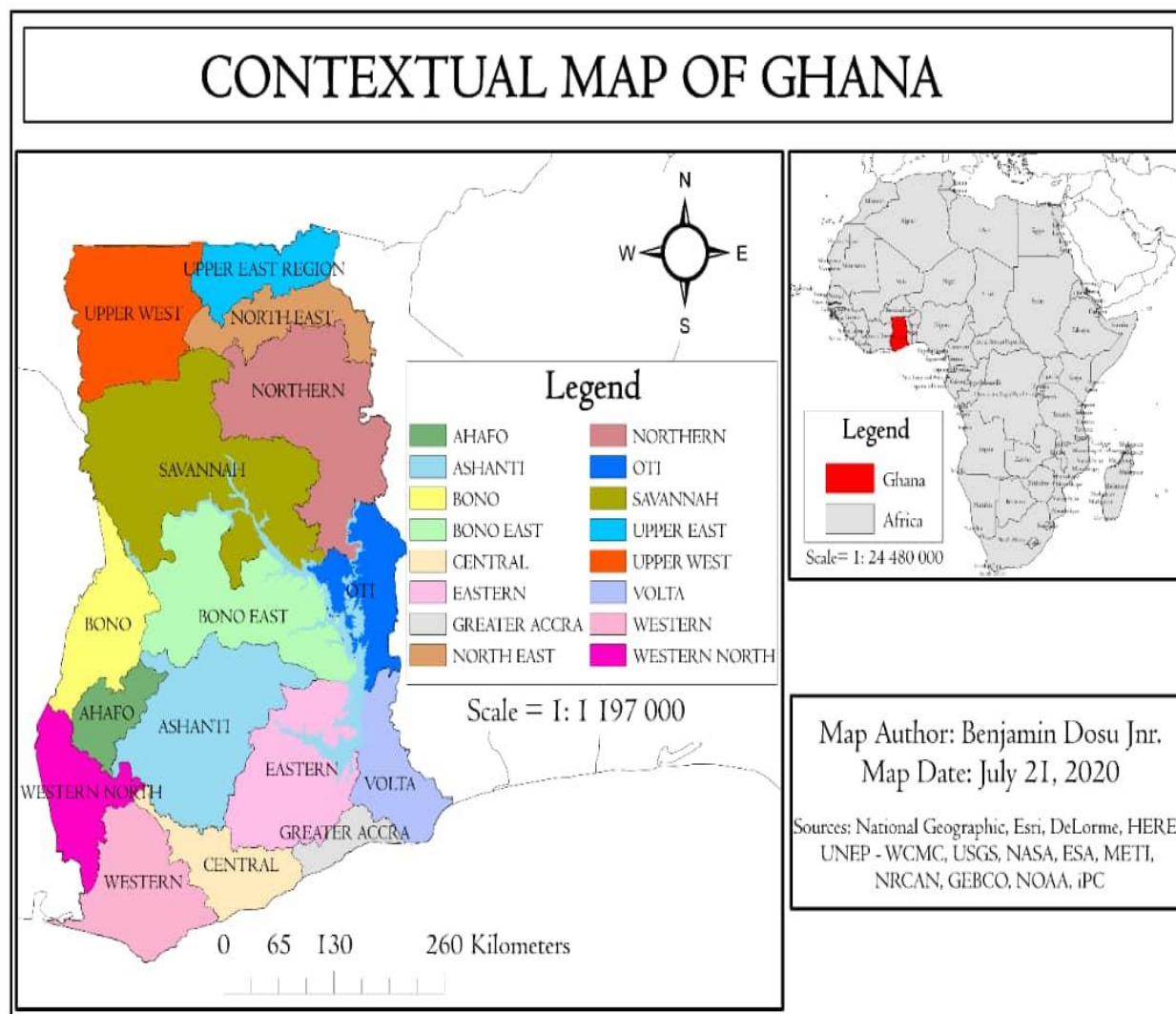


Figure 3.1: Location of Ghana in Africa

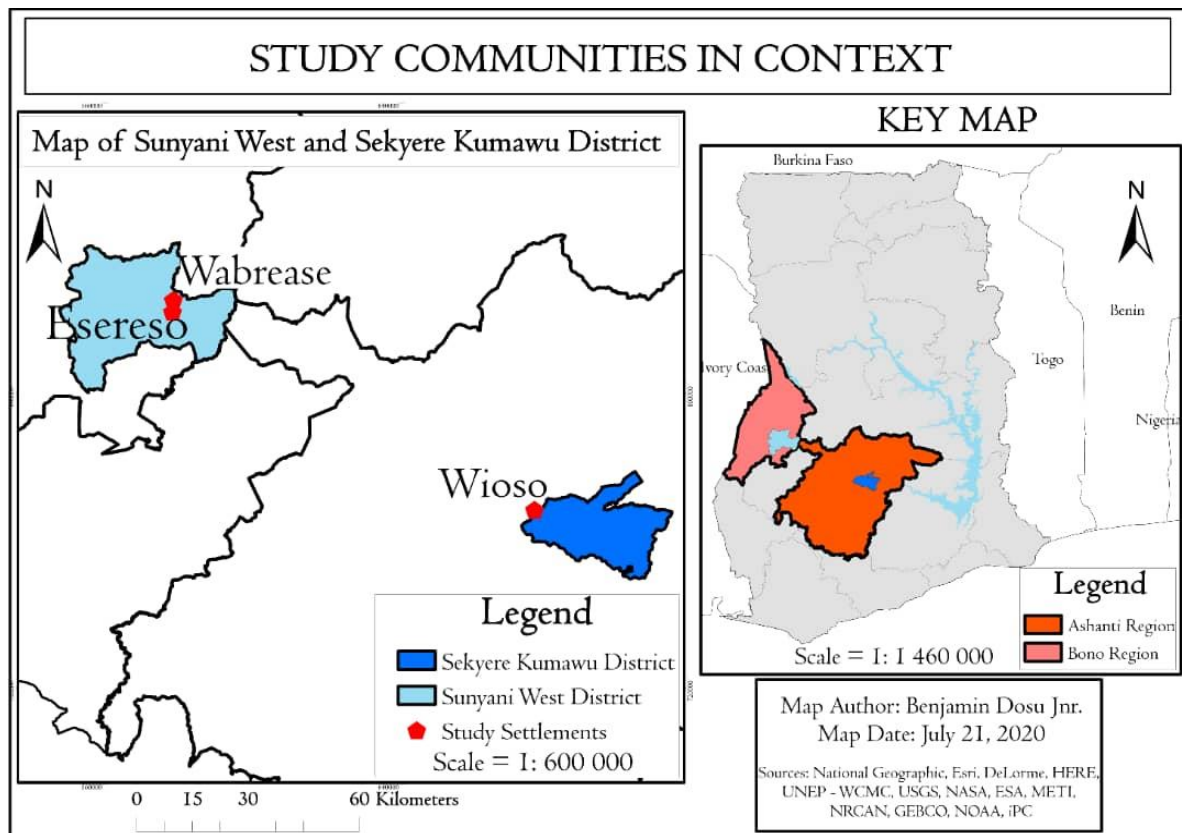


Figure 3.2: Locations of the study communities

3.2.1 Selection of Study Communities

Ghana has a rural population of 12,113,594, accounting for about 49% of the country's total population (Ghana Statistical Service, 2012). The Ghanaian population was distributed across the then ten main administrative units comprising 216 metropolitan, municipal, and district assemblies (MMDAs)⁵. MMDAs represent the highest political, legislating, budgeting, and planning authority

- ⁵ A metropolis is a local government unit or area with a minimum population of 250,000 people;
- A municipality is a single compact settlement with a minimum population of 95,000 people; and
- A district is a local government unit or area with a minimum population of 75,000 people (Stiftung, 2016).

at the local level (Stiftung, 2016). After a referendum in December 2018, six additional regions were created, making it 16 in total.

Table 3.1: Ghana's Rural Populations by Region

Region	Total Rural Population	Percentage of Rural Population (%)
Ashanti	1,883,090	15.5
Brong Ahafo	1,282,510	10.6
Central	1,163,985	9.6
Eastern	1,489,236	12.3
Greater Accra	379,099	3.1
Northern	1,728,749	14.3
Upper East	826,899	6.8
Upper West	587,457	4.8
Volta	1,404,517	11.6
Western	1,368,052	11.3
Total	12,113,594	100

Source: Ghana Statistical Service (2012)

The study communities' selection was aided by the national database of the Community Water and Sanitation Agency (CWSA) – a national agency responsible for rural water supply and management. This database ranked the then ten regions in Ghana based on rural water coverage in the various MMDAs. Although coverage does not imply water security, the existence of data on rural water coverage offered the best means of identifying communities with or without a drinking water facility. Rural water coverage is measured by the existence of either of the following water facilities; boreholes (BH), hand-dug wells (HDW), small community pipe systems (SWPS), and rain harvest systems (RHS) (Table 3.2).

Table 3.2: National Rural Water Coverage

Region	Number of Communities	Facilities				Rural Coverage	
		BH	HDW	SCPS	RH S	Population Served	Rural Coverage (%)
Ashanti	3,059	5,420	248	1	4	2,413,366	58.14
Brong Ahafo	3,550	3,352	427	2	0	1,473,890	65.37
Central	3,589	2,144	460	14	79	1,560,342	64.59
Eastern	3,328	2,958	1,140	0	15	1,330,234	57.29
Greater Accra	1,104	521	103	8	0	553,604	62.28
Northern	4,227	4,730	597	2	0	1,719,924	62.10
Upper East	2,193	2,879	512	0	0	954,335	66.37
Upper West	981	1,892	0	2	0	576,152	77.81
Volta	3,275	2,506	56	75	9	1,414,791	64.61
Western	2,047	1,865	451	24	0	1,027,897	56.31
Total	27,353	28,267	3,994	128	107	13,024,535	62.03

Source: Community Water and Sanitation Agency (2016)

Due to the limited resources, the study focused on three selected rural communities to form the research scope. Based on the available database and recommendations from the CWSA, I selected two different districts from two regions – Sekyere Kumawu and Sunyani West districts in the Ashanti and Brong Ahafo (Currently Bono) regions, respectively (Figure 3.1). The selection of districts from different regions was meant to ensure data validation and regional diversity in the selected participants.

I selected the specific rural communities with assistance from the officials from the District Water and Sanitation Teams (DWST) in the two districts. Using reported cases on communities with challenges in drinking water security as the basis, I identified all the communities which had been water insecure within the past 12 months. Assigning different numbers to each of the identified communities, I randomly selected the study communities – Esereso and Wabrease - from Sunyani West District in the Bono region and Wioso from the Sekyere Kumawu District in the Ashanti region.

3.3 Research Design of the Study

The research design refers to the framework of methods and techniques for collecting, analyzing, interpreting, and reporting data of a study (Ivankova et al., 2007, 58). It also includes the criteria for evaluating social research (Bryman, 2016). The research design, therefore, provides a framework that outlines the type and sources of data, means of collecting and analyzing the data, and how these serve to answer the set research question(s) or achieve the research objective(s). Selecting an appropriate research design helps researchers choose appropriate methods and helps set up the logic by which researchers make interpretations at the end of the studies (Creswell and Plano Clark, 2011).

The study sought to collect and present detailed information about households' water security experiences in the selected rural communities – Esereso, Wabrease, and Wioso (Figure 3.3) and explain the policy implications for such experiences. This study's contextual nature made it imperative to apply a case study research design involving a cross-sectional study. This is because the study took a snapshot of the selected households' experiences within the selected cases – study rural communities (Bryman, 2016). The adoption of the case study approach offered a profound understanding of the studied phenomenon, either in the context of a specific instance or generalized over a population (Haye et al., 2015; Yin, 2017). The approach is particularly useful in answering "how" and "why" questions within a particular geographical context (Yin, 2017; 2014), and is associated with both theory generation and testing (Bryman, 2016). The case study structure was based on the problem, the context, the issues, and the lessons learned from the communities' experiences in drinking water security.

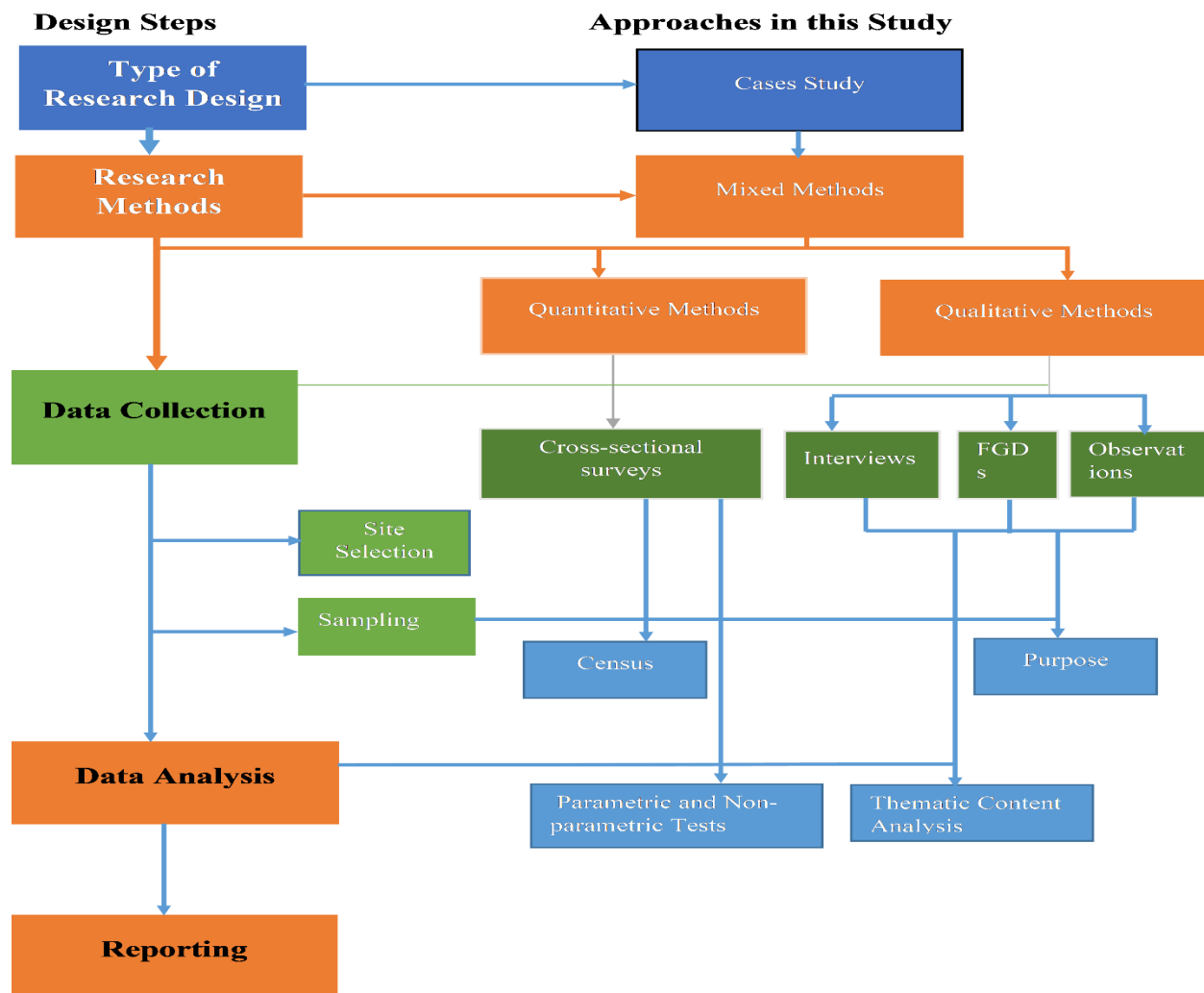


Figure 3.3: Research Design and Methodology

Source: Author's Construct (2020)

3.2.1 Philosophical Stance

The philosophical assumptions that guided this study's design constitute the beliefs that dictate the study's approaches. Indeed, how a study is conducted depends upon a range of factors, which for this study, include the researcher's beliefs about the nature of the social world and what can be known about it (ontology), the nature of knowledge, and how it can be acquired (epistemology), the objective(s) of the study, and the characteristics of the researched (Ritchie et al., 2013, 14).

The questions of ontology are concerned with the positions of objectivism and subjectivism. The former constitutes whether social entities can and should be considered objective entities that have a reality external to social actors. At the same time, the latter is concerned with whether such social entities can and should be considered social constructions, built up from the perceptions and actions of social actors (Bryman, 2016). These positions imply that human experiences can either be studied independently from the actors involved or through constructed meanings and interpretations of the actors (Ritchie et al., 2013).

The epistemological stance focused on the means of knowing about reality and what constitutes the basis of knowledge (Bryman, 2016; Ritchie, 2013). An epistemological issue is often associated with what is or should be regarded as acceptable knowledge in a discipline (Bryman, 2004). Ritchie et al. (2013) outline three issues that surround the debates on epistemological stance. The first consideration argues that social research is affected by interactive processes between the researcher and the researched, making it difficult to achieve value-free research, unlike the natural sciences. Given this, the "empathic neutrality" position has been suggested for social research. This recognizes that social research cannot be value-free but should be transparent. Secondly, there is a distinction between the theory of truth in the natural sciences and the social worlds. While the former commands a match between observations of the natural world and independent reality, the latter suggests that independent reality can be achieved in a consensual rather than absolute way. Finally, there is a debate about a choice between inductive and deductive reasoning. They argued that this distinction does not have a clear cut as to which approach works for a particular research method but rather highlights how different beliefs give rise to different research practices.

As Richardson (1996) argued, it is difficult to combine ontological and epistemological assumptions in a single study. Given this, researchers are encouraged to appreciate pragmatism in choosing the appropriate research methods for a particular study rather than dwelling on the underlining philosophical stance. Furthermore, qualitative and quantitative approaches should not be seen as conflicting but rather complementing strategies appropriate for different types of research questions (Ritchie et al., 2013). The study, therefore, adopted a combination of the two views. This was based on the belief that there is a natural world that can be studied in structured ways. In this case, the selected participants acted as social objects to modify and interpret their surroundings. This was supplemented by constructed meanings and interpretations that were useful in assessing households' drinking water experiences in the study communities. The study did not only test hypotheses but also assessed the households' experiences through interpreted meanings.

3.4 Research Methods

The study employed mixed methods approach. Given this, both qualitative and quantitative approaches were used in data collection, analysis, and drawing of inferences (Tashakkori and Teddlie, 2003). As Ritchie et al. (2013) noted, both qualitative and quantitative methods do not calibrate exactly but provide the different ways each method contributes to understanding the research question. This suggests that mixed methods provide an approach for research questions that cannot be answered by using only a quantitative or qualitative approach alone.

This strategy's strength is that the weakness of one approach will be compensated for by using an alternative method (W. Creswell and D. Creswell, 2017). For instance, qualitative methods could be employed in areas where quantitative methods are inapplicable and vice versa. The strategy also allows for a better understanding and interpretation of the data and a better

understanding of drinking water security/insecurity in rural Ghana. It gives insights into trends for generalization and also meanings and perspectives of research subjects. This was useful in providing a more comprehensive insight than using either of the methods alone and an expanded understanding of the research problem (Creswell, 2013).

To ensure that both the qualitative and quantitative data were collected concurrently during the data collection, I employed a mixed-methods concurrent triangulation strategy. This strategy allowed both the qualitative and quantitative data to be collected at the same time. The aim was to compare the convergence, the differences, or the combinations of the data and establish the relationships between these different data types (Creswell, 2013). Collecting the data simultaneously also saved time and the resources that would have been needed to go back to the field to conduct the second phase of either of the two methods (Creswell, 2013). Where necessary, additional data were collected to resolve any discrepancies that arose from the combination of the two methods simultaneously (Creswell and Planor Clark, 2007 cited in Creswell, 2013).

3.4.1 Quantitative Methods

Quantitative methods involve the techniques associated with gathering, analyzing, interpreting, and presenting numerical information (Tashakkori and Teddlie, 2009). Quantitative researchers employ strategies of inquiry, such as surveys, to collect numerical data on pre-determined instruments. It allows such numerical data to be analyzed statistically. Quantitative techniques have the strength of producing quantifiable and reliable data, which can potentially be generalized in a larger population (Bryman, 2016). The technique was applied to the study's objectives and sub-objectives with numerical values. These include the household's income and expenditure; distances and time travel for water collection; and the quantity of drinking water collected and

used (Appendix A). This study's quantitative method went through three main stages: determination of sample size, data collection using semi-structured survey questionnaires, and data analysis involving both descriptive and inferential statistics.

3.4.2 Qualitative Methods

Qualitative methods are the techniques involving collecting, analyzing, interpreting, and presenting narrative information from research participants (Tashakkori and Teddlie, 2009). These methods allow researchers to observe or interact with participants to provide an in-depth understanding of the phenomenon under study. Qualitative research aims to achieve an in-depth and interpreted understanding of research participants' social world by learning about their social and material circumstances, experiences, and perspectives (Ritchie et al., 2013). This provides rich and detailed descriptions of the meanings from participants' perspectives and explanations to the reasons behind the phenomenon (Creswell, 2016). Like the quantitative methods, the qualitative approach used in the study involved two main stages. The first stage constitutes data identification and collection using document analysis, in-depth interviews (Appendix B and E), focus group discussions (FGDs) (Appendix C), and observations (Appendix D) (Ritchie et al., 2013). The second and final stage involved the analysis of the study data. Since some of the study's objectives have no numerical variables, the qualitative strategy helped meet these objectives.

3.5 Data Collection: Fieldwork

The research involved multiple strand studies in achieving its objectives and, therefore, required multiple types and sources of data (Tashakkori and Teddlie, 2003). Both the primary and secondary data were collected through field data collection and literature reviews, respectively. The primary data were collected from three main sources: government agencies, households, and

key informants in rural communities using quantitative and qualitative approaches. These approaches included cross-sectional surveys, in-depth interviews, focus group discussions, and observations.

The fieldwork activities in Ghana took two different phases. The first phase involved a trip to Ghana in Summer 2018. This visit was made to the various government agencies in charge of rural water management and was aimed at identifying and selecting the appropriate communities to form the scope of the study. Three communities from two different districts were selected with the aid of institutional data and consultations. The second phase, which occurred between June/July 2019, constituted the actual field data collection.

Out of the five weeks, I used 21 days for the household data collections, including 158 surveys, 19 household in-depth interviews, four key informant interviews, ten interviews with people living with physical disabilities, and two focus group discussions. In addition, I used the same periods to observe the activities involving drinking water collection at the community levels. The remaining days were used for interviews with the selected government officials.

3.5.1 Training of Field Research Assistants

The fieldwork was conducted over five weeks. To assist with data collection, I employed two field Research Assistants (RAs). The main responsibilities of the RAs included visits to institutions to set the pace for the actual data collection, design of survey questionnaires using the required software, and provision of assistantship during the data collection. I provided training and orientation to the RAs regarding the content of the survey questionnaires and other things that were required for the data collection. This provided a useful platform to resolve issues that were likely to arise during the fieldwork.

3.5.2 Determination and Recruitment of Study Participants

Sample sizes were determined for household surveys. The sample size determination was based on the statistical data from the two district assemblies. I obtained the master list of the total population and the number of households in the selected communities to form the sample frame (see Table 3.3).

Table 3.3: Sampled Households from the Study Communities

Community	Population	Number of Households	Number of Households Surveyed	Respondent Rate (%)	Number of Households Interviewed	Number of People with Disabilities (PWDs) Interviewed
Esereso	420	75	40	53	6	3
Wabrease	457	81	47	58	5	2
Wioso	551	120	71	59	8	5
Total	1,428	276	158	57	19	10

Source: Field Data (2018)

As there were only 276 households combined in the three communities, I used a census approach for recruitment purposes. This approach allowed all households to be sampled to achieve a desirable level of precision and helped eliminate sampling error (Israel, 1992). The study captured about 57% of household participation, which exceeded the minimum requirement of 30% in a census approach, as recommended by Neuman and Robertson (2007). Even though one-fifth of the surveyed households (31) were targeted for in-depth interviews (Tashakkori and Teddlie, 2009), 19 households participated in the study.

Despite targeting households' heads as the sample unit, I gave the selected households the option to identify a person to represent them. This person constituted the one who made decisions about water collection and uses in the household. This ensured the inclusion of women in the study. In rural Ghana, a household is defined as either a private or multi-person household (Randall et

al., 2015). A private household constitutes a person who lives alone in a separate housing unit or who, as a lodger, occupies a separate room or rooms in a part of a housing unit. The multi-person household comprises of two or more persons who combine to occupy the whole or part of a housing unit and provide for themselves, food, or other essentials for a living (Randall et al., 2015). It is common to find more than one household within a house in rural Ghana.

Vulnerable populations, including people with physical disabilities, were purposively targeted for inclusion in the study using a snowball sampling method. To be included in the sample, potential participants had to have been permanent residents of one of the study communities for at least 12 months prior to the survey date and had to be at least 18 years old, the age of majority in Ghana.

It is important to note that officials from government agencies and community key informants were also purposively selected. The key informants have a stake and extensive knowledge regarding community-based water management in their respective rural areas.

Recruitment of People with Disabilities

People with disabilities (PWDs), according to the United Nations (2006), include those who have long-term physical, mental, intellectual, or sensory impairments, which in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others. These factors are also mirrored in the *Ghana Persons with Disability Act* (Act 715) s.59(Gh.). In addition, section 59 of the *Act* pays attention to reducing the physical, cultural, or social barriers that substantially limit one or more of individuals' major life activities ((Republic of Ghana, 2006, s.59).

Although the magnitude of impact engendered from interaction with various barriers to safe drinking water is similar to everyone, the selection of PWDs focused only on people with physical or sensory disabilities. These limitations hinder the person from performing tasks of daily living, including accessing drinking water.

The assessment was, therefore, based on the visible and physical conditions such as visual impairments, amputations, or any other physical conditions that could potentially make it difficult for water collection. These physical conditions are considered disabilities because they do not allow those with such conditions to engage in day-to-day activities in the same ways as other people (Pradhan and Jones, 2008). Indeed, given the labor-intensive nature of water collection in rural Ghana, it is imperative to give voice to the people in this category.

Furthermore, I assessed disability based on the reported limitations in the core functional domain in water collection (such as walking, fetching, and hauling) using Mactaggart et al.'s (2018) 4-point scale: no difficulty, some difficulty, a lot of difficulties, and cannot do at all. Even though my target was to include all persons with physical and sensory (visually impaired) disabilities within the selected study communities, I encountered difficulties identifying them due to the social stigma associated with disabilities (Ocran, 2019).

Through referrals by community leaders and members, I selected ten participants, including three from Esereso, two From Wabrease, and five From Wioso. Even though I planned to excuse those who would express discomfort about participation, all the people selected participated in the study without any refusal.

Table 3.4: Characteristics of People with Disabilities

Participant	Limitations in Water Collection	Age	Sex	Marital Status	Number in the household	Employment status
1	A lot of Difficulties	44	Female	Divorced	5	Economically Inactive ⁶
2	Cannot do it all	80	Male	Married	9	Unemployed
3	Cannot do it all	60	Female	Single	1	Economically Inactive
4	Cannot do it all	35	Female	Single	4	Economically Inactive
5	A lot of Difficulty	26	Male	Single	1	Economically Inactive
6	A lot of Difficulty	23	Male	Married	1	Economically Inactive
7	Cannot do it all	20	Female	Single	1	Economically Inactive
8	Cannot do it all	55	Female	Single	2	Economically Inactive
9	Cannot do it all	44	Male	Single	2	Economically Inactive
10	Cannot do it all	48	Male	Married	2	Economically Inactive

Source: Field Data (2019)

3.5.3 Community Entry and Data Collection Activities

To ensure that community protocols were observed, I adopted a community entry technique to access each study community. This constituted obtaining formal permission from the gatekeepers, including local chiefs and community leaders (specifically the assemblyman/woman or the unit committee head). The aim was to ensure that appropriate community protocols were observed

⁶ Economically inactive people are those who are not eligible to work due to either physical and mental conditions or the stages of their development. E.g., young people in school, the aged, some persons with disabilities (Ghana Statistical Service, 2016).

before the data collection. During such engagements, I explained the study's purpose and learned about the necessary "dos" and "don'ts" of each community. These included some cultural norms and taboos in each community. Even though the leaders of the selected communities had expectations of the study's outcome, I overcame that by explaining the purpose of the study in detail.

Household data were collected cross-sectionally in three phases, the first of which involved deploying a common survey instrument. In the second phase, I used in-depth interviews and focus group discussions to add depth and richness to the survey data. I selected the participants of in-depth interviews based on the issues identified during the first phase. These include gender participation in water collection, female-headed households, and men who live alone as a household. The interviews focused on the qualitative experiences of households in water collection, use, and management. I administered the survey questionnaires and conducted the interviews in the study participants' preferred language – all members of the field research team are fluent in several of the local languages – but the information collected was translated into English for subsequent analysis. To ensure that errors were minimized, I reviewed the responses from each participant after every data collection.

The household data collections were conducted on a door-to-door basis and based on the household's availability and willingness to participate in the study. Since farming is the main economic activity for most households in the selected communities, I targeted days (Fridays), which were forbidden for farming activities in each rural community, and Sundays, which serve as days of rest for Christians. The remaining days targeted households who were available. The surveys and in-depth interviews were carried out throughout the day.

Participants were asked to read and sign the informed consent letter before the community survey and the interviews (Mitchell and Drapper, 1983), and when participants consented, the interviews were audiotaped and transcribed *verbatim* (Creswell, 2005). The data collection process involved asking questions of non-personal nature before proceeding to the sensitive ones. This helped put respondents at ease and build up confidence and rapport with the participants.

Piloting of Data Collection Instruments

To assess the accuracy, thoroughness, and effectiveness of the survey questionnaire, I conducted a pre-test with ten households in Esereso in the Sunyani West District. This was also intended to help estimate the time needed to complete a survey and an interview. The results of the pre-test were not included in the final study. Based on the pre-test, sections of the questionnaire were revised where appropriate (Schulz et al., 1998). Revisions included changes in wording, the framing of statements, and structuration. This reduced statements that were considered complex, opened to interpretations, and leading in nature.

Community Surveys

Using survey questionnaires, I conducted cross-sectional surveys in the three selected communities, namely, Esereso, Wabrease, and Wioso, at a respondent rate of 53%, 58%, and 59%, respectively (Table 3.5). This was higher than the initial target of 30% of the households, which was required to represent all households in the selected communities. The cross-sectional survey allows researchers to collect data to make inferences about a population of interest at one point in time (Hall, 2008). Together with the RAs, I surveyed 158 households, accounting for 847 (Table 3.5) individuals in total, and captured the field's data using a software application designed for

Android devices called Census and Survey Processing System (CSPPro). It took an average of 40 minutes to complete a survey.

Table 3.5: Descriptive Characteristics of Individuals in the Study Households (N =847)

Socio-economic Parameters		Sunyani West		Sekyere Kumawu	
		Esereso and Wabrease		Wioso	
		Frequency	Percentage	Frequency	Percentage
Sex	Male	249	51.6	172	47.3
	Female	234	48.4	192	52.7
Age	0-5	42	8.7	38	10.5
	6-15	131	27.1	115	31.7
	16-18	51	10.6	35	9.6
	19-60	235	48.7	150	41.3
	61+	25	5.0	25	6.9
Ethnicity (First Language)	Ashanti (Twi)	8	1.7	301	82.9
	Bono (Bono)	75	15.5	0	0
	Dagaati (Daaare)	244	50.5	41	11.3
	Frafra (Frafra)	104	21.5	0	0
	Lobi (Lobi)	46	9.5	0	0
	Others (Other)	6	1.2	21	5.8

Source: Field Data (2019)

The questionnaires, which contained both closed and open-ended questions, had two main sections (Appendix A). The first section constituted the demographic and socio-economic information about households, while the second section collected data on the community experiences in drinking water security/insecurity. The questionnaire section on household water security was categorized into the six pre-defined dimensions involving availability, access, safety, community preferences, management, and sustainability. These dimensions were based on a set of benchmarks that were based on a minimum level of service (rudimentary service) as prescribed by both national and international standards, including existing guidelines and technical literature. Some of the data that were not in the numerical form were quantified for statistical analysis. This was done by ranking or ordering such data using numbers (Tashakkori and Teddlie, 2009). The

categories of responses were sorted, built into numbers, and integrated into the questionnaire in advance for easy classification. For instance, I obtained the participants' perceptions about water quality by ranking them from 1 to 5, with 1 and 5 being excellent and very poor, respectively.

Household In-depth Interviews

Interviews provide means to gauging first-hand information from people who are subjects of particular issues under discussions rather than documentary sources. Face-to-face interviews were conducted with 19 selected households (Table 3.6) and ten persons with disabilities (PWDs) (Table 3.4) with the aid of semi-structured questionnaires. These questionnaires were printed on sheets of paper with spaces available for recording responses from the interviewees. The semi-structured interviews provided the means to pursue more depth in particular areas that emerged for each respondent. Like the survey questions, the interview questionnaire consists of sections divided into six pre-defined water security dimensions with sub-questions under each category. The in-depth household interviews took approximately 25 minutes per household.

Table 3.6 Selected Participants for Households' In-depth Interviews

Participants	Esereso		Wabrease		Wioso	
	Males	Females	Males	Females	Males	Females
	2	4	1	2	3	7
Total	6		3		10	

Source: Field Data (2019)

During the interviewing process, I employed certain techniques to control the outcome of the interviews. To ensure that responses were captured clearly without any misrepresentations, I adopted attentive skills. Again, I employed open and emotionally neutral body language such as nodding, smiling, looking interested, and making encouraging noises. Finally, the techniques of elaborations, clarifications, and reflections of the participants' remarks helped reduce the

occurrence of ambiguity in both the questions that were asked and the information that was obtained. Efforts were made to avoid the use of "leading" or "loading" questions, which could have influenced the participants' responses (Gill et al., 2008). These techniques were also useful during the key informants and institutional interviews.

Key Informants Interviews

A key informant interview was conducted in each of the selected communities with a local Water and Sanitation (WATSAN) Committee representative. These community water managers were selected for interviews because of their stake and extensive knowledge regarding community-based water management in their respective rural areas. The interview, which lasted for approximately 30 minutes, was conducted using an interview guide. This was also audio-taped when a participant consented. The issues covered included the formation and composition of the WATSAN committees, mandates, functions, and challenges associated with their water management duties.

Table 3.7: Key Informants

Key Informant	Position
Key Informant (Esereso)	WATSAN Committee Member
Key Informant (Wabrease)	WATSAN Committee Member
Key Informant (Wioso)	WATSAN Committee Member

Source: Field Data (2019)

Observation

Fetterman (1998, 34-35) defines observation as "a research method which combines participation in the lives of the people being studied with the maintenance of a professional distance that allows adequate observation and recording of data." Unlike the use of interviews, which are based on answers from the interviewees and could happen under an artificially created environment,

observation allows the researcher to collect data in real-life situations rather than relying on the information provided by the participants. It allows independent verifications of some of the responses from the research participants.

As part of the community data collection, I observed the water collection activities in the selected communities using an observation checklist. These included the distances covered, means of water hauling, the sizes of the containers, the sex composition of water collectors, and the average time of the day for water collection. A rota of activities for these water collection activities was recorded.

Observation has a major limitation of influencing the actions of the observed, especially when they are aware of such observations. Based on this, I did not participate in water collection activities but rather observed independently without the prior knowledge of those under observation. However, informed consent was obtained during the community surveys. This means that only the surveyed households were observed.

Focus Group Discussions (FGDs)

As the name implies, this involves a focus on specific issues, with a group of people participating in an interactive discussion. This is a 60-90-minute interactive discussion and usually consists of six to eight selected participants led by a trained moderator focusing on specific issues (Gill et al., 2008; Hennink, 2013). FGDs provide a convenient atmosphere for study participants to discuss a wide range of issues focusing on a specific objective. FGDs give participants a degree of control not offered by other information and decision-support methods, albeit with direction from a moderator (Hennink, 2013). The group discussion aims not to reach a consensus of the issues under discussion but to provide the selected participants with the opportunity to voice their views. During

the discussions, participants share their views and hear the views of others. This provides an opportunity to refine their views based on what has been shared by the other participants (Hennink, 2013). Participants are allowed to seek clarifications or ask questions regarding what has been shared, which may trigger additional issues or share similar experiences (Boateng, 2012), thus increasing the discussions' clarity, depth, and details.

The FGDs were conducted to fill gaps identified in the interviews. Following Gill et al.'s (2008) advice, the focus groups also allowed information to be gathered concerning attitudes, feelings, and experiences, information that could not be gathered during the household interviews. This provided quality checks and balances on the household interviews, which helped remove false or extreme information. There were two separate FGDs in two of the selected communities – Wabrease and Wioso.

There were eight participants in the FGD held in Wabrease, five women and three men. One of the men has a permanent physical disability. The FGD in Wioso comprised four women and two men. There was no FGD held in Esereso due to recruitment problems. The participants for the FGDs were selected based on issues raised during the household surveys and the interviews. I made efforts to include both men and women. Since women have the primary responsibilities of household water collection and use in rural Ghana, this allowed women to discuss issues that affect them.

Using pre-designed questions to stimulate discussions (Gill et al., 2008), I served as the moderator for the FGDs while one of the RAs took notes. Based on the consent of the participants, the discussions were also digitally recorded. The participants shared similar experiences regarding drinking water in their households and their communities. I probed further to most of the emerging

issues that came up during the discussions, which allowed the participants to elaborate more on such issues.

To ensure that the participants were free to voice out their views devoid of intimidation and being judged by others, I made an effort to create a permissive and non-threatening group environment (Boateng, 2012). The environment was also accessible, comfortable, private, quiet, and free from distractions (Gill et al., 2008). This allowed the selected participants to share their ideas, beliefs, and attitudes within the group of people who shared similar socio-economic characteristics (Gill et al., 2008). The selection of the venue was made in consultation with the community leaders.

3.5.4 Institutional Data Collection

The selected institutions constituted a national and four decentralized government agencies charged with the responsibilities of rural water supply and management. These include the CWSA, the Sunyani West District Assembly (SWDA), the Sunyani West District Health Directorate (SWDHD), the Sekyere Kumawu District Assembly (SKDA), and the Sekyere Kumawu District Health Directorate (SKDHD) (Table 3.8).

Table 3.8: Selected Government Officials

Name of Institution	Position
CWSA	Senior Officer
SKDA	Officer of District Planning and Coordinating Unit
SKDHD	Senior Officer
SWDA	Officer of District Water and Sanitation Team
SWDHD	Senior Officer

Source: Field Data (2019)

The data collection started with an interview with an official from the CWSA in Accra. Using an interview guide, the interview spanned about two hours. Notes were taken in addition to

audio recordings. The interview questions involved national policy issues related to rural water management, including drinking water supply, sources of funds, source water protection, and policy programs for the vulnerable and marginalized people.

Since the four decentralized government agencies are responsible for local development, I completed the households' data collection before the interviews with officials from these local government agencies. The aim was to verify some of the issues that would come up during the community data collection. I conducted four separate in-depth interviews in the two district assemblies.

In SWDA, I had an interview with the District Water and Sanitation Team leaders. Using an interview guide, the officials were asked a series of questions regarding rural water management in the district. I also sought clarification on issues identified from the community data collection. Notes were taken in addition to audio recordings. However, this was not the case with the interview at the SKDA, where the officer declined audio recordings. I used ten days to complete the institutional data collection and interviews. In addition to the in-depth interviews in the district assemblies, I had two other interviews with the DHDs, which involved senior officers in the SWDHD and the SKDHD. These interviews focused on health-related issues associated with rural drinking water insecurity.

3.6 Data Analysis and Presentations

The questionnaires were numbered and coded before the survey for identification purposes. Having collected the data, "a cleaning-up exercise" was done to remove and correct errors that came out during the survey and the interviews. Since the survey data were collected electronically, it was possible to export it to the Statistical Package for the Social Sciences (SPSS) format. For

the quantitative data, cleaning involved replacing missing data, removing outliers, and correcting skewness.

Unlike the quantitative data, I reviewed the responses from the participants after every interview. This minimized errors and helped to overcome the misinterpretation of results (Field, 2005). I also did data recategorizations where necessary. The "refined" data were then subjected to quantitative and qualitative analysis.

3.6.1 Quantitative Data Analysis

The quantitative analysis was performed using the IBM SPSS Version 25 (IBM Corporation, 2017). Descriptive statistics combined with other univariate and multivariate statistics were adopted for data analysis. The analysis involved statistical tests of differences and associations at a 95% confidence level ($P =$ or < 0.05) (Noack, 2018). Both bivariate and multivariate statistical tests of difference and associations were used to compare means and relationships between variables that met normality assumptions (i.e., Pearson's r correlations and One-way Analysis of Variance). In addition, I used the multiple linear regression model to compare the relationship and predictability of the six conceptualized dimensions of rural water security.

When normality was violated for scale or continuous variables, the data were transformed to correct the skewness. The descriptive results of the non-transformed data were, however, reported after the analysis. In addition, appropriate non-parametric tests (i.e., Chi-Square analysis and Mann-Whitney U) were conducted for cases where normality was violated or beyond transformation and for variables with nominal and ordinal attributes. The statistical results were presented in the form of charts and tables.

3.6.2 Qualitative Analysis

Qualitative data analysis software NVivo (version 12) was used for data analysis. The analysis was done using thematic content analysis, categorization, and contextualization (Tashakkori and Teddlie, 2009). A reproductive approach was applied to overcome the limitations of using either a purely inductive or deductive approach (Bradley et al., 2007; Hartig, 2011). This involves a dialogue between ideas and evidence where the latter helps to extend, revise, and test the former, which leads to an understanding of social life (Hartig, 2011). The link between theory and data, therefore, formed the basis of the qualitative approach that was employed in this study, right from the data collection stage to the use of thematic content analysis.

Sorting

Sorting involves organizing data and assigning them to different categories and headings. Sorting helped link together themes that previously seemed disparate. The analysis of qualitative data began with the organization of the household and institutional interviews and the FGDs. Reflections and write-ups from the observations, interactions, and other informal meetings were also organized. The audio recordings were transcribed manually and *verbatim*. The pre-categorization of water security dimensions before the data collection made it simpler and easier to regroup the participants' responses under each category. Transcripts from the audio recordings, FGDs, observations, and reflections were read carefully from the beginning to the end while highlighting text that appeared to describe the pre-define dimensions of water security.

Coding

Guided by the pre-defined water security dimensions, codes were developed and regrouped under the broader categories for comparison and analysis. I took great care to avoid forcing data into

these pre-defined dimensions because a code exists for them (Bradley et al., 2007). I also employed names for codes from the actual words of participants and then grouped codes to directly reflect the texts as a whole (Anderson, 2007). The data that could not be coded were identified and analyzed later to determine if they represented a new category or a subcategory of an existing code. The code represents the abstract concept for each dimension, not the specific statement about that concept (Bradley et al., 2007).

Development of Themes

Through the thematic content analysis, I examined and recorded patterns (or themes) within the entire data set and individual participants' responses (Bradley et al., 2007; Hsieh and Shannon, 2005). Convergences and divergences were noted in responses and interpreted accordingly. Following this, I presented the transcripts in the form of results either as a standalone statement to respond to the study's objective or to support quantitative analysis. Direct quotations from the respondents were used to capture respondents' actual responses and actions based on the triangulation method (Jick, 1979).

3.7 Reliability and Validity of the Research

3.7.1 Reliability

Reliability constitutes the replicability of study results using the same or similar methods in another study (Ritchie et al., 2013). Reliability in research can only be achieved if researchers explicitly specify the procedures within which the research was carried out (Kirk and Miller, 1986). Unlike in quantitative research, the extent to which replication can occur in qualitative research has been questioned and subjected to scrutiny (Bryman, 2016; Ritchie et al., 2013). This,

according to Ritchie et al. (2013), is due to a lack of a single reality to be captured, the complexity of the phenomenon, and the influence of the research context.

However, reliability has been recommended particularly in applied qualitative research and interchangeably referred to as dependability (Bryman, 2016). Reliability can be achieved by providing an in-depth description of the research procedures and instruments used. This makes it possible for other studies to be carried out in similar ways (Given and Saumure, 2008). Reliability in mixed methods was, therefore, achieved by ensuring robust research in terms of data quality and data collection procedures (Bryman, 2016). In this research, the following was ensured to enhance reliability:

- The rigorous selection and explicit description of research methods and overall research design.
- Adoption of appropriate procedures for selecting the study communities and study participants.
- The data type and sources. The secondary data was collected from reliable sources including peer-reviewed published journals and books while the procedure for collecting primary data was clearly outlined.
- Comprehensive and systematic descriptions and interpretation of both qualitative and quantitative analysis. The interpretations were covered by enough evidence. And
- The use of reasonable assumptions, especially in quantitative analysis.

3.7.2 Validity

This involves whether the study measures and achieves its intended objectives (Bryman, 2016). The reliability in research enhances validity in that research. As Bryman (2016) noted, if the

research procedures are unreliable, the validity of the findings cannot be achieved. Validity comes in two dimensions, namely internal and external validity. While the former represents the link between the researcher's objectives and findings, the latter involves whether the research results could be generalized beyond the research scope (Bryman, 2016; Ritchie et al., 2013). Just like reliability, validity primarily applies to quantitative research and positivist research more broadly.

However, the applicability of validity is an equally significant issue for qualitative research (Ritchie et al., 2013). The smallness in sample size in qualitative research makes it difficult to achieve external validity. Given this, the qualitative approach was not to generalize but to provide further explanations to enhance the quantitative results to confirm the theoretical frameworks associated with the study (Bryman, 2016). To achieve both internal and external validity of this research; the following was recognized and applied:

- Ensured that an adequate sample was taken to represent the entire population. Over 50% of the total households in the selected community participated in the study.
- Provided quality survey and interview questionnaires which captured the issues under study.
- Identified, labelled, and categorized the data collected to reflect the characteristics, views, and meanings of the study households.
- Used mixed methods to complement the weaknesses in either of the methods. For instance, observations and FGDs ensured the validity of the households' interviews.
- Prior fieldwork reflections to reduce biases in data collection. And
- The use of households from multiple cases.

3.8 The Mixed Methods Procedure

Mixed methods allow the researcher to benefit from different methods and data sources, enhancing the integrity of the inferences drawn from the research – triangulation. Thus, triangulation provides how the different methods are integrated (Bryman, 2016). In this study, these procedural issues include the timing for each approach, the weight assigned, and the means of mixing the two approaches.

3.8.1 Timing (Implementation) Decisions

This involves the timing for both qualitative and quantitative data collection, that is, whether the data is collected in phases (sequentially) or at the same time (concurrently) (Creswell, 2013). In this study, the concurrent triangulation strategy of mixed methods was employed to collect both the qualitative and quantitative data concurrently. The aim was to compare the convergence, the differences, or the combinations of the data and establish the relationships between these different data types (Creswell, 2013).

3.8.2 Weighting Decisions

This represents the priorities given to each of the two methods in meeting the research objectives (Creswell, 2009). Since the research assesses households' experiences in the study communities, both qualitative and quantitative data provided the best possible means to convey these experiences. Given this, priority was given to both the qualitative and quantitative approaches. While the quantitative approaches tested the relationships and differences between households' variables, the qualitative methods provided detailed explanations of the variables.

3.8.3 Mixing (Integrating) Decisions

The integration decisions constituted the stage in which the mixing of both the qualitative and quantitative approaches occurred (Bryman, 2016). This focuses on when and how the mixing/integration occurred (Creswell, 2009). I employed both methods during the data collection, analysis, and interpretations. Both approaches helped to complement each other. For instance, while the quantitative provided descriptions of certain household experiences, the qualitative data provides further explanations of these experiences.

3.9 Ethical Considerations

Research ethics constitute a complex set of values and standards that regulate a research activity. Research ethics have been put in place to protect research participants from potential harm likely to occur due to the research and address the cultural responsiveness of research communities or participants. Ethics helps identify what is or is not legitimate or what "moral" research involves (Neuman and Robertson, 2007).

To ensure that research ethics were followed as required by the University of Lethbridge Human Subject Research Committee (HSRC), I obtained informed consent from the research participants, ensured the anonymity of the information collected and protected participants' privacy and the confidentiality of the collected data. In addition, I made the participants aware of the potential benefits of this study and addressed the issues of emotions and discomfort that arose from the data collection.

The informed consent was obtained by asking to read and consent to the data collection. Where a participant was unable to read, I read and interpreted it to the basic understanding of such a participant. The participants were made to either sign or thumbprint to confirm consent. This was

done in the presence of a witness. In addition, the collection, management, and presentation of the data were done in conformity with Ghana's Data Protection Act, 2012.

3.10 Positionality and Power Relations

The issues of positionality and power relations addressed the experiences of my interactions with the research participants. Research ethics and personal situatedness in knowledge production have been embraced in discussions in geographical and cognate social scientific research methodologies in Sub-Saharan Africa (e.g., Adu-Ampong, 2017; Adu-Ampong and Adams, 2020; Dery, 2020; Yacob-Haliso, 2019). Geographers (e.g., Bondi, 2003; England, 1994; Muhammad et al., 2015; Smith, 2013, 2006) have generally argued that knowledge production through fieldwork is inevitably affected by multiple positionalities that are usually heavily linked to the intersections between the researcher and their participants.

The main concern is that historically, geographically, and demographically constituted variables such as the researcher's age, gender, class, or geographical location, have become important factors to acknowledge as things that matter and should be borne in mind when formulating and evaluating processes in geographical research (Geleta, 2014). Based on this, I familiarized myself with the literature on personal situatedness, which brought to bear the need to pay attention to my positionality and how that could influence the fieldwork. Thus, I anticipated that my inability to navigate through such things could affect the production of knowledge my research sought to achieve.

I situated my understanding of positionality within the broader body of feminist geographic literature. While there are multiple explanations of researchers' positionalities and how they play out in fieldwork, my reflections highlighted the influence of gender, ethnicity, age, and social class

(Chacko 2004; England 1994; Faria and Mollett 2016; Mandiyanike, 2009; Richardson 2015; Rose 1997; Sultana, 2007) as the multiple positionalities that required my attention as a researcher conducting fieldwork in rural Ghana. Thus, my idea of positionality was based on where I stood in relation to the research based on these multiple visible characteristics (Merriam et al. 2001; Narayan 1993).

Reflecting on Chacko's (2004) viewpoint on positionality, I realized that unequal power relations are implicit in positionality. While acknowledging that the researchers may have power by virtue of their positionalities, I took inspiration from Merriam et al.'s (2001) position that power is negotiated, not given during fieldwork. Again, I reflected on other possible positionalities focusing on insider/outsider variations (Banks, 1998; Merriam et al., 2001). Categorizing such variations into four typologies, namely, the indigenous-insider the indigenous-outsider, the external-insider, and the external-outsider, (Bank, 1998, 9) assumed that in a diverse, pluralistic society, individuals are socialized within ethnic and cultural communities and share the knowledge that can differ in significant ways from those individuals socialized within other microcultures.

As anticipated before the fieldwork, I encountered positionality and power relations issues where my age, gender, and urban background made me either an outsider or insider or both to the research participants. In the next section, I have explained my experience based on two categories – my experience in institutional settings and the interactions with the rural households.

3.10.1 Experience from the Institutional Settings

The location of government agencies (responsible for drinking water management) in urban areas created the impression that my positionality would not influence my interactions with the officials.

While studies (e.g., Smith, 2006) have suggested that it may be particularly difficult to access elite groups as they are more accustomed to negotiating terms and conditions, or even preventing access, some of the officials surprisingly gave warm receptions having obtained knowledge about the background of the research and the researcher.

Consistence with Adu-Ampong and Adams's (2020) findings, introducing myself as a doctoral student in a Canadian university allowed me to project myself as a credible researcher worthy of the investment of time and effort from the government officials. However, while access was assumed to be relatively easy due to locational and institutional affiliations associated with the study, this did not come without challenges during interviews with some agencies' officials. There were instances of shifts from the topics of discussions to other irrelevant issues, such as my experiences living abroad.

Being a doctoral student was considered prestigious to some officials, which produced a tense environment during the interviews. Some of the respondents treated the interview questions more as a test of their knowledge. As one participant confessed,

"I hope you're not here to test me. I know how you 'the book long' (a term used for the well-educated) can put people to test " put people to the test.

Despite being considered as a credible researcher, power negotiations were more formal and stricter. These power negotiations involved verifying my identity and the authentication research, including ethical concerns, research methods, dates, and timing for the interviews. Some of the participants also expressed concerns about protecting their anonymity, and in some instances, refused to be audiotaped. As Adu-Ampong and Adams (2020) observed, government officials, are skeptical about their trust in unknown researchers, which affects their response to questions or information sharing. In some of the government agencies, there were also challenges of scrutiny where the research objectives, methodology, and choices of study locations were

questioned, critiqued, and, in part, resisted. For instance, an official was more interested in why I chose their district instead of a different district, including my home district. According to the official,

"I'm sure that the people in your home district will be proud to have a smart guy working on issues that affect them. Why did you decide to come here? Don't you have drinking water challenges in your district...?"

3.10.2 Experience from the Study Communities

The study communities were rural, different from the cities where I have spent most of my life. However, ties in rural areas and familiarities with rural life due to my previous experience brought me closer to rural settings. My first contact point was community gatekeepers, either the chief or the unit committee chair or both. I was seen more as a development agent even though I explained the study's purpose to the community leaders. They assumed that my position was inevitably connected to access to big contacts in Canada who could come into their aid. To manage such expectations, there was a need to explain the purpose of the fieldwork repeatedly. This resulted in more time required to complete a household data collection than I initially anticipated.

The more a researcher has the attributes of the researched in terms of similar cultures and socio-economic class, the more it is assumed that the researcher will have access, share meanings with the researched, and be assured of the validity of findings (Collins, 1999; Merriam et al., 2001). As Merriam et al. (2001) and Mullings (1999) observed, for instance, being an insider implies easy access, the ability to ask more meaningful questions and read non-verbal cues and project an accurate understanding of the cultures of the study areas. As a Ghanaian from the *Akan* tribe, I am well versed in the culture and appropriate protocols of most traditional societies. As traditional customs demand, I visited and presented drinks to chiefs (*Odikro*) in each community. I observed

the necessary cultural practices as required by visitors to the communities. I also performed rites such as the pouring of libations as required before visiting waterbodies. Observing these basic customary ethics put me in an insider's position, which brought me closer to the researched.

While access was assumed to be relatively easy due to a common language and cultural identity, there were challenges associated with these shared characteristics. As Merriam et al. (2001) rightly noted, insiders are usually accused of being inherently biased and too close to the culture to be curious enough to raise provocative questions. In some instances, an insider is considered as the embodiment of local knowledge and conditions. As observed during my household data collection, some of the research participants laughed off some of my interview questions. First, they felt as a Ghanaian, I needed to know the answers to those questions. Second, they accused me of asking questions that I knew would be difficult for them to answer. This posed challenges to asking certain specific questions and sometimes probing further to certain issues. To reduce these barriers, I reframed most of my interview questions.

Research participants are considered colleagues in research and could exercise control in the research process. Given this, some of the participants negotiated power with me by determining where and when the interviews were held, who else would be present, and of course, what information was shared. A female participant in one of the selected households, for instance, insisted she would not answer any question unless her husband had returned from the farm. Even though I managed to explain the importance of her views in the survey and how she could perfectly answer the questions without her husband, there was the need to reschedule another appointment to interview her husband. In some households, husbands mostly allowed their spouses to contribute to the interviews only when they did not have the required information to correctly answer specific questions. In other instances, some participants exercised power by refusing to participate in the

research. These participants were those who have had previous experiences with other researchers. Consistent with Dery's (2020) finding, they felt that their participation in such research activities had not brought any significant improvements in their lives. This reinforces the need for cooperation between the researcher and the researched, including sharing research findings.

Despite the insider status that I got due to my familiarities with rural settings, my positionality also put me as an outsider in some cases. My physical appearance, including the attire I wore, made me different from the communities' residents, which made me more like an outsider. I dressed to match the status quo, including wearing slippers and shorts, but that did not hide my identity. Perhaps it was due to the prescription glasses I was wearing. There are different perceptions and meanings attached to wearing glasses in some communities in Ghana. Some people perceive those who wear glasses as fancy and classy.

This outsider position distanced me from the study communities and the selected households. In some instances, some of the male participants felt threatened, especially during interactions with the female participants. During the visit to one of the study communities, the previous experience had shown that women had sole responsibilities for water collection and were in better positions to answer questions regarding households' experiences even though most of the households were male dominant in terms of headship. Given this, I decided to focus mainly on women with men's support in the data collection process. These created conditions of discomfort, most especially among some of the men in the community. Some expressed their disapproval for talking to women and girls, as expressed in this quote,

"...why are you so interested in our women? This can land you into trouble..."

Even though I explained to them why the focus was mainly on women, this was only the case for those who sought to know.

As an outsider, I also faced challenges of extortions and exploitation. This was mainly because of my position as a student from Canada. Some community leaders in the selected communities perceived me as a consultant who had monies to spend. Knowing that I needed the data, some of them wanted to extort money from me. I was also exploited for almost everything that I purchased and the services I acquired. This poses barriers to effective data collection for researchers who find themselves in outsider positions.

3.11 Profile of the Study Communities

3.11.1 Profile of Esereso and Wabrease

Esereso and Wabrease are located in the Sunyani West District in the Bono region (Figure 3.2) and have populations of 420 and 457, respectively. Esereso lies approximately between longitude -2.27 and latitude 7.47, while Wabrease is between longitude -2.26 and latitude 7.47. Sharing boundaries, the two communities are about four kilometers apart. Esereso has 75 households, while that of Wabrease is 81, both with an average household size of 5.6 people per household. According to the field data, males outnumber females in both communities, and about 36% of the population was found to be between the ages of 0 and 15 years (Table 3.9). The latter statistic mirrors that for the district as a whole, but at the district level, females outnumber males.

Similar to the district as a whole, the populations of Esereso and Wabrease are ethnically heterogeneous. However, unlike the district where *Akans* are the largest Ethnic group, *Dagaates* comprise the largest share of the population (50%) and more than twice the number of the second highest ethnic groups – *Frafra* (21%). Although *Bono* is the dominant language in the two communities, which is fluently spoken by all the study populations, *Dagaare* is the second language spoken by most people.

Table: 3.9 Socio-economic Characteristics of Households in Esereso and Wabrease (N=483)

Socio-economic Parameters		Frequency	Percentage
Sex	Male	249	51.6
	Female	234	48.4
	Total	483	100
Age	0-5	42	8.7
	6-15	131	27.1
	16-18	51	10.6
	19-60	235	48.7
	61+	25	5.0
	Total	483	100
Relationship with the Household head	Head	84	17.4
	Spouse	82	17.0
	Child	288	59.6
	Other	29	6.0
	Total	483	100
Ethnicity (First Language Spoken)	Ashanti (Twi)	8	1.7
	Bono (Bono)	75	15.5
	Dagaati (Dagaare)	244	50.5
	Frafra (Frafra)	104	21.5
	Lobi (Lobi)	46	9.5
	Others (Other)	6	1.2
	Total	483	100
Education	Never been to school	152	31.5
	Not yet started	24	5.0
	Basic school	262	54.2
	High school	41	8.5
	Post-secondary	4	0.8
	Total	483	100
Occupation	Agriculture	219	45.3
	Craft/related trades worker	8	1.7
	Trading/Retail	6	1.2
	Economically inactive	235	48.7
	Apprenticeship	4	0.8
	Unemployed	8	1.7
	Professional	1	0.2
	Service/transportation	4	0.4
	Total	483	100

Source: Field Data (2019)

Assessing the participants' occupation based on the type of work a person is engaged in, the study found that agriculture is the highest contributor to employment in the two communities, constituting about 88% of those actively employed. Of those engaged in agricultural activities, most engaged in near-subsistence peasant farming. This leaves community members with seasonal incomes dependent on modest agricultural surplus. The economically inactive people (49%) constitute those who are not eligible or available for paid work due to physical or mental conditions. These include those who are in school, pensioners, people with disabilities, and those who are too young to work.

Table 3.10: Household Income and Expenditure in Esereso and Wabrease

Income				
Quintile	Monthly Income (GHC)	Average Monthly Household Income (GHC) (319)	Percentage Share of Monthly Income	Percentage of Households
First (Lowest)	1,254.10	73.77	4.5	19.5
Second	2,554.00	141.89	9.2	20.7
Third	3,992.00	234.82	14.4	19.5
Fourth	6,297.10	349.84	22.8	20.7
Fifth (Highest)	13,570.00	798.24	49.0	19.5
Total	27667.20	1,598.56	100	100
Expenditure				
Quintile	Monthly Expenditure (GHC)	Average Monthly Household Expenditure (GHC)	Percentage Share of Monthly Expenditure	Percentage of Households
First (Lowest)	1,149.69	67.62	4.4	19.8
Second	3,267.61	181.53	10.9	20.9
Third	4,497.00	264.53	17.2	19.8
Fourth	5,618.03	330.47	24.9	19.8
Fifth (Highest)	9,864.7	580.28	42.6	19.8
Total	24,397.03	1,424.43	100	100

Source: Field Data (2019)

The average total household monthly income is about GH¢1,598, while the average per capita total income is GH¢319 (Table 3.10). Using the prevailing annual average exchange rate of 2018 (i.e., GH¢4.6 to 1 US dollar), the average total household monthly income is US\$347 while the average per capita income amounts to US\$69. Given an average household of five, per capita income is US\$14. The spread of income shows unequal distribution among households since only 40% of the households have over 70% of the total monthly income. Besides, the highest quintile households have a total monthly income ten times greater than those in the lowest quintile. Accordingly, the highest total expenditure is concentrated on households (40%) in the fourth and fifth quintiles, constituting about 67% of the monthly share of the total household expenditure.

Esereso has two handpump boreholes, only one of which was operating when the field data were collected. However, the functional handpump borehole, which was constructed by the district assembly, is unreliable as it breaks down frequently (Figure 3.4).



Figure 3.4: A Faulty Handpump Borehole in Esereso

Source: Photo taken by the author (2019)

Unlike Esereso, Wabrease has a handpump borehole. However, the utilization of Wabrease's handpump borehole exceeds the Ghanaian Government's maximum threshold of 300 people per handpump borehole by a large margin. The communities also have a stream (Asuo Bisi) (Figure 3.5) that serves as alternative water sources for households (in cases of a facility breakdown) and agricultural use.



Figure 3.6: Alternative Water Source (Asuo Bisi) in Esereso and Wabrease

Source: Photo taken by the author (2019)

Although all the two study communities have WATSAN committees, tribal differences affect the committee's operations in Wabrease. Even though the district had rural water coverage of 94% in 2016 and expects to achieve 100% by 2020, water insecurity still exists in the rural communities.

3.11.2 Profile of Wioso

Wioso is located in the southern part of the Sekyere Kumawu district (Figure 3.2). It lies approximately between longitude -1.38 and latitude 7.95. Wioso has a total population of 551

people representing 0.6% of the total population in the district. More people are identified as females (52.6%) in Wioso than males (47.4%), reflecting the district's sex composition. Wioso has an average house size of 5.1 people per household, higher than the district rural average household size of 4.7.

Like the district's age composition, the study found that about 42% of the population is between 0 and 15 years. Accordingly, the majority (67%) of the study household members have attained up to the basic education level. Due to its geographical location, Wioso is relatively homogenous in terms of ethnicity. *Akans* (Ashantis), who are in the majority (83%), co-exist with the few Northern tribal groups like *Dagaates*, *Kotokolis*, and others. *Twi* is a widely spoken language in the community.

The majority (58%) of the population are economically inactive. For those in active employment, agriculture is the main employer constituting about 75% of the community's working population. As in Esereso and Wabrease, the predominant involvement in subsistent farming leaves the community members with seasonal incomes dependent on-farm yields.

Table 3.11: Socio-economic Characteristics of Households in Wioso (N=364)

Socio-economic Parameters		Frequency	Percentage
Sex	Male	172	47.3
	Female	192	52.7
	Total	364	100
Age	0-5	38	10.5
	6-15	115	31.7
	16-18	35	9.6
	19-60	150	41.3
	61+	25	6.9
	Total	363	100
Relationship with the household head	Head	71	19.6
	Spouse	37	10.2
	Child	210	57.9
	Other	45	12.4
	Total	363	100
Ethnicity (First Language Spoken)	Ashanti (Twi)	301	82.9
	Dagaati (Dagaare)	41	11.3
	Others (Other)	21	5.8
	Total	363	100
Education	Never been to school	46	12.7
	Not yet started	16	4.4
	Basic school	243	66.9
	High school	50	13.8
	Post-secondary	8	2.2
	Total	363	100
Occupation	Agriculture	116	32.0
	Craft/related trades worker	14	3.9
	Trading/Retail	8	2.2
	Economically inactive	209	57.6
	Apprenticeship	2	0.6
	Unemployed	3	0.8
	Professional	4	1.1
	Service/transportation	7	1.9
	Total	363	100

Source: Field Data (2019)

Wioso has a higher average total household monthly income (GH¢3,892) and average per capita total income (GH¢ 763.40) compared to Esereso and Wabrease. Using the same prevailing annual average exchange rate, the average total household monthly income is US\$846, while the

average per capita income amounts to US\$166. Just like Esereso and Wabrease, Wioso has an unequal distribution of household income, with about 40% of households having over 70% of the total average share of monthly income (Table 3.12). Accordingly, the lowest quintile households have just about 4% share of the monthly household expenditure as compared to 43% of those in the highest quintile.

Table 3.12: Household Income and Expenditure in Wioso

Income				
Quintile	Monthly Income (GHC)	Average Monthly Household Income (GHC) 763.40	Percentage Share of Monthly Income	Percentage of Households
First (Lowest)	1,960.80	130.72	3.7	21.1
Second	3,463.00	288.58	6.5	16.9
Third	8,988.25	561.77	16.9	22.5
Fourth	1,2041.96	860.14	22.7	19.7
Fifth (Highest)	2,6671.00	2,051.62	50.2	19.7
Total	53,124.05	3,892.83	100	100
Expenditure				
Quintile	Monthly Expenditure (GHC)	Average Monthly Household Expenditure	Percentage Share of Monthly Expenditure	Percentage of Households
First (Lowest)	1,425.87	109.68	4.4	19.1
Second	3,550.70	253.62	10.9	20.6
Third	5,571.90	297.99	17.2	20.6
Fourth	8,068.00	576.29	24.9	20.6
Fifth (Highest)	1,3821.00	1,063.15	42.6	19.1
Total	32,437.47	2,300.73	100	100

Source: Field Data (2019)

A report from the District Planning and Coordinating Unit reported that access to potable water is extremely compromised (Sekyere Kumawu District Assembly, 2014). According to the District Water and Sanitation Team, the district has a total of 74 boreholes, out of which 21 are

not functional. Of Wioso's two handpump boreholes, one serves as the community's primary source of drinking water and was found to have utilization rates exceed government guidelines. The community also has streams that serve as alternative water sources for households and agricultural use (Figure 3.6). Wioso has a WATSAN committee whose operations are hugely affected by chieftaincy interference.



Figure 3.6: Alternative Drinking Water Source for Households in Wioso

Source: Photo taken by the author (2019)

3.12 Summary of the Chapter

In this chapter, I have provided information on the study communities and the research design and methods employed for the study. The information about the communities includes how I

selected these communities as well the demographic and socio-economic information about the community members based on the sampled households. The information provided in this does not seek to present the study results but to use primary data to describe the study communities.

The chapter also provides comprehensive information about the research design and methodology. As part of the research design, I have described the case study cross-sectional design was employed for this study. I explained that this approach provides a profound understanding of the study areas by taking a snapshot of the communities' water security experiences. The research methods section describes the mixed methods approach (involving qualitative and quantitative methods), the sampling procedure, and data collection and analysis approaches.

CHAPTER FOUR

ASSESSING THE CAPACITY GAPS IN DECENTRALIZED WATER MANAGEMENT IN RURAL GHANA

4.1. Introduction

This chapter assesses the capacity gaps for decentralized water management in rural Ghana using qualitative evidence from water management agencies and the study communities. Through institutional and household interviews as well as community focus group discussions, I assessed rural capacity based on five dimensions of water management capacity, including financial, human resources, institutional, social, and technical, to contextualize the gaps in rural water management. In addressing these capacity gaps, I recognize that despite the several capacity challenges confronting the community-based water management in Ghana, available evidence to date (e.g., Adadzi et al., 2019; Adank et al., 2013; Braimah et al., 2016; Jackson and Gariba, 2002, Opare, 2007; Sun et al., 2010) is mostly focused on general shortcomings aimed at limited rural technical, financial, and human resource capacities. The chapter extends the discussion beyond these three capacities to include the institutional and social capacity gaps in rural water management in Ghana.

To enhance contextual understanding and discussions of study results, I have presented operational definitions of rural capacity dimensions through which rural gaps were assessed (see Chapter Two). The findings reveal evidence of gaps in all five capacity dimensions, limiting the effective implementation of community-based water management in Ghana. I argue that despite the need for institutional capacity to serve as the backbone of other rural capacities, financial capacity is required to overcome all the challenges of rural capacities for water management. I further argue that capacity gaps in community-based water management can be reduced by combining local resources with support from central governments. The research findings enhance

the understanding of the identified capacity gaps that affect rural water management in Ghana and possibly throughout the region.

Before delving into the analysis of capacity gaps for rural water management, the chapter makes reference to Chapter Two of this dissertation, which discusses the current and historical context of rural water management in Ghana. I have provided a broad overview of decentralized rural water management, which includes the historical trajectories and operationalization with evidence of key capacity challenges as well as the institutional and regulatory frameworks. Following the data analysis, I offer some prescriptions to transform rural water management in Ghana.

4.2 Results

Consistent with the purpose of this chapter, I have organized the results according to the five dimensions of water management capacities: [1] Institutional capacity; [2] Financial capacity; [3] Human resources capacity; [4] Technical capacity; and [5] Social capacity.

4.2.1 Water Management in the Study Communities

Similar to other rural communities in Ghana, water management in Esereso, Wabrease, and Wioso operates on the CBWM model with voluntary-based WATSAN committees as water managers. Esereso has a seven-membership WATSAN committee involving five men and two women. In Wabrease, there was an interim WATSAN committee due to the resignations of elected members. This interim committee has three women and four men. Unlike Esereso and Wabrease, Wioso does not have a WATSAN committee in the community; however, there is a WATSAN committee that oversees water management in three different communities, including Wioso. The six-member committee includes four men and two women, with representations from each of the three

communities. Except for Wabrease, the gender composition on the WATSAN committees in the other two communities is less than the recommended 40%. The study observed that, contrary to the recommendations of the CWSA's guidelines, the inclusion of women was based on communities' discretion. According to a committee member in Wabrease, in response to the inclusion of women,

"The assembly did not oblige us to consider women during the selection of the committee; we did it on our own prerogative."

This reflects a lack of commitment to gender equity in rural water management. As the subsequent chapter will show, the sole participation of women and girls in water retrieval and use coupled with their exclusion in water management exacerbate their marginalization in rural water security.

The WATSAN committees have a mandate of overseeing the operations and maintenance of the hand-pump boreholes in their respective communities. Except for the committee in Wioso that meets twice a month, WATSAN members in Esereso and Wabrease meet once a month. All the WASANT committees have rooms for emergency meetings when the need arises. Aside from the WATSAN committee members, all the communities have caretakers who are in charge of the day-to-day operations of the water facilities. These caretakers are rewarded based on portions of revenues generated from the water sales. Water users in Esereso and Wioso are required to pay for water based on volume, while Wabrease operates on monthly contributions based on household size. All the study communities are faced with limited institutional, financial, human resources, social, and technical capacity challenges that impede effective water management at the local levels.

Unlike the handpump boreholes, streams are managed by community elders and the traditional authorities of the Ashanti tribe. In the Ashanti tribe, water is considered sacred, which is either regarded as a god or a dwelling place for the gods. Since the traditional authorities in the

communities are the custodians of the land and other natural resources, they have a responsibility to protect waterbodies and to preserve their sacred nature. Given this, some taboos and myths, including restrictions on when and who should visit waterbodies, guide how such waters are managed and used in each community.

4.2.2 Institutional Capacity

The analysis of institutional capacity focuses on the availability of legislation and policies to support local drinking water management and the effectiveness of institutional coordination towards water management (Timmer et al., 2007). The findings show political and chieftaincy interference and poor institutional coordination as the major gaps in rural water management.

Several pieces of legislation, policies, and guidelines govern rural water management in Ghana from the national to the local levels. Ghana is also committed to international policy goals such as the former MDGs and the current SDGs. The CWSA has the mandate to implement the government's visions towards rural water supply and management. The study found that political administrations can focus on implementing political manifestos at the expense of the operational plans of rural water management agencies. An interview with a CWSA official reveals that political interference sometimes determines the beneficiary communities of drinking water infrastructure. As reflected in this quote,

"...we cannot discount political interference in the provision of rural water supply. A community with a powerful political leader or chief can easily influence water supply in its favor..." (CWSA Official).

At the community level, the study found that the influence of the traditional authority also affects WATSAN committees' establishment and operations. According to the interview results, political interference usually occurs through the establishment of the WATSAN committees, where members of the incumbent political administration are selected to serve on the committee.

The traditional authorities also sometimes interfere by either setting up their water management teams in addition to the existing committees or taking monies from accumulated funds from water sales. Despite this, there are no appropriate remedies to deal with chieftaincy interference in water management at the community level. As the official noted,

"The only people who can call the traditional authorities to order are the district's political leaders. The fear of losing the support of the traditional authorities, especially during elections, usually discourages the political leadership from calling the traditional authorities to order" (District Water and Sanitation Official 1).

In addition, there is ineffective institutional coordination among national and within decentralized institutions. The analysis reveals an inconsistency in information regarding rural water management decisions among the various agencies. For instance, this study identifies gaps between the number of boreholes reported by the CWSA and the number reported by the MMDAs. As indicated in the CWSA report, Wioso has just a borehole, which contradicts the existence of two boreholes in the community. There were also conflicting responses regarding MMDAs and water managers' roles and mandates at the community levels. As an official in one of the district assemblies reiterated,

"Coordination is supposed to exist between the local and national level agencies, but this rarely exists" (District Water and Sanitation Official 2).

A CWSA official added that poor institutional coordination affects data collection, sharing, and use. In addition to the poor institutional coordination, interviews with the government officials also identify top-bottom approaches to decisions regarding the provision of rural water infrastructure as another institutional challenge affecting rural water management. This means that beneficiary communities' inputs are either less or not considered in decision-making regarding water management.

4.2.3 Financial Capacity

The financial capacity was measured based on the ability to acquire adequate funds for the initial construction of water facilities and pay for the operations and maintenance. Some of the key challenges associated with the collection and use of water user fees were also identified. The analysis shows two main results; reductions in rural water investments by the central government and limited rural financial capacity to support the operations and maintenance of rural water infrastructure.

Since the introduction of the NCWSP in Ghana, rural water infrastructure provision largely depends on donor funds from bilateral and multilateral organizations. According to the CWSA official, this external funding support constituted about 90% of the total project investments and capital expenditures in 2006. A large portion of these funding sources came in the form of grants. Only a small portion, which came in the form of concessional loans, was provided as credits. However, the achievement of the Ghanaian economy as a lower-middle-income status brought huge reductions in external donor funding for rural water supply. Interview results from the CWSA highlighted two main arguments that supported these huge reductions. First, as the donors argued, the middle-income economy puts the government of Ghana in a position to solely finance rural water supply. Secondly, the Ghanaian economy makes it possible to finance rural infrastructure through borrowing from external sources. Accordingly, the government's focus on borrowing to finance rural water infrastructure has created huge external debts. The government's efforts to reduce rural water investments through borrowing have significantly affected the investments in the rural water supply. Even though the CWSA usually encourages community initiatives through self-help rural water projects, the official opines that rural households' low-incomes levels make it impossible to be realized.

In 2009, the government abolished the initial 5% community contributions towards the provision of rural water facilities. This has placed total responsibility on the government to finance rural water infrastructure, which is usually supplemented by NGOs/CSOs. However, rural water users are responsible for covering all the financial expenses associated with the operation and maintenance of water infrastructure through water user fees. The rural communities, however, report insufficient financial resources to meet this responsibility. The lack of enforcement mechanisms for water payment, low-income levels of rural households, households' mistrust of the use of revenues from the water fees, and lack of training for effective revenue collection are the major factors that largely contribute to the limited financial capacity for O&M of rural water infrastructure. This limited financial capacity largely affects the extent to which communities can carry out operations and maintenance activities. Interviews with households and community water managers reveal that communities usually remain out of potable water in cases of a facility breakdown, and this remains so until the required amount is raised for a repair. According to a WATSAN committee member,

"...nobody helps us when the facility breaks down. We always have to rely on our revenues from the water fees. When the amount is not enough, we ask every household to contribute, which is usually hard to do" (WATSAN Committee Member 1).

4.2.4 Human Resources Capacity

The human resource capacity was assessed based on the availability of employees dedicated to water management; access to individuals with the requisite skills and training to manage drinking water; the availability of ongoing and up to date educational and training opportunities for staff involved in water management; and access to external expertise (Timmer et al., 2007).

The rural water management model is characterized by voluntary-based water management teams who receive little or no training to prepare them for water management responsibilities. As part of the NCWSP in rural Ghana, the CWSA, through the various MMDAs, is required to provide training for selected community members to take charge of operations and maintenance of rural water infrastructure. Even though the water management teams sometimes receive training, this came in the form of training on minor checks and maintenance on water facilities. The officials from the district assemblies attributed their inability to provide training to limited financial capacity. As one official noted,

"We solely rely on the common fund from the central government, which is not even enough to provide the required water facilities. How do we even have extra funds for training?"

Interviews with water managers also reveal that even where there are training opportunities on major repairs, it is usually volunteers who take part. Those trained may not remain in the community permanently; this is particularly true of young adults.

Major repairs and maintenance often require more qualified technicians or mechanics, but these are few and usually located in urban areas. For instance, there are only three mechanics in the Sekyere Kumawu District with over 60 rural water facilities (boreholes/hand-dug wells). It takes time and resources to obtain the services of specialized mechanics for major breakdowns, which could deprive rural communities of potable water for weeks. Also, since rural water management teams are not paid but rather work as volunteers, there is a high attrition rate. The water management team members are usually a subject of public criticism or shame from other community members when water management decisions are unpopular. A lack of financial incentives may demotivate and discourage members from staying on such water committees amid such criticisms.

4.2.5 Technical Capacity

Groundwater constitutes about 95% of potable water sources for Ghana's rural communities (Awuah et al., 2009). The district assemblies and rural communities have by-laws that govern rural water management, including the protection of water sources. While the assemblies' by-laws focus on managing drinking water facilities, many respondents in the study communities pointed to the communities' attention on both the drinking water facilities and the protection of surface water sources. The community water managers' responses suggest that the lack of enforcement mechanisms on the part of the district assemblies poses a challenge to the effective implementation of by-laws. Even where a community is able to put enforcement mechanisms in place to protect surface water sources, as the respondents pointed out, difficulties still exist regarding achieving such enforcement in other neighboring communities that share the water sources. According to a community water manager,

"We have tried our best to stop people from polluting the stream. The difficulty lies on how to get the neighboring communities to do the same. This is where we need the assembly to intervene..." (WATSAN Committee Member 2).

The absence of emergency plans for disrupted water supply makes it difficult for rural communities to respond to emergencies. Issues regarding what constitutes an emergency in rural water supply seem non-existence to rural water managers at the district and national levels. The research identified conflicting responses from government officials regarding the length of time for which communities can be without potable water ranging from three days to two weeks. However, the household's interviews reveal that the rural communities can go up to four months to a year without potable water. As one participant stated,

"We can go for months without access to potable water when the borehole breaks down. When this happens, we always have to rely on the stream for our water needs. I don't know if this is what you call an emergency. We have always been in that situation and have to deal with it on our own."

Besides, while the CWSA guidelines stipulate that water quality testing should be done twice a year – during the dry and rainy seasons – there is no commitment to that effect. This has been affected by an unclear description of who has responsibility for conducting water quality monitoring and testing. An interview with the CWSA official placed the responsibility on the various MMDAs, which in turn, have been downloaded to the various rural communities. Accordingly, the only time community water users complain about water quality is when the appearance, taste, and smell are compromised. The household interviews and FGDs reveal that water quality perception is based on these three components, with no considerations for chemical or biological compositions. The communities respond to perceived changes in components of water quality by applying chemical treatments. As quoted by a WATSAN committee member,

"...we put chlorine (chemical) into the water when we realize the color has changed..." (WATSAN Committee Member 3).

4.2.6 Social Capacity

This section presents results on data regarding the support of community members for water management, and the relationships between community members and the rural water managers, and the local NGOs. The study data analysis reveals that social cohesion plays a role in the effective management of rural water systems and other community-based projects. According to an official from the CWSA, in addition to the provisions of the CWSA guidelines, the existence of social cohesion forms one of the bases for providing rural water infrastructure. The official argues that such social cohesion brings community members together towards contributing to effective management. The opposite is true for a community faced with internal conflicts, as reflected in this quote from the CWSA official,

"A community that has internal conflict makes it difficult to form a group to be able to manage a water system..." (CWSA Official).

The community interviews and FDGs identify that community cohesion can exist in an atmosphere with little or no tribal differences. However, it was noted that one of the study communities (Wabrease) has tribal differences that have created apathy among members of WATSAN committees. These differences stem from the tribal composition of the WATSAN committee members. The committee members tend to seek the interest of their tribal groups in the community rather than serve the committee's purpose. This affects water management decisions and implementation, including financial contributions from water users. For instance, some water users sometimes refuse to contribute financially once a particular tribal group dominates the water committee's composition.

In addition, social linkages – both vertical and horizontal – contribute to the provision and maintenance of rural water infrastructure. An interview with CWSA official reveals that rural communities' social linkages with influential people have been associated with financial donations towards providing and maintaining water facilities. According to the official,

"The communities that have rich or influential natives appeal to them for support in water supply, management, and maintenance. Sometimes, these influential people do not only contribute financial assistance but also can use their influence to lobby for other external supports" (CWSA Official).

The community interviews and FDGs confirmed such social supports towards rural water supply and management. Two study communities, for example, benefited from such individual donations towards the provision of water facilities. This quote from the water managers in Esereso confirms such social support,

"We had the second borehole from the family of a 'white man' who came to do voluntary work in this community. We heard that the man died on his way back to his home country through a vehicular accident. The family decided to use part of his funeral donations to provide the facility" (WATSAN Committee Member 1).

In addition, social linkages between the district assemblies and the local-based NGOs have contributed to rural water management, including the provision of rural water infrastructure and training opportunities as well as support for O&M of water facilities. The Sunyani West District, for instance, has benefited from some of the NGOs located in the district and in the regional capital (Sunyani). This came in the form of training support for borehole mechanics in the district.

Due to the limited human capacity in rural communities, their participation in rural management is limited to the daily management decisions of water facilities. These include fee collections, operations, and maintenance activities through the WATSAN committees. Even though the composition of WATSAN is mandated to include a female membership of at least one-third, the results of the FGDs reveal that women's roles are limited to mobilizing other women for sanitation purposes (e.g., sweeping and weeding around water facilities), with limited influence in major management decisions. As reflected in a quote from an official of an MMDA,

"We try to encourage women's participation by assigning them with sanitation responsibilities" (District Water and Sanitation Team Official 2).

Besides, the household interviews highlighted a knowledge gap on households' roles in contributing to effective community water management. The interview results also reveal confusion among community water management teams regarding their mandates. Similarly, community water managers hold contradictory views on the regulations governing rural water management. Consequently, the participation of beneficiary communities has been limited to the provision of information through community gatherings or *durbars*, particularly during the provision of water infrastructure.

Even though households' knowledge of a community's rural water management responsibility is limited, the research identifies strong community support towards rural water infrastructure sustainability. The community members consider it a sense of responsibility to

ensure that water infrastructure is protected from frequent breakdowns. Given this, one of the study communities has a community by-law, which regulates how water facilities should be handled.

4.3 Discussion

Since the early 1990s, local capacity has gained increasing attention in water resource management (Chowns, 2015; Rawlyk and Patric, 2013). Subsequently, there has been a paradigm shift towards the transfer of decision-making, management authority, and payment responsibilities to the rural households or water users at the community level. As Mandara et al. (2013) noted, there is a general notion that once the community-based rural water management is initiated, local institutions and actors must have the capacities required to operate and sustain rural water infrastructure. However, evidence from this study and that of others (Adank et al., 2013; Braimah et al., 2016; Chowns, 2015; Hanrahan and Dosu, 2017; Rawlyk and Patrick, 2013) suggest that it is not sufficient to involve local actors in the management of water systems without adequate power and resources to carry out their legitimate mandate. As this study reveals, there are limited local capacities relating to institutional, financial, human resources, technical, and social, which together cover the core operational and regulatory components of effective rural water supply and management.

Hamdy et al. (1998) highlighted the need for a robust institutional capacity as a backbone for all other local capacities. However, as this study has shown, institutional weakness and malfunctions are a major cause of ineffective and unsustainable rural water supply and management in Ghana. Mandara et al.'s (2013) research findings in rural Tanzania cite political interference in the operations of local officials to effectively contribute to rural water management. This study's findings identified not only political interference but also chieftaincy interference in

the operations of WATSAN committees in rural water management in Ghana. While the political interference involves the influence of the ruling political administration in the provision of water infrastructure, chieftaincy interference includes undue involvement of traditional authorities in water management at the community level.

Similar to this study's findings, Hamdy et al. (1998) and Norman et al. (2011) identify poor institutional coordination among decentralized agencies as another critical challenge affecting rural water management. Hamdy et al. (1998) attribute this to multiple institutions among decentralized water agencies with unclear delineation and overlapping responsibilities. This creates challenges of integration, coordination, and data access, which result in fragmented decisions. Institutional capacity constitutes not just the delineation of sufficiently robust regulatory and institutional frameworks but also the need for independent and coordinated national, regional, and local level agencies. Besides this, I found a vague description of roles among actors, including confused responsibility for providing training for local water managers and conducting water quality monitoring and testing in the study communities.

Despite institutional capacity holding the key to general capacity development, this study shows that limited financial capacity affects all the other capacity challenges impeding effective community water management. Limited financial capacity goes beyond water supply in developing countries to decentralized water management in developed economies such as Canada as well (Hanrahan and Dosu, 2017; Rawlyk and Patrick, 2013). For instance, in an analysis of cross cases analysis water crises in small communities in Canada, Hanrahan and Dosu (2017) identified that small communities are not adequately resourced to manage downloaded responsibilities, including the cost of operations. Rawlyk and Patrick (2013) also highlighted

limited finances for implementing source water protection plans as the most pressing problems with no obvious solution available.

Apart from the heavy reliance on unreliable donor funding for the initial provision of rural water systems, the study reveals that the rural communities lack the required financial resources to cover operations and maintenance expenses. The low-income levels of most rural households, and variable seasonal income from agricultural activities, affect the availability and timing of revenue collection for operations and maintenance of rural water systems. As Rawlyk and Patrick (2013) argue, small communities usually have limited tax bases to support decentralized water management operations. A lack of revenue collection mechanisms and skills required by rural water managers for safe record-keeping and financial management also affect the collection and administration of rural water revenues. For instance, research by Adank et al. (2013) in one of our study districts (Sunyani West) revealed that more than half (57%) of the WATSAN committees failed to keep relevant data on revenues and expenditure on proceeds from their water sales.

The findings also show that limited financial capacity has implications for both the community's and agencies' ability to provide the human resource and technical needs for rural water management. Limited financial capacity affects training, attracting, and retaining the human resource base for rural water systems. The result is that rural communities rely on volunteers to be in charge of facility management and external operators for operation and maintenance. Similar to the findings of Chowns (2015) and Mandara et al. (2013), the study found that there were no trained operators and other technical expertise (human resources) in the study communities. Accordingly, the communities rely on external operators (area mechanics) within or outside the district for maintenance activities. Interestingly, only 43% of the Sunyani West District's rural communities can acquire the services of area mechanics within three days of a water facility

breakdown. Other findings add that the communities which fall within the three-day benchmark depend on their ability to pay for such services and the availability of spare parts that are not evenly distributed across the country (Chowns, 2015; Mandara et al., 2013). Maintenance is, therefore, rarely done and characterized by long delays and sub-standards. The lack of technical expertise to conduct water quality monitoring also forces water users to use their senses (e.g., smell, sight) to determine water quality without biological or chemical consideration. The overreaching effects are that the limited technical or human capacity affects the level of compliance with water management norms and standards at the service provision level (communities) and service authority (district assemblies) level.

Finally, the study shows social capacity gaps, including limited community participation in the provision of rural water infrastructure and tribal apathy. As revealed by the study results, the communities' involvement in water infrastructure provision is usually characterized by passive participation, which affects how the water users can exercise their voice and influence on the project. There is also a challenge of tribal differences, which creates apathy among community members and their willingness to fully participate in rural drinking water management. Tribal apathy in water management occurs when divisions are created, or decisions are made on tribal lines other than the committee's sole purpose. According to Akramov and Asante (2009), this negative impact is significantly higher in rural areas. Despite this, the need to have access to potable water usually encourages community members to commit to ensuring the sustainability of drinking water infrastructure.

4.4. Conclusion

In this chapter, I assessed the capacity gaps for decentralized effective rural water management in Ghana. The findings contribute to a growing body of literature on community capacity to effectively manage rural water supply. They enhance our understanding of the identified capacity gaps that affect rural water management in Ghana and possibly throughout the region. This chapter's findings have shown that the community-based water management model has not been successful, considering the capacity challenges it imposes on rural water users and community water managers. This means that decentralization cannot work unless rural water managers have sufficient resources to carry out their mandates. This calls for a shift in management approaches, which does not assume that the community-based management model entails a sense of ownership that automatically translates into a community's ability to fully participate in water management.

A key lesson is that water users at the community level are generally encouraged by a desire to have unlimited access to potable drinking water and are willing to fully participate to enhance its uninterrupted supply. Given this, while rural water users' involvement at all levels of water supply and management may be useful, more emphasis needs to be on the provision of required resources and targeted capacity-building (Hanrahan and Dosu, 2017). Another approach is to explore ways to proactively involve traditional authorities (chiefs). Appropriate capacity development is required for all actors at every level of rural water supply and management, with targeted emphasis on the financial and institutional capacity to support and enhance human, technical, and social capacity.

CHAPTER FIVE

RE-DEFINING THE PREVAILING CONCEPTS OF DRINKING WATER SECURITY IN RURAL GHANA

5.1 Introduction

The term "water security" and its underlying concepts have attracted researchers and policymakers' attention across geographical regions, disciplines, and scales. Despite the palpable rise in its use, there is a lack of comprehensive understanding of how water security is conceptualized and applied in different contexts worldwide. Arguably, there is a blurring of focus on how water security is conceptualized in the literature (Aboelnga et al., 2020; Bakker, 2012; Cook and Bakker, 2012; Gerlak et al., 2018; Hoekstra et al., 2018).

This chapter contributes to the debate on water security by assessing how the concept is considered, articulated, and operationalized within the context of rural areas. The chapter focuses on water security at the rural level in Ghana by using household experiences. To achieve this, I introduce several elements that are specifically valid for water security at the community level. Thus, the chapter assesses rural water security as operating within six-dimensional indicators that map water availability, water access, water safety, water management, community preferences, and water resources and systems sustainability. Given that the term water security is an emerging concept at best, this chapter is merited considering its increasing usage among scholars and policymakers to frame water-related issues.

In Chapter Two, I delved into the concept in general by reflecting on the different interpretations of water security and within the scope of this study. As widely noted by a growing number of researchers, water security is a multifaceted challenge that hangs on a plethora of dimensions, making it difficult for policymakers to deal with it at different levels (Aboelnga et al.,

2019; Grey et al., 2013; GWP, 2000). Arguing from this position, this chapter recognizes that the current conceptualizations of water security have been developed primarily by scholars and development organizations—rather than by on-the-ground practitioners (Gerlak et al., 2018). Using the core elements of the human right to water and the baselines for the United Nations' SDG 6, the study conceptualizes rural water security dimensions through household experiences. I hold that establishing this framework is crucial for identifying the variables independent of the multiple definitions of water security and other natural resources.

In the next section, I proceed with an analysis of rural water security based on the six dimensions using cross-sectional survey data from rural Ghana. These dimensions were defined based on a set of benchmarks that were derived from the national guidelines for rural water supply in Ghana and international guidelines, particularly the World Health Organization. Using a multiple regression model, the chapter establishes the predictability of these six dimensions on rural water security in Ghana. Finally, I conclude with the recommendation on the need to consider context-specific issues and factors in defining rural water security.

5.2 Results

In this section, I present the results of households' water security experience in the study communities. These results are presented based on six main water security dimensions: access, availability, quality, preferences, sustainability, and effective management (Table 5.2). These dimensions were assessed based on a set of benchmarks (Table 5.1) that were based on a minimum level of service (rudimentary service) as prescribed by both national and international standards, including existing guidelines and technical literature (e.g., the CWSA guidelines).

Table 5.1: Benchmark for Measuring Rural Water Security

Dimension	Indicators	Benchmark
Availability	Daily collection (in liters)	50 $\geq$ per person per day
Access	Distance (in meters)	$\leq$ 500
	Time (in minutes)	$\leq$ 30
	Affordability	$\leq$ 3% of Household Income
Safety/Quality	Water testing	Twice a year
	Source water protection	Availability of water safety plans
	Water collection	Covered
	Water storage	Protected
	Users' perceptions of color, taste, and smell	Ranked from excellent to very poor
Preference/Desirability	Cultural preferences Social values	Considered/not considered
Management	Participation	Effective/ineffective
	Capacity	
	Accountability/transparency	
	Responsiveness	
Sustainability	Protection of source water	Protected/unprotected
	Protection of water systems	

Source: Author's construct (2019)

5.2.1 Description of Water Collection Activities in the Study Communities

Household water collection is carried out through the day by women and girls and depends largely on water needs during a particular time. Most households collect water at dawn and in the evenings. This makes it possible to meet the water needs for household chores in the morning and evenings, including bathing, washing, and meal preparations. Sometimes, early morning water collection are influenced by the likely water shortage in the afternoons, the need for water sedimentation, and potential water pollution by other users. According to the focus group participants in Esereso,

“We try to collect water in the morning and the evening since the borehole is usually closed in the afternoon. The caretaker usually closes the borehole to allow water recharge in the afternoon. Sometimes, water does not flow from the borehole even after it has been allowed to recharge.”

In response to the water sedimentation, the participants added,

“Early morning water collection, especially from the streams, allows the water particles to settle during the day. This makes it usable in the evenings.”

Asked if there are risks associated with water collection, some of the study participants cited snake and scorpion bites as a risk they experienced mostly during early morning and late evening water collection. As one participant recounted,

“Collecting water at dawn or late evenings is very dangerous. A scorpion once bit my daughter. We have had several instances of seeing huge snakes on our way. One of my neighbours was bitten by a snake during an evening water collection.”

Water collection activities are characterized by walking over several distances and making several trips. Water retrieval also involve carrying different sizes of containers, which is usually determined by the age and the physical conditions of the collector since children are usually able only to carry smaller containers. Long queues characterize water collection in Esereso, taking extensive time. Water collection activities are undaunting tasks for water collectors, mostly women and girls, in most households. As reflected in this quote from one female participant,

“Carrying water is a tedious task. Since the borehole is more than a kilometre walk from our house, water collection can be a full-day task depending on our needs. The worst part is that this is an everyday activity.”

Table 5.2: Characteristics of Water Security Experience of the Study Households (N=158)

Dimension		Measurement	Percentage	
Availability and Reliability	Availability	< 50 litres	64.6	
		50 litres	17.7	
		> 50 litres	17.7	100
	Reliability	Very Poor	12.0	
		Poor	38.6	
		Good	26.6	
		Very good	14.6	
		Excellent	8.2	100
Access	Distance in Meters	< 1000	53.8	
		1000	16.5	
		>1000	29.7	100
	Time in Minutes	0-30 mins	24.1	
		> 30 mins	75.9	100
	Percentage of expenditure on income Per month	<3%	54.4	
		3%	6.3	
		>3%	39.2	
Safety	Perceptions based on organoleptic properties	Excellent	23.4	
		Very good	34.2	
		Good	20.3	
		Poor	15.2	
		Very Poor	7.0	100
	Overall perceptions of water safety	Safe	28.5	
		Unsafe	71.5	100
Management	Capacity	Existence of rural capacity	19.6	
		Lack of rural capacity	80.4	100
	Participation	Participate		
		No participation		100
	Accountability	Accountable	18.4	
		Not accountable	81.6	100
	Responsiveness	Responsive	29.7	
		Not responsive	70.3	100

Source: Field Data (2019)

5.2.2 Water Availability

In this study, the quantity and supply of water constitute water requirements for domestic purposes, excluding other uses. The water supply available for an individual should be sufficient and continuous for personal and domestic uses, which ordinarily include drinking, personal sanitation,

washing of clothes, food preparation, personal and household hygiene. Overall, 50 litres of water per person per day is required to meet the most basic and domestic needs, and few health concerns may arise (WHO, 2011).

The assessment of water availability was based on three indicators, namely the temporal physical presence of water at a water point (reliability), the flow rate of water into the container, and quantity in litres per capita per day (LCD) collected from the water point (Majuru et al., 2012) to meet the required domestic water need. This assessment involves the difference between the quantity of water required per day based on the stipulated standards and the quantity collected by households.

The study reveals that less than half (35.4%) of the population can meet the required 50 litres per capita per day for at least 95% of the time throughout the year. According to the CWSA's guidelines, for a water facility to be considered functional, the flow of water should be available 95% of the time throughout the year. Technical difficulties can stand in the way of this. Factors such as dried boreholes and streams and frequent water facilities breakdown account for households' water unavailability to meet their basic requirement of consumption, food preparation, cleaning, and laundry, as reflected in this quote,

“Within the past three months, water has been hard to come by. The borehole, our primary source of drinking water, has broken down six times in the last three months. These times made it hard for us to meet our drinking water needs”.

As part of water availability, the study assessed the perceptions of drinking water reliability based on the ability of the drinking water source to provide water for at least 95% of the year, which is interpreted as 347 days without interruption (Adank et al., 2013). In this assessment, more than half (60%) of the households rated their current water supply as poor and very poor (Table 5.2). The water supply is usually interrupted during the dry seasons. As a participant noted,

"The boreholes have shown to be unreliable. The streams cannot be relied upon since it also dries up during the dry season."

Another added,

"In the dry season, both the borehole and the stream dry up. When you pump, the water does not come. It takes a while before it flows."

Due to women's involvement in water collection, they expressed more concern about water reliability than men. All the participants agreed that water unreliability affects their socio-economic and cultural lives, including family life, farm activities, and school attendance.

The study also identifies some of the household coping strategies during water scarcity. These include relying on unmonitored water sources, collecting water from nearby communities or towns (usually tedious and expensive), and reducing water usage. Water from unmonitored sources is usually not treated before consumption. According to a household respondent in Esereso,

"We collect water from the stream (Asuo Bisi). Even though it is difficult to drink from Bisi, but we do not usually have a choice. We consume the water directly from Bisi without any treatment."

5.2.3 Water Access

Access is defined as the distance and time covered to collect drinking from the source (physical access/coverage) and means of acquiring it (affordability) (WHO/UNICEF, 2017; WHO, 2011). The assessment of water accessibility in this study considers the users' ability to pay for water, the distance covered for water collection, and the time traveled to retrieve water, including waiting time. According to the WHO/UNICEF Joint Monitoring Program (2017), drinking water can be considered basic to households when such water is from an improved source. The collection time should not also exceed 30 minutes for a round trip, including queuing. However, limited water service exists when the average collection time exceeds 30 minutes, including waiting time. In

addition, the CWSA guidelines recommend a maximum of 500 meters, which is translated as a 1000 meters roundtrip to access a handpump borehole in rural Ghana.

Even though none of the households has optimum access (when the facility is within the yard), the study reveals that not all households (30%) are about to meet the basic distance required for water collection from improved sources. Despite meeting the basic distance requirements for water collection, only about a quarter (24%) of the households can collect water within 30 minutes, including commuting and queuing time (Table 5.2).

Most of the study households (61%) prefer to collect water at dawn and in the evenings to prepare for the day, and meal preparations and washing, respectively. Households spend an average of 108 minutes, covering 975 meters per round trip on the average for water collection (Table 5.3). With an average of five trips per day to meet the water requirements of five people per household on average, about 7 hours are spent on water collection activities each day. This could be more considering that almost half (46%) of the households spend more than five trips for water collection daily, covering about 4 kilometers on average. According to some women participants during a focus group discussion in Wabrease,

“Water collection is usually easier when there are more females and fewer males in a household. However, it can be hell when the situation is different. This is even worse for some of us with large families.”

Table 5.3: Description of Households’ Water Collection Activities (N=158)

	Mean	SD
Number of Trips per day	4.50	2.19
Water collection time per trip (in minutes)	108.01	172.03
Water Collection Time per day (in hours)	7.07	6.80
Water collection Time and other domestic Time per day (in hours)	12.39	8.24
Distance per trip (in meters)	975.45	1449.63
Daily distance per day (in KMs)	3.71	4.76

Source: Field Data (2019)

The study assessed the percentage of households' water expenditure on monthly income in addition to distance and time. The WHO/UNICEF Joint Monitoring Program (2017) recommends that water costs should not exceed 3% of household income. The study reveals that about 40% of the households spend more than 3% of their monthly income on drinking water. This includes the cost of transporting water, particularly for households who use motor vehicles. According to a household head in Wabrease,

"Since it can take more than four hours to walk for a one trip water collection, I always use a motorcycle to make it easier. The cost of fuel on use is unbearable, but we have no choice."

The cost also discourages people from using water from improved sources. As one household members noted in unison,

"Due to our high-water demand, we usually use water from the borehole for drinking while the stream helps in food preparation, cleaning, and laundry. It costs a lot to pay and transport water."

Another 74-year participant echoed this,

"The cost of water collection is one of the major reasons I depend on the stream for water instead of the borehole. Even though those over 70 years are not required to pay for water, those living with children are asked to pay. Using the stream does not require payment. "

5.2.4 Water Safety

The water for personal and domestic use must be safe. To assess the quality of drinking water, this study adopted three approaches. First, the study assessed local water managers' ability to protect water sources from contamination and carry out water quality testing twice a year (during the dry and rainy seasons) as stipulated by the CWSA guidelines. This also includes the existence of water safety plans, such as source water protection (SWP). Due to the limited or lack of local capacity, there are no commitments to water quality testing. Besides, there are no water safety plans for

protecting water sources; hence, this has been left at the mercies of community bylaws without any proper enforcement mechanisms. According to a male participant in Esereso,

"It got to a point where we were afraid to consume water from the borehole because we could not stop someone from erecting a toilet facility near it. It took the interventions of the district assembly to get this resolved after a protracted disagreement."

Second, the study assesses users' perceptions of water quality based on organoleptic properties, including appearance, taste, and smell. The study participants rated their perceptions of drinking water sources based on these properties. The study reveals that less than a quarter (22.5%) rated the drinking quality as either poor or very poor. The household interviews reveal that water quality perception is based on these three components, with no considerations for chemical or biological compositions. Furthermore, the only time community water users complain about water quality is when the appearance, taste, and smell of the water are compromised. As a participant noted,

"Sometimes, the water from the borehole appears oily in addition to the presence of black particles" (see Figure 5.1).



Figure 5.1: Sample of borehole water with particles from Wioso

Source: Photo taken by the author (2019)

The users' poor perceptions about these physical properties can also affect the consumption of water, as confirmed by one participant,

"I no longer trust the borehole because there are always some particles in it. I prefer the stream since it is what we relied on before the borehole was constructed. It never made us sick."

Finally, since water can be contaminated during haulage and storage, the study identifies how water is collected and stored. These include whether water is covered during collection or storage, how long water is stored, and the safety of water collection containers. Apart from those who use *Kuffour gallons* (usually requires to be covered before transport) to collect water, none of the participants cover water containers during water haulage. Besides, only about a quarter of the

study participants cover water containers during storage. Since all the participants do not have an on-premises water facility, it is difficult to collect more than enough water than required; hence, water is not stored for a long time. The maximum number of days for water storage before refilling in most households is three days.

Based on these three factors, the study participants ranked their perceptions about the overall water quality using a dichotomous response. More than two-thirds (72%) of the study participants have a bad perception of their drinking water quality.

5.2.5 Users' Preferences and Perceptions

Understanding the preferences and perceptions of rural water users is another consideration that should be factored in assessing a community's drinking water security. Studies (Akpabio and Takara, 2014; McGregor, 2008), particularly within SSA, show that taboos are important social assets that help contribute to the protection of natural resources, including forest and water sources. This is because of the reverence and respect residents have for the deity and other “spiritual beings” with respect to the usage and protection of the natural environment and resources. In line with this, the study identified and examined the taboos, myths, and customs held by the communities in regulating water collection, use, and activities near water bodies. The interview findings showed that all residents in the study communities connect waterbodies to the spiritual world. Participants were of the view that the streams serve as a mother goddess that seeks to protect the community members from calamities, provide the needs of those in need, including a constant flow of drinking water, and have the ability to cure barrenness. Given this, the study communities observe certain practices that ensure that surface water bodies are kept sacred.

First, it was revealed through the interviews that water users are restricted from visiting waterbodies on certain days; Tuesdays in Esereso and Wabrease and Fridays in Wioso. The days were regarded sacred. According to a community leader,

"Just as we take days to rest from work activities, do the streams and other natural resources. They also need days off to rest, and more importantly, to have privacy..."

In addition, non-community residents are not allowed to go near water bodies without the company of a community resident. For instance, as a custom in Esereso, a community elder to performed rites before our first visit to the stream (*Asuo Bisi*). Holding a fruit (pear), the elder explained the visit's purpose and asked for permission to be near the stream. This was followed by cutting the pear into pieces and spreading it into the stream as a sign of gift. Once the gift was accepted, this permitted us to "interact" with the stream. This practice serves as an impediment for outsiders from bypassing community leaders to conduct activities that may be detrimental to the stream. As a participant revealed in Wioso,

"Before any activity is taken place here that involves the streams, the elders have to perform certain rites before that can happen."

Second, there is a ban on farming activities near water bodies. Considering that the streams and the trees around them are gods that protect the communities, the residents consider farming activities near them to be detrimental to the peaceful existence of these sacred resources. The study reveals that farming near water bodies can result in indiscriminate cutting down trees or dumping of chemicals (such as fertilizers and weedicides) into the stream. According to a community elder,

"We make sure nobody farms near the stream. This is something our forefathers used to do. Even though nobody explained to us why this practice was done, but we know that they help protect the stream."

Finally, there are general "dos" and "don'ts" for water users. These include a ban on stepping into the stream with footwears, siting refuse dump or toilet facilities near the stream, and washing clothes in the stream. According to the community elders in a focus group discussion,

these restrictions in the past included bans on visiting with uncleaned containers and by menstruating women. As the elders recounted, a disregard for these restrictions could attract sanctions from the community leaders as well the stream gods. As one elder recalled from his childhood days,

"We do not normally see this in the current days; sanctions from the gods used to happen in the past. One could easily be faced with the calamities for showing disregard to the customs associated with the stream."

Another participant added on the actions of community leaders in ensuring that these customs are adhered to:

"Despite not seeing much of the spiritual consequences, we make sure that those who disrespect the local rules and customs are dealt with accordingly. We cannot allow our customs and traditions to diminish just like that."

As a general consequence, there was a unanimous consensus on the part of the participants of the focus group discussions on why the streams dry up during the dry season. They argued that a general disregard and relaxation of traditional norms and customs are the reasons for water shortages during the dry season. According to an elderly woman,

"The gods are compassionate now. Unlike in the past, where they used to kill us for disobeying them, this no longer happens. However, we see clear evidence of punishment on how the streams dry up, causing water shortages."

Considering community preferences can be crucial for effective implementation of community water management, incorporating societal values into the provision of water facilities and services does not only contribute to the usage of such services but also able to solicit community support and participation in planning, implementation, and management of such facilities. Given this, the study assessed the considerations of water users' cultural preferences during community-based water management. The participants were asked to indicate whether existing cultural norms and values are considered during water management, particularly on

projects implemented by external water managers. The study reveals that for most participants (68%), their preferences are considered in drinking water management.

5.2.6 Sustainability of Water Resources and Systems

Sustainability in rural water security involves whether water resources and infrastructure continue to meet the users' requirements over time. For water resources, the assessment was based on how both ground and surface water sources are sustained and prevented from pollution. The study result shows that the only measures that protect water resources are the poorly enforced community bylaws. Even where a community can put enforcement mechanisms to protect surface water sources, the respondents pointed out that difficulties still exist regarding enforcing such bylaws in other neighboring communities that share the water sources. According to a community water manager,

"We have tried our best to stop people from polluting the stream. The difficulty lies in how to get the neighboring communities to do the same. This is where we need the assembly to intervene..."

Accordingly, more than half (55.5%) of the study participants rate their water resources as either unsustainable or highly unsustainable. The rating was done based on how frequently a water facility (boreholes or hand-dug wells) breaks down or unable to function.

Aside from the limited attention to water resources in water security discourses, this study also assessed the extent to which water infrastructure is sustained in the study communities. The study measured borehole sustainability based on a borehole's ability to provide an indefinite water service with certain agreed characteristics over time. Even though no internationally agreed indicators exist for measuring the sustainability of rural water supply systems, Adank et al. (2013) note that this is usually affected by a range of factors that contribute to the service's likelihood to be provided over time. The study reveals that factors such as limited financial, institutional, and

managerial capacities affect the extent to which the water facilities can provide users' water needs over time. This was reflected in the participants' responses, where only 9% perceived their water facilities as highly sustainable.

5.2.7 Water Management

The current challenges of household water security have been associated with management failures. Accordingly, the study assessed how rural water management affects water security. This assessment was based on capacity, participation, accountability, and responsiveness. The capacity for rural water management was categorized into five dimensions: institutional, financial, human resources, social, and technical. Over 80% of the study participants believed that these dimensions are either limited or unavailable for effective rural water management.

In addition, less than half of the sampled households participate in rural water management. Their participation was based on the contribution of resources (or in-kind) and involvement in decision-making. Because of this, most households perceived their water managers as unaccountable (82%) and unresponsive (70%). The study result shows that these factors, in combination, are poorly achieved in the study communities. Given this, only a quarter of the study participants believe that the community-based water management approach is effective. One community water manager agreed with households' responses,

“I see water management as chaotic in this community. It seems we just exist to collect water fees. There is nothing like a collaboration between we the WATSAN committee and the district assembly. They (the assembly) should just tell us that they don't care, and we will take it over from there.”

5.2.8 Predicting water insecurity using Multiple Linear Regressions

By pooling reported experiences of water security/insecurity derived from the six defined dimensions, the data collection gathered a set of 18 experiences of water security/insecurity. To establish how these dimensions are associated with rural water insecurity, this section uses a multiple regression model to predict the influence of these dimensions on rural insecurity (Figure 5.1).

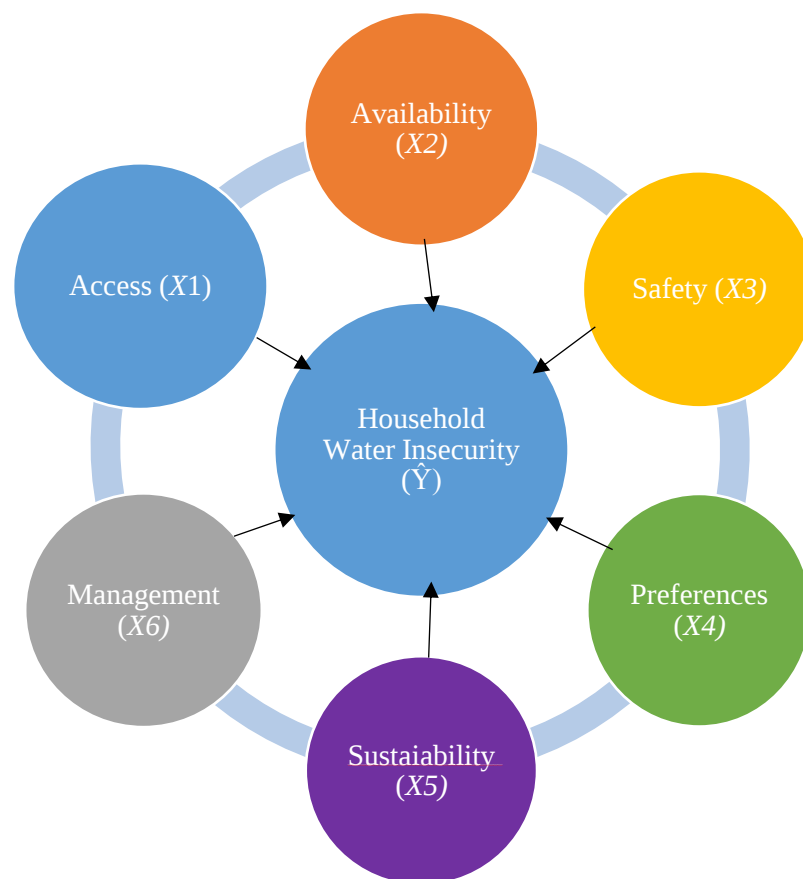


Figure 5.2: Predicting Rural Water Insecurity

Source: Author's construct (2020)

To enhance this analysis, I framed each of the nominal variables as dichotomous. Due to fewer cases to measure all the variables, I combined some of the variables as a single composite unit (Tabachnick and Fidell, 2013). The outcome variable (water insecurity) was obtained by rating (in percentages) how the six dimensions of water security can contribute to water security. The participants' ratings were in percentages (0-100%) where 0% and 100% represent highly water-secure and highly water insecure, respectively.

The multiple regression model linking the set of regressors (dimensions of water security) to the outcome variable (water insecurity) is obtained by the regression equation:

$$\hat{Y} = B_0 + B_1X_1 + B_2X_2 + \dots + B_p X_p$$

where $\hat{Y}$ is the observed value of the outcome variable (water insecurity), B_0 is the intercept, B_1 is the regression coefficient, and X_1 to X_p represents the independent variables (IVs). Using the survey data, I conducted linear multiple regression analysis with water insecurity (WI) (outcome variable) as a linear function of access, availability, safety, preferences, sustainability, and management (six regressors). The multiple regression equation that models water insecurity for this analysis is:

$$\text{Water Insecurity} = B_0 + B_1\text{access} + B_2 \text{availability} + B_3\text{safety} + B_4\text{preferences} + B_5\text{sustainability} + B_6\text{management}$$

Based on this, I conducted a simultaneous multiple regression analysis with the frequency of water insecurity as the dependent variable and water access (Acc), water availability (Av), water quality (Qty), consideration of preferences (Pre), sustainability (Sus), and effective management (Mtg) as the independent variables. The means, standard deviations, and intercorrelations can be found in Table 5.4. No univariate or multivariate outliers were observed.

Table 5.4 also displays the unstandardized regression coefficients (B); the standardized regression coefficients (β); the semi-partial correlations (sri^2); and adjusted R^2 . R was

significantly different from zero, $F(6, 157) = 37.5, p < .001$. All the variables contributed significantly to prediction of rural water insecurity, access ($sri^2 = .08$), availability ($sri^2 = .08$), quality ($sri^2 = .04$), preferences ($sri^2 = .06$), sustainability ($sri^2 = .04$), and management ($sri^2 = .09$). Overall, 58% of the variance in rural water security is explained by the six dimensions of water security (independent variables). According to Cohen (1988), this is a large effect. This means that there are smaller differences between the observed data and the fitted values.

Table 5.4: Simultaneous Multiple Regression of Dimensions Water Security on Water Insecurity

Variable	WIN (DV)	Acc	AV	Qty	Pre	Sus	Mgt	URCs (B)	SRCs (β)	sri ²
Acc	-.22							-12.9**	-.281	.08
Av	-.35			.16*				-14.1**	-.286	.08
Qty	-.55						.70**	-16.7**	-.334	.04
Pre	.20							9.4**	.195	.06
Sus	-.22			-.14*				-13.5**	-.298	.04
Mgt	-.51							-15.3**	-.298	.09
Means	58.58	.58	.30	.28	1.32	.47	.24			
SD	22.71	.50	.46	.45	.47	.50	.44			

Constant 72.56; $R = .77$; Adjusted $R^2 = .58$; $F(6, 157) = 37.5, *p < .05; **p < .001$

5.3 Health, Economic, and Social Effects of Water Insecurity

This section provides information on the effects of water insecurity on households. These are categorized into health, socio-economic, and cultural effects. The health effects assessment sought to find out whether any member(s) of the study households had experienced water-related health concerns as a result of water collection and use. The assessment was based on the past 12 months from when the data were collected. The study found that most households (56%) had at least a reported case of water-related health effects. These cases are more concentrated among those who reported rheumatism and joint pain (78%) because of water collection activities. Unlike diarrhea and typhoid, caused by water consumption, foot rot and skin rashes are caused by contact with

contaminated water. While some households reported being affected with skin rashes through bathing with contaminated water, others identified stepping into streams barefooted as the cause of contracting foot rots.

Except for typhoid, which recorded a few cases (8%), a significant number of households reported having experienced both diarrhea (45%) and skin diseases (39%). Except for rheumatism and joint pain, where households use self-examination to attribute its cause to water collection activities, the remaining cases were verified to have been caused by water insecurity through visits to health facilities as reflected in a quote from a participant,

“My daughters and I feel lots of pain on days where we collect much water. We don’t need a doctor to tell us that the pain came from the water collection activities.”

This was supported by another household head,

“At first, we used to have skin rashes. We visited a clinic, and the doctor told us to change our bathing water. Since then, we have never contracted skin diseases.”

Interestingly, diarrhea, skin diseases, rheumatism, and joint pain are among the top ten common health-related cases reported by the two districts' health directorates.

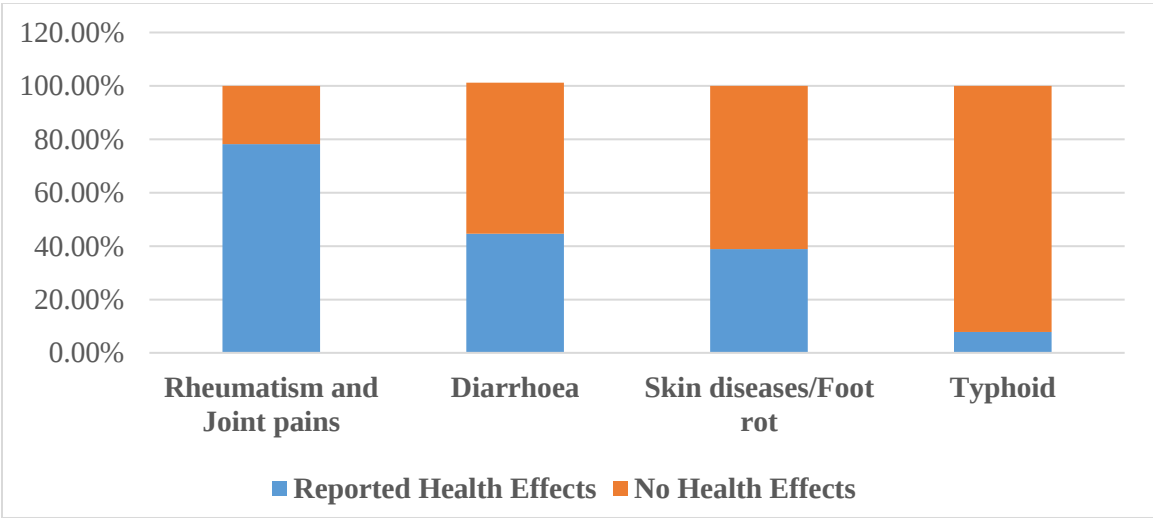


Figure 5.3: Health-related Effects of Water Insecurity as Reported by Households (N=89)

Source: Field Data (2019)

These health effects from water insecurity have negative implications on the household's socio-economic, cultural, and religious lives. Owing to this and other factors, more than half of the study households reported that water insecurity affects their occupation (63%), expenditure (67%), and family lives (58%), while sizeable numbers have their cultural/religious lives (26%) and children's education (46%) affected by water insecurity. Economically, water insecurity affects households' occupation and expenditure. Most households (63%) reported that unsustainable water supply affects either the time required to work or their overall contribution to productivity. According to one female participant,

"Sometimes it is either the borehole is broken, or there is a long queue. Either of these leaves more time to collect, giving little or no time to work."

Another female responded added,

"Water collection is a tedious activity. Collecting water before work makes me tired, which affects my daily inputs on the farm. Even when water is collected after work, this makes me more tired, making it difficult to wake up in the morning. Indeed, water collection affects our work."

While the effects of water insecurity on households' occupations directly affect their income, it also affects their expenditure on basic needs. Aside from the usual expenditure made on water tariffs, it costs more to collect water from long-distance locations in cases of protracted water scarcity. For this to happen, some households cut down expenditure for other basic needs or depend on an unmonitored water source. According to one household head,

"How can I spend more on water and food at the same time? I will rather collect water from the stream than pay extra for water from other places."

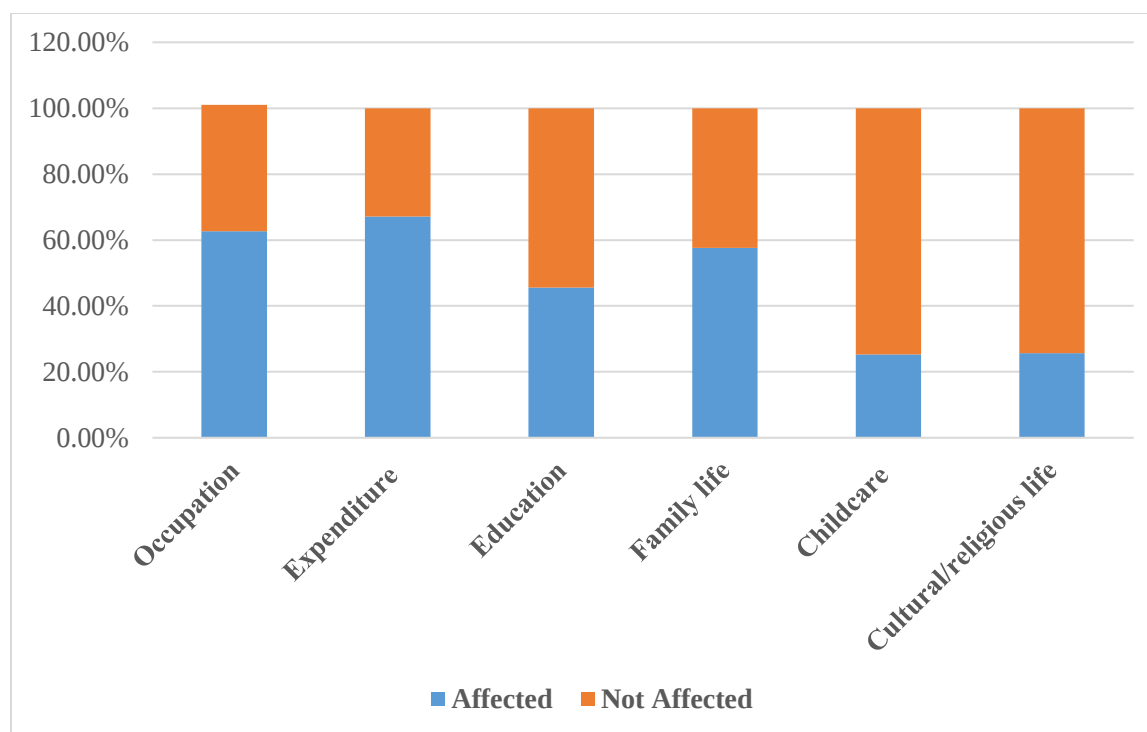


Figure 5.4: Reported Effects of Water Insecurity on Social, Economic, and Cultural Lives of Households (N=158)

Source: Field Data (2019)

For most adult women and children, water insecurity affects their relationships with their husbands and parents, respectively. According to the FGD participants in unison,

"Water insecurity means that we cannot perform our usual domestic chores such as food preparation, cleaning, and laundry. Our husbands normally do not understand why somethings are left undone. This creates problems in our homes."

Another female participant was more specific,

"I get stressed from water insecurity. This affects the extent to which I'm able to relate with my husband, including our sexual encounters."

The study also found that some women get frustrated with water insecurity. This frustration is normally directed to either the community water managers or the caretakers of water facilities. Consequently, involvement in community water management is one of the most challenging jobs in the study communities.

For children's education, particularly girls, water insecurity affects both attendance and performance. Water insecurity either increases the chances of being late for school or not attending school. The inability to collect water on time in early mornings increases children's chances (water collectors) of being late for school. The fear of being punished or subjected to humiliation for coming to school late usually discourages children from staying in school. As one parent confirmed,

"My children, through no fault of theirs, always get punished for being late for school. To avoid this, they refuse to go to school whenever they are late."

This is also exacerbated by their inability to stay in school due to water-related health concerns. As a respondent revealed during an interview,

"My children sometimes stay out of school due to water-related health concerns involving water collection and consumption."

Consequently, water security affects children's performances in school. According to a community water committee manager,

"Water collection activities affect school attendance and participation, which results in poor performance."

5.4 Discussion

Achieving rural water security constitutes a major challenge for policymakers if there is no basis for defining and operationalizing the concept. This study's results show that for rural water security to be achieved, it is important to consider all the dimensions of water security – availability, access, quality, preferences, sustainability, and management.

Water management is a significant bottleneck to achieving drinking water security in most developing and even some developed countries (de Boer et al., 2013). According to UNESCO (2006), water management constitutes the main challenge to the current water crisis and not water

supply or technology. Therefore, good management is necessary and is one of the highest priorities of practice for achieving drinking water security at the community level (Cook and Bakker, 2012; Rogers and Hall, 2003). It provides the vehicle for other variables to operate towards achieving rural water security. For example, accessibility, availability, and water quality will not have a bearing on the individual's water security experience if they lack the means to manage the water resources and infrastructure, signifying the importance of management in water security analysis.

Interestingly, the study results show that effective management is the dimension with the highest unique contribution to water security. The study reveals that a change in effective management could potentially result in a significant decrease in rural water insecurity. Lankford et al. (2013) noted that effective management focuses not only on the presence of policies and institutions in enhancing people's access to safe water but also on building the capacities of the beneficiaries to ensure effective contributions to the provision and management of drinking water. However, this study reveals that factors such as limited rural capacity, poor participation, unresponsive and unaccountable water managements constrain the effectiveness of the community-based water management in rural Ghana.

Even though not the highest in terms of its coefficient contribution to rural water security, water resources, and systems' sustainability rank the second most important dimension to achieving water security among the six dimensions examined. The contribution of sustainability is high because it is the only dimension that pays attention to water resources and water infrastructure. The absence of either of them means that it is impossible to achieve each of the rural water security dimensions. Sustainability in rural water security involves whether water resources and infrastructure continue to meet the users' requirements over time (Lockwood and Smits, 2011). While sustainability is considered vital to achieving rural water security, the results

of other researchers suggested poor attention is paid to such an indicator. Lockwood and Smits (2011), for instance, estimate that just a little over one-third of handpump boreholes function in most rural communities in Sub-Saharan Africa. Similarly, Harvey (2004) found that depletion of groundwater levels in weathered aquifers coupled with an insufficient recharge of fractured aquifers have resulted in dry boreholes in most rural communities in Ghana. Unsurprisingly, the majority of this study's participants rated their water resources and systems as either unsustainable or highly unsustainable.

The study results established that limited rural capacity affects the extent to which water resources and infrastructure are sustained in rural Ghana. The sustainability of water resources always ensures its availability to meet users' demand and supply. As this study results reveal, water security achievement depends on the availability of water flow to meet households' needs. However, this is not the case in the study communities as almost two-thirds (65%) of the households cannot meet the minimum required of water of 50 litres per person per day necessary for personal and domestic uses. The study reveals that water flow is unreliable due to the frequent breakdown of water facilities as well as insufficient recharge of aquifers during the dry season.

Even though unmonitored water sources can supplement the unavailability of improved water, this study found a positive correlation between water quality and availability. This finding suggested that water users are not only interested in quantity but also in the quality of drinking water available for use. The study results also show that water quality has the highest coefficient contribution to water security, implying that improvement in water quality will result in a significant decrease in water insecurity. According to the WHO (2011), for water to be considered safe, it must be free from micro-organisms, chemical substances, and radiological hazards that can pose threats to a person's health. Safe water should be of acceptable color, odor, and taste and must

strictly follow national and/or local standards for recommended either personal or domestic use. However, this study found that households in the study communities rely on unsafe water to meet their daily needs. Even though no chemical test was conducted, the study found that water quality is compromised due to poor water monitoring, unsafe water haulage, and poor water storage. Besides, this study found that most households (72%) have bad perceptions about their drinking water quality.

Water access constitutes another critical consideration for defining rural water security. The availability of the right quantity of drinking water is meaningless if households do not have access. Access is defined as the distance and time covered to collect drinking from the source (physical access/coverage) and means of acquiring it (affordability) (WHO/UNICEF, 2017; WHO, 2011). As in other studies, this study found that rural households cannot boast having access to water considering these three factors. Although most households (70%) meet the prescribed basic distance required for water collection, there are those (30%) who travel more than a kilometer per trip for water collection. Surprisingly, only 24% meet the basic requirement of 30 minutes for water collection. This figure extends to about 844 million people worldwide who are unable to meet prescribed basic water services (WHO/UNICEF, 2017).

Aside from distance and time, communities' ability to afford water influences their uses of water and the choice of water sources. This study found that the households' inability to pay for water has two main effects: relying on unmonitored water sources and reducing the quantity of water consumed. Either way has implications on good sanitation or poses a significant health risk (WHO/UNICEF, 2017).

Finally, it is necessary to factor in rural water users' preferences in operationalizing community water security (Daemane, 2015). In this regard, most households contended that their

cultural preferences are considered in the provision and management of rural water. The study found that this is attributed to the community-based water management that allows their own people to be in charge of water management. This is one significant benefit of community-based water management since the water managers are from the community and understand the social and cultural contexts of their communities. Generally, all respondents in the study communities deemed these practices and beliefs as efficient and effective in regulating the use of available water sources; hence, the need for its integration into formal interventions and policies.

In addition, the United Nations posits that all drinking water facilities and services must be culturally appropriate and sensitive to gender, lifecycle, and privacy requirements, without which beneficiaries may not participate (UNDESA, 2014). Incorporating societal values into the provision of water facilities and services not only contributes to the use of such services but also solicits community support and participation in planning, implementing, and managing such facilities. In cases users' preferences are not considered in providing water services, consumers tend to rely on alternative sources for their water needs, including unmonitored sources or purchasing from expensive sources (Goldhar et al., 2013). In order to meet the preference of communities in providing drinking water services, the location of water facilities, the color, and taste of water should be factored into the design and implementation of such water facilities and services.

5.5 Conclusion

This chapter has shown that rural water security encompasses a multifaceted dimension that not only constitutes meeting the needs of water users but also the sustainability of water resources and infrastructure. Clearly, the assessment of each of these indicators showed that water insecurity

exists in rural Ghana despite some positive results from some of the indicators. This means that defining rural water security should go beyond mere coverage of water facilities, as is currently the case for rural Ghana. As shown in this chapter, coverage constitutes just an aspect of water access.

It has also shown that water users require their water sources to meet the conditions of acceptable quality, accessibility, and domestic requirements for drinking, food preparation, basic sanitation, and hygiene. In addition, they expect not just effective water management that involves active participation, capacity building, accountability, and responsiveness, but also the management approaches that respond to their preferences and enhance water resources and infrastructure sustainability. Failing to achieve this can result in a community's or a household's reliance on other alternative water sources that are usually unmonitored.

Even though this chapter's findings have shown that these six dimensions matter when defining rural water security, the findings also suggest the need to consider context-specific issues since each of these indicators has contextual meanings, interpretations, and applicability. Indeed, the basic approach involves paying attention to the specific issues of concern when addressing rural water security. This helps eliminate socio-economic, cultural, and environmental factors that do not contribute to water security in a particular context. For instance, the application of cultural considerations may depend on a particular context. Even though cultural considerations are vital to water management decisions in the study communities, this may not work in different communities. Based on this, it will be interesting to test a similar hypothesis of how water security is conceptualized and operationalized in a different jurisdiction using the six dimensions as the basic indicator framework.

CHAPTER SIX

THE EXPERIENCE OF WOMEN AND CHILDREN IN DRINKING WATER SECURITY

6.1. Introduction

This chapter extends the discussions in the previous chapter by assessing the experience of women and girls – two of the marginalized populations in rural water security. This chapter assesses women and girls' water security experience from the perspectives of their sole involvement in water collection activities. This study's analysis is based on the position that the patriarchal system of traditional Ghanaian societies has created unequal relations and status between men and women (the genders recognized locally). As in other Sub-Saharan African countries, gender inequalities in Ghana include differences in power to make and implement decision-making in households and the community at large, weaker access to productive resources, and discriminatory social norms (Harris et al., 2017; Mikell, 1997; Mukherje et al., 2017). These gender inequalities are inherently grounded in traditional Sub-Saharan African culture, societal expectations, and norms (Adjiwanou and LeGrand, 2014).

Consequently, in many parts of rural Ghana, men have the power to influence decision-making while women are subordinates and passive decision-makers. The presumed legitimacy of men's control is derived from a perceived ideology of male superiority, which leads to men's dominance in traditional Sub-Saharan Africa societies (Boahene, 2013). The result is that a girl in rural Ghana is usually socialized from birth and is conditioned into accepting her position as subordinate (Boahene, 2013). Accordingly, women are marginalized through ascribed and defined domestic work, marriage, and childcare. A Ghanaian woman's status depends on her ability to live up to her primary responsibilities for childbearing and home management (Boahene, 2013).

Domestic activities in rural Ghana, therefore, have a female's face implying that responsibilities for food preparation, water collection, cleaning, and laundry are largely assigned to women and girls. For this reason, women and girls are the primary water collectors and domestic users in most traditional rural communities in Ghana. Water is woven into the daily schedules of women's and girls' role performance and is inextricably connected to their domestic responsibilities (Harris et al., 2017; Van Houweling, 2016). Gender norms are, therefore, significant in determining water access, collection, use, and management, as well as potential outcomes of water projects (Sultana, 2009).

The labor-intensive nature of water collection in rural Ghana and its unequal retrieval, use, and management at home between men and women widens the inequality gaps between the sexes and increases women and girls' marginalization. This marginalization extends to all aspects of Ghana's social, economic, and political life (Gyimah and Thompson, 2008; Wrigley-Asante, 2008). Gyimah and Thompson (2008), for instance, identify the low participation of women in local governance in northern Ghana. Similarly, Awumbila (2006) argues that women are more vulnerable to poverty due to gender inequalities. Women constitute the core of the poorest among the poor people (Wrigley-Asante, 2008). This makes it imperative to pay attention to women and girls in policy interventions involving rural water security in Ghana.

As explained in Chapter Four, neoliberalism has been the policy thrust that has shaped Ghana's water security. While acknowledging that water security challenges in rural Ghana and gender-based inequality existed long before neoliberalism, I hold that neoliberalism has exacerbated the ongoing challenges of providing and sustaining water infrastructural needs of rural areas (Obeng-Odoom, 2012). The lack of water is experienced most by women and girls; it is their struggle and worry (Cole and Muslin, 2020, 10). Thus, women and girls are most negatively

impacted by post-neoliberal rural water security in Sub-Saharan Africa. As shown in Chapters Four and Five, the post-neoliberal rural water security in Ghana is largely characterized by the labor-intensive nature of water collection, non-functional water infrastructure, and limited local capacity to provide, maintain, and manage safe and reliable potable water services.

Global water security challenges have been a subject of international concern, with significant progress made towards water security. Despite this progress, there remain worrying discrepancies involving water access and use across age groups and between genders (Staddon et al., 2018). According to Wrisdale et al. (2017), progress has been uneven and characterized by inequalities that marginalize women and girls. As Coles and Wallace (2005) pointed out, for example, there are concerns about policy oversights related to women's roles in water access and use. For instance, the MDGs failed to incorporate gendered perspectives despite the role of women in domestic water collection. Even though the SDG 6⁷ pays special attention to women and girls (WHO/UNICEF, 2017), it must be considered that women's and girls' roles in households' water security exacerbate their vulnerability in traditional Sub-Saharan African society. Thus, in this chapter, I argue that a disregard for contextual gender roles and obligations on household water security issues can have severe consequences for women and girls.

While existing studies offer insights into women's and girls' domestic water collection experience, I hold that gaps still exist, requiring policy attention. Findings from Nauges' (2017) study in Ghana and Van Houweling' (2016) in Mozambique, for example, identify both boys' and

⁷ Sustainable Development Goal 6 seeks to ensure access to water and sanitation for all. Target 6.2 focuses on achieving access to adequate and equitable sanitation and hygiene for all by 2030 with special attention to the needs of women and girls and those in vulnerable situations (WHO/UNICEF, 2017).

girls' involvement in domestic activities, including collecting drinking water in the early stages of their growth. Girls, however, solely assume these responsibilities as they grow older. Even though there are no specified ages for boys to "graduate" from water collection activities, Nauges (2017) concludes that boys are usually freed from water collection just as they enter their teenage years. Geere's (2016) estimates also suggest that women and girls spend about 40 billion hours yearly on water collection activities in the Global South. However, it is unclear in the literature as to the number of trips required to collect water to meet the daily requirements of water, the waiting time, and the times allocated by households for such purposes in Ghana. There is a consensus in the qualitative and quantitative literature that women, rather than men, are more concerned with quality issues associated with drinking water and are more likely to voice complaints about water insecurity (Hanrahan and Mercer 2019; Harris et al., 2017; Masanyiswa et al., 2015). However, scanty evidence exists for men's and women's perceptions of water quality and water supply reliability in rural Ghana.

This chapter fills in the gap by assessing the experiences of women and girls in rural water security in Ghana. Using quantitative statistical analysis, I test the mean difference between water collection time and time for other domestic activities, the age differences between boys and girls involved in household water collection, and the perceptions of both men and women in community drinking water quality and reliability. In addition, using qualitative analysis, this chapter moved beyond Harris et al.'s (2017) reported men's knowledge and involvement in community water management to describe households' perceptions of men's participation in water collection. Based on these analyses, I argue that rural Ghanaian women's and girls' assigned connection to water collection is discriminatory, constitutes environmental sexism, and reduces their involvement in other forms of economic and social activities, especially in the public sphere. This places a

disproportionate health burden on women and girls and makes them more vulnerable to water injustice.

6.2 Results

In this section, I present the results on water security of experience of households with emphasis on gender participation in water collection activities. Using the household as the unit of analysis with a focus on routine domestic gender roles (Hanrahan and Mercer, 2019), I present the study results based on these roles and how these affect women and girls compared to men and boys.

6.2.1 Water Collection by Gender

The study results show that adult women, aged 19 years and above, constitute over 79% of households with only women's participation in water collection (Table 6.1; Figure 6.1). About 81% of all girls in the sampled households, between the ages of 6 and 18, participate in water collection activities compared to half the number of boys in the same age category (Table 6.1; Figure 6.2).

Table 6.1: Gender Participation in Water Collection

Households Adults' Participation by Gender (Aged 19+) (N=157)			
		Frequency	Percentage
Households with only Men's Participation		8	5.1
Households with only women's Participation		124	79.0
Households with both men and women's Participation		25	15.9
Total		157	100
Boys and Girls Participation (Aged 6-18 Years) (N=333)			
Boy-child	Participation	89	50.0
	No Participation	89	50.0
	Total	178	100
Girl-child	Frequency	127	81.9
	Percentage	28	18.1
	Total	155	100

Source: Field Data (2019)



Figure 6.1: Women's Participation in Water Collection (using different sizes of containers)

Source: Photo taken by the author (2019)



Figure 6.1: Boys' and Girls' Participation in Water Collection

Source: Photo taken by the author (2019)

The study households spend an average of 108 minutes, covering 975 meters per round trip for water collection. The study found that unlike most men and boys who sometimes use bicycles and motorcycles for water collection, women and girls collect water by walking and carrying water loads on the head. Based on field observations, women and girls use a wide array of vessels (ranging between 15 to 30 litres) for water haulage. Most women and girls cited a lack of skill as

the major reason for not using a bicycle or motorcycle. Explaining the reason for not using bicycle or motorcycle, one woman stated,

How can we even think of a motorcycle when we can't even ride a bicycle? Because we can't ride, we don't even think about owning one. What is the use of soap for a dog?"

The study also found that only about a quarter of households meet the basic requirement of water access within the 30 minutes benchmark as prescribed by the World Health Organization (WHO/UNICEF, 2017). In addition, households spend five trips on average for water collection. Over 46% of the households exceed this average. The quantity of water required usually depends on the household size as a large household size tends to consume more water. However, the World Health Organization (WHO) recommends a minimum of 50 litres per person per day to meet basic needs and health concerns (WHO, 2011). With an average household size of five, an average of 250 litres is required for each household per day to meet basic water requirements. Recounting their experience with water collection in a family of ten people, this quote from a young woman reflects how difficult this can be,

"Large family size means that we need a lot of water to cook large meals and meet the water needs for bathing and washing. Everything about large family size is tedious, especially when there more males than females as in my house."

To ascertain whether there is a statistically significant time difference between adults' participation in household water collection, a statistical test was conducted to evaluate the time difference between the daily household hours spent on water collection by men and women aged 19 and above. The independent variable, households' water collection by gender, had three levels: households with only men's participation, households with only women's participation, and households with both men and women. The test results, $F(2, 154) = 4.164, p = .017$, show a statistically significant difference between the hours spent on water collection by women as compared to men (Table 6.2).

Since the variances among the three groups were equal, Tukey's test was used for post-hoc comparisons to evaluate the differences among the means. This identified a statistically significant difference between households' average time with only women's participation and households with both men's and women's participation in water collection. In addition, the analysis on the daily distance traveled for water collection found a statistically significant difference, $F(2, 154) = 4.164, p = .047$, in the daily distance in kilometers covered by women for water collection as compared to men in the same households. In summary, women spend more time retrieving water than men and covering more distance for water collection.

Table 6.2: Descriptive Statistics for One-Way ANOVA

Type of Analysis	Test Used	Variables	Frequency	Mean	SD
Gender involvement in Water Collection (Age 18>)	ONE-WAY ANOVA	Men's Participation	8	.4823	.13
		Women's Participation	124	.7084	.23
		Both Men's and Women's Participation	25	.7525	.263
Total			157	.7039	.24
Gender Distance (in metres)) Covered in Water Collection		Men	8	.488	.16
		Women	124	.646	.27
		Both Men and Women	25	.751	.32
Total			157	.655	.28

Source: Field Data (2019)

Adding water collection to other domestic activities, the study recorded an average of 12 hours daily per household for domestic chores. The study also found that over 50% of the households spend between 9 and 30 hours daily. The analysis shows that women and girls aged six years and above spend an average of 5 hours for domestic activities daily for every household.

A Pearson r correlation, which was applied to examine the relationship between household water collection time ($M = 7.1$, $SD = 6.8$) and time for domestic chores ($M = 12.4$, $SD = 8.2$), shows a significant positive correlation, $r = .85$, $p < .001$ (2-tailed), indicating that water collection time is associated with the overall time spent on domestic activities. Roughly 72% of the variability in time for domestic activities is predicted by knowing the time for household water collection, or vice versa. As women and girls spend more time on water collection, the average time allocated for daily domestic activities increases.

Women's and girls' sole involvement in water collection, use, and domestic management constitutes a daunting task, which also affects their health, social, and economic activities. The study found that 87% of women reported having water retrieval-related rheumatism and joint pain, compared to 13% of men. In addition, 78% and 67% of women reported negative implications of water collection, use, and domestic management on their participation in employment and social activities, respectively. As reflected in this quote by a woman during the FGD in Wabrease,

"...we are always tired of being involved in water retrieval and use. Sometimes this gives us pains, which makes it difficult to do other domestic work. The worse part is that our husbands sometimes do not understand. Besides, our girls get punished for not being in school because of water-related pains and illness."

Men's participation in water collection use is influenced by two factors, the first of which is household status; men who live alone are required to collect for their own water. The second factor is occupation, with some men taking part in water collection for farming purposes. There were mixed views regarding men's involvement in water collection. While some women wanted to be supported in domestic chores, including water collection, others argued that it is their responsibility to carry out those responsibilities. Some women regarded those who allowed their male partners to be involved in water collection as irresponsible. As one female participant noted,

"How can I ask my husband to collect water? How do you expect the rest of the community members to perceive me?"

This was, however, contradicted by another participant:

"There is nothing wrong with men helping with water collection considering the fact that we (women) do all the other domestic work."

One participant agreed with men's participation but was quick to identify the reactions and attitudes of the community members to men water collectors,

"Men's participation in water collection can be a good division of labour in the household, considering the labor-intensive nature of water retrieval. However, such men will be seen as useless (kwaadonto) in this community."

Since boys are usually "graduated" from water collection activities during their teenage years, I also assessed gender involvement in water collection by children aged 6-18 years. This age category represents the school-going ages from basic school to high school in Ghana. A Chi-square test was conducted to evaluate the differences in gender participation in water collection between boys and girls (aged 6-18). The results show a statistically significant difference between boys' and girls' participation in water collection $\chi^2(1, N = 333) = 37.08, p < .001$.

Table 6.3: Gender Participation in Water Collection (Aged 6-18 Years) Crosstabulation (N=333)

Sex		No Participation	Participate	Total
Male	Count	89	89	178
	Expected Count	115.5	62.5	178.0
Female	Count	28.0	127.0	155
	Expected Count	54.5	100.5	155.0
Total	Count	216	117	333
	Expected Count	216	117	333

Source: Field Data (2019)

A follow-up test was also conducted to assess the statistical difference between age groups within both boys and girls in water collection. The respondents were categorized into age groups

6-10, 11-15, and 15-18 years. These groupings were based on the age categories for primary, junior, and senior high schools in Ghana, respectively. A significant Chi-square statistic was obtained, $\chi^2(6, N = 333) = 32.38, p < .001$. Follow-up z tests of column proportions using the Bonferroni correction found that boys who are not involved in water collection are significantly higher among the age group 15 to 18 years as compared to the rest of the age groups between boys and girls, $\chi^2(6, N = 88) = 16.843, p = .01$. The analysis implies that though boys participate in household water collection, girls tend to participate more than boys. In addition, boys, unlike girls, are excluded from water collection after the age of 15 years. As one participant who is also a parent jokingly revealed,

“Boys think they are men the moment they enter into secondary (high) schools or enrolled in apprenticeship...”

Table 6.4: Boys’ and Girls’ Participation in Water Collection by Age Group (Aged 6-18 Years) Crosstabulation (N=333)

Participation in Water Collection		Age Group			Total
		6-10	11-14	15-18	
Boy-child Participation	Count	48	28	13	89
	Expected Count	33.1	27.0	28.5	89.0
Girl-child Participation	Count	42	46	38	126
	Expected Count	46.9	38.2	40.9	126.0
Boy-child No Participation	Count	23	21	44	88
	Expected Count	32.8	26.7	28.5	88.0
Girl-child No Participation	Count	11	6	13	30
	Expected Count	11.2	9.1	9.7	30
Total	Count	124	101	108	333
	Expected Count	124	101	108	333

Source: Field Data (2019)

Despite their significant involvement in water collection and use, women have limited participation in rural water management and decision-making. Even though community water management committees are mandated to include female membership of at least one-third, the

study found out that women's roles are limited to mobilizing other women for sanitation purposes (e.g., sweeping and weeding around water facilities) with limited influence in major management decisions. According to some women with a common voice during a group discussion in Wioso,

"Men are always the ones making decisions on how water should be managed in this community even though we are the ones mostly affect during scarcity. We wish we could talk to the district assembly ourselves."

6.2.2 Household Perceptions of Water Quality and Reliability

Several researchers (e.g., Harris et al., 2017; Masanyiwa et al., 2015) have observed that women are more concerned with quality issues associated with drinking water and are more likely to express complaints on water insecurity. To this end, I assessed the gender perceptions of water quality. These perceptions were measured on the appearance, taste, and smell of both the main and alternative household drinking sources. The participants ranked their perceptions from one to five. A choice of one was considered very poor, while five was rated as excellent. A Mann-Whitney *U* test was then conducted to test whether women's perceptions ($n = 63$) differed from that of men ($n = 79$). The mean rank of women's perceptions found no significant differences between women's and men's perceptions about water quality, Standardized Test Statistic = -3.22 ($U = 2413.5$), $p > .75$ (2 tailed). Unlike other studies (e.g., Anadu and Harding, 2000; Johnson, 2003) that found that women express deeper concerns about the quality of water than men, this result means that men and women do not have different perceptions about the quality of water. This can be explained by the fact that both men and women consume water collected and, therefore, form similar perceptions about water quality. However, another Mann-Whitney *U* test conducted to test the women and men's perceptions on water reliability shows that the mean rank of women's perceptions is significantly higher than men, Standardized Test Statistic = -2.94 ($U =$

1813.5), $p = .00$ (2 tailed), indicating that women show more concern about water reliability as compared to men.

Based on this result, I contend that the greater involvement of women in water collection, use, and its management domestically explains the observed gender-based differences in perceptions about the unreliability of water supply. I assessed the perceptions of drinking water reliability based on the ability of the drinking water facility to provide water for at least 95% of the year, which is interpreted as 347 days without interruption (Adank et al., 2013). All the participants agreed that the frequent breakdown of water facilities makes these facilities highly unreliable throughout the year. As a participant noted,

"This year has been difficult. The borehole has broken down nine times in three months."

The unmonitored streams that serve as an alternative water source in cases of broken-down facilities are also unreliable during certain times of the year. According to a participant in Wioso,

"The boreholes have shown to be unreliable. The streams cannot be relied upon since it also dries up during the dry season."

I also identified that the unreliability of water supply affects the relationships among couples and sometimes results in verbal and physical abuse on women and girls. As a woman stated in Wioso during an interview,

"My husband gets angry whenever he returns from the farm and finds no water to bath. He usually uses unpalatable words on me. He does not usually care whether the borehole functions or not. This usually creates problems for days."

Another added,

"My dad usually beats my younger siblings for their inability to collect water."

As a confirmation to this assertion, a man reveals that he beats his younger daughters whenever they are unable to collect water.

6.3 Discussion

In Ghana, and most of the Sub-Saharan African countries, socio-cultural expectations and a range of contextual factors determine gender roles and responsibilities (Harris et al., 2017; Mukherjee et al., 2017). This tasks women and girls with responsibility for low-status work, including water collection. Women and girls are, therefore, primarily responsible for water access and use in most rural households. As Van Houweling (2016) noted, being a good wife in some traditional societies in Sub-Saharan Africa is tied to the ability to perform domestic tasks, including providing water for the household.

This study found that household size usually determines the number of trips required per day for daily water collection. With an average of five persons per household, women and girls undertake about five trips per day, covering over 3.7 kilometers for water collection. Since distance is associated with time, an estimated one hour and 48 minutes per trip imply that households with five people require over seven hours to collect the daily water requirement. Similar to this study, Geere (2016) argues that women and girls spend an estimated 40 billion hours yearly for water collection activities across developing countries. This study found that aside from the long hours of water collection, use, and management, women and girls are hugely involved in other domestic activities such as cooking, cleaning, and laundry. This, according to the study findings, constitutes an estimate of 12 hours per day in each household. The study further reveals that water collection time for women and girls is correlated with the time for other domestic work, implying that water access improvement has no effect on gender roles in water access and uses but provides additional time for women to be involved in other domestic activities.

While previous studies (e.g., Karim et al., 2014; Harris et al., 2017) have established that men's involvement in water collection is mostly associated with either income-generating activities

such as irrigated farming, this study's findings add that men's participation can occur when they live alone. Furthermore, men's use of bicycles and motorcycles significantly reduces the water collection burden compared to women. Similar to this study's findings, Cole and Muslin (2020) observed that men would collect water in jerry cans by motorbike, but they would not be seen carrying water. Most men see it as a matter of pride and status not to be involved in water collection. Generally, men consider their involvement in water collection for domestic uses and household chores as extending "a helping hand" to their spouses rather than responsibility. Besides, Coles and Wallace (2005) argue that others often disparage men who help in water collection and other household-related tasks, which disincentivizes men's involvement in such activities. The study found this social stigma associated with men's household water security involvement discourages some women from asking their husbands to participate in domestic water collection, use, and management.

Nauges (2017) and Van Houweling's (2016) findings suggested that boys, just like men, exclude themselves from domestic water collection activities in their teenage years. The study results were more specific, adding that such exclusion generally occurs between 15 and 18 years old when enrolled in either high school or apprenticeships. Based on this, the study found that women and girls express more concerns about water reliability issues, including frequent breakdowns of water facilities.

Women's and girls' connection with water constitutes water injustice and limits their geography and their place in the public sphere. It also places them in a marginalized position in sharing environmental challenges in cases of drinking water insecurity. The involvement of women and girls in low-status, time-consuming work such as water collection limits their opportunities vis-à-vis education and paid work compared to men and boys. Similar to this study,

several studies have shown that improved access to water reduces the time women must allocate towards unpaid work and increases the time available for other activities, including training and education (see, for example, Nauges, 2017; Koolwal and Van de Walle, 2013;). According to Nauges (2017), for example, a 50% reduction in water-hauling time in rural Ghana leads to a 13-percentage point increase in school attendance for girls. Girls who stay in school are less likely to be sexually active at a young age, are older on average when they marry, and can look forward to a brighter economic future and improved health (Hallfors et al., 2015; Jukes et al., 2008).

As in other studies (e.g., Geere, 2015; Fry et al., 2010; Masanyiswa et al., 2015; Sarkar et al., 2015), the study found that the labor-intensive nature of water collection is associated with a host of health-related problems, including fatigue, body pain, rheumatism, and joint pain. The study also found that compromised water quality or quantity is connected with elevated levels of stress and psychosocial distress among women and girls, and these health risks are further exacerbated for pregnant women and women with disabilities. Besides the negative health implications, there are other risks associated with water collection, which can cause physical and psychological harm to women and girls. While previous studies identified risks such as sexual abuse (Harris et al., 2017; Wali et al., 2020), this study identified snake or scorpion bites as a major physical risk faced by early morning or late evening water collectors. Additionally, many of the women and girls in this study reported being victims of physical and verbal abuse when they were unable to meet household water requirements.

Despite gender inequalities in household water collection activities, men are more involved in drinking water governance than rural women. A survey conducted in Ghana on gender differences related to access, practice, knowledge, presence in governance, and lived experiences of water reveals that men reported more knowledge and community involvement regarding water

governance than women (Harris et al., 2017). However, I found in this study that women's management roles are limited to facility sanitation activities - exacerbating gender-based subordination. In addition, women's contributions to water management are perceived as not meaningful because it is thought that women cannot contribute to decision-making; they are too busy, they lack the skills to negotiate, or social norms prevent them from voicing their concerns. This assertion further exacerbates the challenges facing women in African traditional societies, where decisions concerning the provision of drinking water tend to ignore their participation. As Gray and Kevane (1999) found in cases of land tenure in Sub-Saharan Africa, female subordination has not gone unchallenged. The study results showed that not all women agree with the current status quo of women's dominant involvement in water retrieval. Some women challenged the existing gender norms by calling for their spouses' supports in water collection and access. Women openly challenging traditional water collection roles may indicate the beginning of a cultural shift in gender-assigned responsibilities.

As Baguma (2013) argued, the improvement of safe water supplies may occur by fostering its management by women. Based on this, international policy recommendations state that spaces should be created for women to play a central role in the provision, management, and safeguarding of water. For instance, the International Drinking Water and Sanitation Decade (1981-90) and the International Conference on Water and the Environment in Dublin (1992), among others, recognize the need for greater participation of women in water provision and management than is currently the case (Task Force on Gender and Water, 2006). Encouraging women's involvement in water management through increased knowledge may promote a reduction in water insecurity. Water-related local associations for women may improve knowledge about water resource management during water shortages. Implementing technologies that save time spent on domestic

duties, such as rainwater harvesting systems, may also encourage females' group participation (Baguma, 2013).

6.4 Conclusion

It is widely understood that enhancing gender equity generates substantial benefits overall - that is to say, in the aggregate – and disproportionately benefits those marginalized and harmed by patriarchy. Advocates of greater gender equity also contend that it stimulates economic growth and development, especially in developing countries. As Maceira (2017) puts it, improved gender equality would positively affect GDP per capita and women's employment. Giving this, the focus of Sustainable Development Goal (SDG) 5 is to achieve gender equality and empowerment of all women and girls. Although progress has been made towards achieving this goal, gaps in gender equality still exist, some of which go beyond socio-cultural expectations. Women's and girls' contributions to unpaid domestic activities not only leave them with few opportunities to pursue education, paid employment, and so on, but they also reduce their contributions to overall economic productivity and community development.

As this chapter has shown, household water collection and use are not gender-neutral and disproportionately affect women and girls than men and boys. This chapter contributes to the ongoing discussions on household water collection by revealing that women and girls are more likely to suffer from water collection risks and spend a significant amount of time on water collection in addition to other household activities. The chapter also shows that while the water quality issue is a concern for both men and women, women are more likely to voice their frustrations on the unreliability of the water supply. In addition, girls, unlike boys, have uninterrupted participation in water collection even during their adulthoods or engagement in economic and educational

activities. This means that water insecurity, such as scarcity, may widen inequity gaps between sex, putting women and girls at a greater disadvantage. This makes it imperative to pay attention to meeting basic water access needs if a meaningful effort to advance gender equality can be achieved.

Any plan to improve access to safe water should not only take into consideration the time and distance, as shown in this study but also the need to ensure the reliability of supply, which Adank et al. (2013) defined as a drinking water facility that provides water for at least 95% of the year. Unreliable water access means that rural households have to rely on alternative water sources that are more likely to be contaminated and require walking longer distances and more time for water collection.

Thus, improving access to water by reducing time and distance and ensuring reliability will go a long way to create more room for women and girls to focus on other productive activities that may empower them. For instance, better water access would likely remove one barrier to girls' education by freeing time and energy. In addition, there is the need for training to unharness the leadership skills of women and skill development in certain technical areas to ensure that their water security solutions are met. This will promote women's input into water management decisions beyond the limited roles currently open to them, as found in this study. Women's involvement is necessary given that later interventions are more successful and sustainable when women are actively involved in every stage of planning, design, and implementation (Task Force on Gender and Water, 2006; Wali et al., 2020). Further, women's leadership styles must be respected; these may differ from men's and should be accommodated.

CHAPTER SEVEN

THE EXPERIENCE OF PEOPLE WITH PHYSICAL DISABILITIES IN WATER SECURITY

7.1 Introduction

This chapter focuses on water security by paying attention to the experiences of people with disabilities in rural Ghana. It is recognized that access to potable water is an essential step towards improving living standards. Given this, the United Nations Human Rights Council in 2010 declared access to water as a human right, which has been endorsed by the contemporary era through the SDGs. Target 6.1 of the SDGs seeks to achieve universal access to potable water by 2030. In addition, the focus of SDG 1 to end poverty in all its forms calls for universal access to basic services, with emphasis on paying attention to the poor and vulnerable groups (WHO/UNICEF, 2017).

This requires national leaders to put vulnerable people at the center of every effort towards the provision of potable water. Serious attention should be directed to the hardest to reach, the poorest, and those whose water needs are currently not addressed by mainstream policy initiatives (White et al., 2016). However, universal inclusiveness remains under threat if we continue to use coverage, the availability of water facility in a particular place at a point in time, to represent access to potable water. Coverage does not guarantee access, considering that several factors can impede the adequate and reliable supply of potable water (Adank et al., 2013; Braimah et al., 2016; UNDP, 2015).

Given this, it is reasonable to argue that the special need of vulnerable populations as stipulated in the SDGs are not being met. For instance, the SDG 6 indicators recommend a minimum of basic access to potable water, despite its target of achieving universal access to safely

managed water by 2030. This basic water access requires users to spend at least 30 minutes roundtrip, including waiting time. Even though about 263 million people spend more than 30 minutes accessing water for domestic use (WHO/UNICEF, 2017), those who fall within the basic distance and time are still required to collect water from the source to the point of use. As Geere and Cortobius (2017) noted, more than a third of Sub-Saharan African populations still rely on bringing drinking water from the source to their homes, and this experience is predominantly higher in rural areas. These water collection trips constitute physical activities that create barriers for PWDs (Pradhan and Jones, 2008; Wrisdale et al., 2017). In addition, despite the SGD 6.1 target of making access to water affordable to everyone, there is no commonly accepted way of measuring affordability and, therefore, exemption considerations for vulnerable populations (WHO/UNICEF, 2017). Based on these and other factors, the WHO/UNICEF JMP predicts that more than one-third of countries will not achieve universal access to an improved drinking water source by 2030.

This is an important issue for policymakers, considering that an estimated one billion people in the world live with disabilities (Kuper et al., 2018). Despite this evidence, there is little discussion or evaluation of the water security issues faced by the 15% of the world's population living with disabilities (Mactaggart et al., 2018; White et al., 2016). As argued in this chapter, PWDs have been left out of water management planning and programs. This omission is exacerbated by inadequate data on social, economic, or health implications that inadequate potable water access might have on the health and well-being of these individuals, households, and their communities (Groce et al., 2011). Moreover, there is a gap in the literature on the exact number of persons with disabilities (PWDs) who do not have access to improved drinking water (Mactaggart et al., 2018), so the extent of the problem within regions and countries and globally is not known.

Ghana developed its first comprehensive water policy in 2007. Although the policy recognizes and states an intention to provide for the special needs of the "physically challenged," there is little or no information regarding policy, programs, and projects that would enhance potable water accessibility by PWDs. Forming about 3% of a population of 25 million people (Ghana Statistical Service, 2014), PWDs' water barriers have been ignored by the national policy; such obvious omissions add to the challenge of recognizing and meeting the needs of PWDs in local policy initiatives and programs. These identified gaps cause concern considering that those with disabilities are among the most marginalized in the broader society and much more linked to extreme poverty and deprivation (Braithwaite et al., 2009; Groce et al., 2014). Several authors (e.g., Geere, 2015; Geere et al., 2010; Wridale et al., 2017) have argued that water insecurity has severe impacts on the vulnerable groups, including PWDs. According to Adger (2006), these categories of people are vulnerable because they are more susceptible to harm from exposure to stresses associated with environmental and social change and have less or no capacity to adapt. Since households' water collection in most rural African is gendered, this makes women with disabilities extremely vulnerable within the intersectionality of poverty, disability, and a disadvantaged geographical location.

The marginalization of PWDs remains despite Ghana's signatories to the *United Nations Convention on the Rights of Persons with Disabilities* and UN human rights to water, which guarantees equal access to basic needs, including water and sanitation. For instance, article 9 of the Convention promotes adequate accessibility by PWDs in equal measures to those without disabilities (UN, 2006). In addition, the SDGs explicitly include persons with disabilities, making it imperative to promote inclusion to ensure access to water and sanitation for PWDs. As Groce et al. (2014) pointed out, the contemporary evidence of a strong linkage between disabilities and

extreme poverty and social marginalization gives clear cause for the need to ensure that PWDs are systematically included in drinking water policy efforts. Given the existing and ongoing marginalization, governments must require additional efforts to ensure that adequate attention is given to PWDs' needs regarding water needs and related sanitation and hygiene services.

To represent PWDs in policy decisions regarding potable water management, Pradhan and Jones (2008) suggest that their experiences should be assessed rather than assumed, and this should be done systematically. This chapter seeks to respond to the gap by looking at PWDs' experiences accessing potable water services in Ghana. The chapter aimed to answer the question: what are the physical barriers that limit PWDs to potable water? Following the UN and using the rights-based approach as the basis of this chapter, I identify socio-cultural, structural, economic, and institutional factors that pose additional barriers to water security among PWDs compared to abled people. I argue that these barriers have a more severe impact on women with disabilities considering that water collection is gendered in rural Ghana, with water collection being a female duty. I demonstrate that these barriers serve as major impediments to the enjoyment of the human right to water, as recognized by the United Nations. This chapter's findings contribute to the current knowledge gap on water (in)security among PWDs and suggest possible policy recommendations towards universal access to potable water in rural Ghana with implications for other rural locations where potable water access is stressed.

7.2 Results

This section presents the study results about barriers to potable water access for PWDs based on the categorisation by Groce et al. (2011) and Kuper et al. (2018): (1) socio-cultural barriers, (2) structural/technical barriers, (3) economic barriers, and (4) institutional barriers.

7.2.1 Socio-cultural Barriers

The socio-cultural barriers were assessed based on cultural and other social factors that pose restrictions on PWDs' ability to access water services. Even though no specific cultural practices or taboos restrict PWDs' water access, disabilities are stigmatized in Ghana. This negatively affects PWDs' confidence as potential participants in social activities. This stigmatization not only limits PWDs' abilities to visit public places but results in PWDs being avoided by other community members, except for their immediate family. PWDs expressed concerns about community members' negative attitudes towards them in public places, including water collection sites. Referring to her experience of being ignored in public places, a participant revealed that the rest of the community had shunned her due to her swollen legs. Another added,

"I don't even go out to public places. Even if I do, some people do not even want to sit close to me due to my condition."

This participant further added that the smells from the nearly permanent sore on her legs usually create uncomfortable situations, increasing the public avoidance she experiences. The frequent expressions of sympathy create discomfort for PWDs. As a resident of Wioso noted,

"When people see me, they expressed sympathy because of who I was before my disability. They look at the way I walk, and it makes me feel sad."

These situations affect the social agency of PWDs, including their engagement in public activities such as water collection. Some of the participants expressed fear of being humiliated by others' actions or attitudes, which usually discourages them from collecting water. As quoted by one participant,

"I'm always discouraged from using the borehole. People do not want me to step on the platform with my feet. People look at me a lot, too. It makes me feel uneasy. Some people tease me when they meet me at the borehole."

Such social barriers act as impediments and pose a significant challenge to potable water access.

7.2.2 Technical/Structural Barriers

Structural difficulties or technical barriers can impede PWDs' access to potable water. These structural difficulties are imposed by the distances to water collection sites, the technical degree of water facility use, and other structural factors. All the PWDs in the study lacked water facilities at or near their dwellings, which necessitates walking and carrying water for several meters from the source to the point of usage.

In addition, there are concerns regarding the design of water infrastructure, which may be technically challenging to operate by PWDs. The disability-unfriendly nature of the physical environment makes it impossible for some PWDs to use water collection facilities. As a participant explained,

"I can't fetch the water myself when I get to the water source. I am weak and can't even climb the water platform."

This was mirrored by another participant in Wabrease,

"I could have fetched the water if there were friendly infrastructure and environment for fetching water. It is so difficult to reach the pump since I can't climb. No one would have fetched for me, and eventually, I would have died. Thirst for water is different from that of hunger for food. Thirst for water is very dangerous."

Others also expressed concerns over the structural issues associated with pumping water from the borehole. According to a resident of Wioso,

"I am old and weak, and I cannot pump it myself. There is an instance I tried to fetch water for myself. I fell flat on the platform."

Out of the ten PWDs who participated in the interviews, seven stated that they could not collect water by themselves at all. The remaining PWDs expressed concerns that can be categorized as extreme difficulty. With an average of 550 meters to improved water sources and 800 meters to unimproved sources, PWDs usually rely on family members: mostly women and

children, given the gendered nature of household work locally, for water collection. One respondent noted,

"My daughter fetches water for me. Without her, I think I would have struggled for water. There would be no one to fetch water for me since I can't get up to fetch water for myself. The struggle occurs when there is no one around to provide assistance."

A participant in Esereso reveals the frustrations she goes through when she needs water while her granddaughter is in school. Those who live alone usually rely on friends and community members for their daily water needs. This reliance is sometimes hampered by the social stigma associated with physical disabilities. Given the gendered nature of household work locally, as confirmed by all the study participants, this places additional responsibilities on women already involved in water collection activities and poses difficulties for women with disabilities in male-dominated households. Voicing out her frustrations as someone involved in water collection, this quote from a participant in Wioso reflects the difficulties experienced by women with disabilities,

"I have had swollen legs for years now. It seems this has come to stay. Since I live with my older brothers, they used to help with water collection at the early stages of my swollen legs. This does not happen anymore. They now see my swollen legs (disability) as normal since I have to force myself to do other things in the house as a woman, including water collection. Even though I haven't complained but water collection hasn't been easy for me."

As in most developing and some developed countries, limited financial resources pose a challenge for decentralized agencies to meeting optimal access, which involves water supply through multiple taps within the house, in the rural water supply. According to an official in one of the decentralized agencies,

"We cannot meet the needs of every community member due to limited resources. I admit distance and infrastructure pose a challenge for PWDs, but the situation is beyond what our capacity could handle."

7.2.3 Economic Barriers

Economic factors add to water insecurity among PWDs. I assessed economic barriers based on the employment status of study participants, the level of household income, and the ability to meet basic needs, including access to potable water. In this setting, water collection incurs costs in the form of fees charged for water usage. Fees are paid either monthly or at the point of water collection through a volumetric-based system. Physical disabilities pose limitations to active employment. Except for one respondent, all the study participants were not active in the labor force and, therefore, relied on remittances and supports from family members, including parents, siblings, and children. Despite their economic status, PWDs are usually required to pay for potable water just like any other community member. Although Esereso, one of the study communities, has proposed a fee exemption for the aged and PWDs, this proposal has not yet been followed through. All the PWDs recounted bad experiences associated with water fees. According to a participant,

"...it is stressful being in this condition. I am sick and old. How can I pay for water?"

In sum, PWDs either cannot pay for water or lack the means to retrieve water. In cases where payment of water fees is possible, the quantity of water collected was limited to meeting basic daily needs. The alternative to bought water is the use of unmonitored sources, which have even more structural barriers than the existing improved water collection sites. Even though none of the PWDs knew that access to potable water was their human right, they all agreed that their current physical condition should warrant exemption from water fees. There is no national policy or programs which exempt PWDs from water payments, as Esereso has proposed to do on a community level. Interviews with the officials from the two district assemblies reveal that water

managers at the community levels can decide who could be exempted from water payment, yet no water fee exemptions exist for PWDs.

7.2.4 Institutional Barriers

In assessing institutional barriers to water security, I considered the involvement of PWDs in water management decisions. I concluded that socio-cultural barriers and structural barriers act as major causes of institutional barriers. Persistent stigmatization and its effects on PWDs' public agency pose restrictions to PWDs' participation in water management. One of the participants explained that her physical condition seriously discourages her from entering public places. "Even if they invite me to participate in water management decisions, I will not turn up," she noted. Stigma aside, some PWDs could not travel to meeting venues because of physical distance and lack of transportation. They further reported that they had not been deliberately excluded from participating in water management decision-making processes; instead, failure to participate has to do with their disabilities and the correlating lack of response to these disabilities. As re-echoed by an official from the CWSA,

"At the community level, you don't see so much discrimination in decision-making even though there is stigmatization. To say that the PWDs are turned away or prevented from contributing during decision-making is something I have not heard of or experienced..."

Asked about their willingness to participate, a respondent in Esereso explained,

"I think we should be given opportunities to manage the water facilities. Our conditions make it impossible to do any farm work. Taking care of water facilities is something everyone in my condition can do."

7.2.5 Available interventions for enhancing water security for PWDs

The Ghana National Water Policy (Government of Ghana, 2007) makes provision for meeting the special needs of PWDs in enhancing water security. As in most countries in the Global South,

limited financial resources pose a challenge to providing for the water security needs of PWDs, which usually requires on-premises access to safely managed water. As a CWSA official explained, the initial focus of the 1994 National Community Water and Sanitation Programme was to provide water for unserved communities, but it overlooked the needs of PWDs. As the official noted,

"Since it is difficult to achieve everything at a time as a developing country, vulnerable populations' needs will be considered with time."

This was echoed by an official in one of the decentralised agencies, who commented that,

"We cannot meet the needs of every community member due to limited resources. I admit distance and infrastructure pose a challenge for PWDs, but the situation is beyond what our capacity could handle."

This omission and the approach to delay meeting the needs of PWDs reinforces the poverty and marginalisation of PWDs.

A claim by the CWSA official that pro-poor interventions exist for PWDs, however, could not be verified since there was no mention of a single policy program. Exemptions from water payments have been left to the discretion of the water managers in the various rural communities and are usually poorly enforced. According to the CWSA official,

"The community water managers have the responsibility to decide on water payment exemptions for vulnerable populations, including PWDs. Even though this has been poorly done but it is challenging for the CWSA to enforce it."

Although Esereso has proposed a fee exemption for the aged and PWDs, this proposal has not yet been put in place. Furthermore, despite the CWSA's efforts to improve borehole designs to accommodate PWDs, the current design continues to pose difficulties for some PWDs. This points to the need to work towards achieving on-premises water access.

Finally, this study found that the government receives supports from both locally based and international NGOs in its efforts to provide water security interventions for vulnerable people, including the provision of rural water infrastructure. In such interventions, in addition to being provided with enhanced access to water, PWDs usually are exempted from water payments. The interventions of these NGOs have contributed to rural water security in Ghana.

7.3 Discussion

PWDs in most developing countries often face many social, technical, economic, and institutional barriers, which limits their enjoyment of human rights to water. PWDs in rural Ghana experience barriers to their enjoyment of the right to water due to stigmatization and social exclusion. Even though the study did not identify taboos that restrict PWDs from access to potable water in the study communities, it is widely recognized that such taboos are common among several cultural groups in some Sub-Saharan African countries. In such cultural groups, PWDs are often prevented from the use of water facilities for fear they will contaminate water sources; in some instances, it is taboo for PWDs to be seen near water sources (Groce et al., 2011). Some cultural practices in Ghana serve to marginalize PWDs and limit their societal involvement. Even where these cultural hindrances are uncommon, evidence from this chapter suggests that the low self-esteem experienced by PWDs limits their confidence and curtails their agency. They feel uncomfortable in the public sphere, which exacerbates their fear of going to retrieve water.

Although Ghanaian laws have been designed to challenge stereotypes, prejudices, and certain traditional beliefs, PWDs face ongoing marginalization and even exclusion due to weaknesses in the legal and regulatory structures meant to protect them (Ocran, 2019). Thus, with insufficient enforcement mechanisms, the UN's *Convention on the Rights of Persons with*

Disabilities has not advanced the water rights of PWDs in rural Ghana. The result is ongoing marginalization and isolation from social and economic activities such as access to potable water. Even when socio-cultural barriers are minimal or non-existent, structural or technical difficulties hamper PWDs' attempts to access water. Structural difficulties are imposed by the distances our study participants, like many other rural Africans, are required to cover daily for water collection (Wilbur et al., 2013).

Since all the households in the study communities lack water service in their homes, water collection from the source to the point of use is a common practice. In most cases, water collection trips are made by carrying different sizes of containers for such collection, depending on the weight an individual is able to handle. Mechanized transportation is not used due to its unavailability. These structural barriers place huge burdens on PWDs. Long distances and disability-unfriendly water facilities mean that water access is compromised and restricted for PWDs. Accordingly, there is a heavy reliance on friends and family members, mainly women and girls, to help meet daily water needs.

As noted in Chapter Six, water collection in most Sub-Saharan countries is gendered. Gender roles in a household are determined by work responsibilities, socio-cultural expectations, and a range of contextual factors. Women and girls are, therefore, responsible for water collection in most households. The results show that half of the PWDs are women. Gendered roles in water collection pose more difficulties for women with disabilities and further marginalize them in water collection and use. This challenge could be more extreme for women with disabilities in male-dominated households. Evidence from this research suggests that men who help in water collection and other household-related tasks are disparaged, which restricts men's involvement in water collection.

While water collection has been documented as one of the means by which water quality is often compromised (Awuah et al., 2009), the labor-intensive task of water collection also has negative health implications. There has been ample evidence on the health implications of water collection in both developed and developing countries. While Fry et al. (2010), for instance, identify fatigue, musculoskeletal damage, soft tissue damage, and early degenerative bone as some of the negative health effects associated with water collection, this study found rheumatism and joint pain as those mostly experienced by the rural households. Based on research in a subarctic Indigenous community, Hanrahan and Mercer (2019) frame water insecurity as a mental health issue in addition to harming physical health. According to Wilbur et al. (2013), the effects of water collection on health could even be greater for PWDs and could exacerbate disabling illness. As Pradhan and Jones (2008) noted, technical barriers affect not only PWDs but also pregnant women, the aged, and sometimes children. This means that making water services easily accessible and user-friendly may benefit other user groups.

Therefore, it is necessary to consider adaptive technologies in addition to community support in the provision of rural potable water services. Alternative water collection methods such as rainwater harvesting (RWH) adjacent to dwellings should also be explored as done in some communities in other jurisdiction (see Ishaku et al., 2012; Mercer and Hanrahan, 2017), especially if water quality can be improved through such means as slow sand filtration, solar technology, or membrane technology (Heinrich and Horn, 2009). RWH has been employed elsewhere in Africa, including in one of Ghana's near neighbors, Nigeria (Ishaku et al., 2012). The recognition of water access as a human right suggests that barriers to implementing this right should be removed. Not only do structural barriers hinder human rights, but they also increase the social and economic marginalization of PWDs.

The use of water fees is contested at the community to international levels (Baer, 2015; Hearne, 2015). Human rights advocates maintain that water access should be universally available and free for everyone as prescribed by the 2010 human right to water; indeed, the concept of water security includes unencumbered access. This argument has been strengthened by adopting the SDGs that seek to achieve universal, equitable access to safe and affordable water for all by 2030 (WHO/UNICEF, 2017). In contrast, privatization is sometimes recommended, often by national governments, as the path to efficiency in water management (Hearne, 2015; Bakker, 2013; Reeves, 2011). Even though Ghana has implemented water privatization through neoliberal reforms, this has been mainly in urban areas. In rural areas, the government bears much of the capital cost of water infrastructure. Rural water users are, however, responsible for the financing of operations and maintenance and, in some cases, servicing in case of breakdowns. These costs are covered mainly through water fees, which are paid monthly or through a per-bucket fee at water collection sites (Braimah et al., 2016; Dosu et al., 2021).

The downloading of these costs has repercussions on water insecurity for PWDs. As Francis (2005) argues, water payment initiatives without assistance from the state can have devastating effects, exacerbating rather than alleviating poverty among vulnerable groups. Disability and poverty are closely linked; poverty is considered highly prevalent among persons with disabilities, especially for those in rural areas in most developing countries (Pradhan and Jones 2008). The World Bank estimates that PWDs comprise about 20% of the poorest of the poor worldwide (Groce et al., 2014); thus, they are over-represented in this deprived group. The study results correlate with this; most PWDs are in the economically inactive category, usually depend on other people to meet their basic water needs, and rely on government transfer payments. Given the scarce resources available to PWDs, water is disproportionately expensive, which contributes

to extreme poverty. The fee collection strategy places a financial burden on high water consumers, thereby limiting the amount of water used by people living in poverty, a population in which PWDs are over-represented. Besides, depending on others for water retrieval, PWDs need the income that would normally go for water fee payment. PWDs rely heavily on unmonitored water sources as a coping strategy, which can compromise health and further increase marginalization.

These barriers remain partly because PWDs have limited opportunities to participate in community water management decisions. This additional barrier is an extension of the socio-cultural and technical barriers which limit the involvement of PWDs generally. The stigma and mobility challenges associated with disabilities often make it difficult to attend community meetings and fully participate in community water management (as well as other community) decisions. The result is that the voices, views, and considerations of PWDs are not well represented in key decision-making processes. PWDs suffer water injustices involving water access and exclusion from decisions and planning about water security. PWDs are forced to suffer in silence as the water injustices from which they suffer go virtually unnoticed at the community and policy development levels.

7.4 Conclusion

Ghana has several legal and constitutional provisions aimed at protecting socially and economically marginalized people, including PWDs. The right to equality, which is enshrined in the 1992 Constitution (Article 29), stipulates that every citizen is deemed equal to all others. This suggests that marginalized people, including PWDs, should have their basic needs met and their rights protected. In addition, Ghana is a signatory to the UN human right to water and to the 2012

Convention on the Rights of People with Disabilities (Ocran, 2019). At this point, however, Ghana lacks appropriate policies and related mechanisms to ensure that the rights of PWDs are respected.

This chapter signals the need for potable water provision to be transformed so that vulnerable populations, such as PWDs, experience inclusion rather than exclusion, whether intended or not. Several barriers impede access to safe drinking water in our study communities, reflecting as well as reinforcing the marginalization of PWDs, similar to many other rural regions in Africa (Saloojee et al., 2007; Smith et al., 2004). To achieve full water access, the chapter recommends that every policy, program, and project must address the needs of PWDs through the robust use of a disability lens through the planning, implementation, and management processes based on their experiences.

A good first step would be to facilitate the representation of the views of PWDs in all aspects of potable water provision; their lived experiences should be explored and assessed rather than assumed. Without their participation, it is impossible to properly reflect their needs. PWDs can be included by making them in charge of the day-to-day revenue collection activities. As the findings suggest, this will not only involve them in water management but also engage them in productive activities. Besides, the financial rewards given to the water revenue collectors can help ease the needs of the PWDs that are given such responsibilities in addition to their exemptions from water payment.

Addressing the needs of PWDs should be viewed as everyone's responsibility and something that can be of potential benefits to everyone in society, considering that there is a chance of being disabled. Measures that specifically target removing the barriers to PWDs' water access are necessary. Ghana can begin by working on targeted measures, assisted by aid donors and NGOs, to achieve SDG-related targets, which are based on optimal water access. As one of Chapter

Four's findings reveals, NGOs have been instrumental in supplementing the government's efforts, making their involvement crucial to enhancing rural water security for PWD.

CHAPTER EIGHT

SUMMARY AND CONCLUSION

8.1 Introduction

This dissertation sought to establish a conceptual framework for rural water security by using rural households' experiences in Ghana. Specifically, this dissertation contributes to the debate on water security by assessing how the concept is considered, articulated, and operationalized within the context of rural areas. It also sought to establish how the analysis of water security experiences might shape or reshape policy. Pursuant to this goal, the dissertation achieved the following objectives:

- Assessed the decentralized rural water management framework in Ghana and the capacity gaps associated with it.
- Established a conceptualized framework of rural drinking water security using community experiences from rural Ghana.
- Determined the marginalization of women and girls in water collection and use in rural Ghana.
- Established the experiences and challenges associated with water collection for people with physical disabilities in rural Ghana. And
- Identified key lessons from households' experiences to improve rural water security.

The achievement of the objectives mentioned above was based on an analysis of cross-sectional data from three rural communities -Esereso, Wabrease, and Wioso - selected from two different districts in Ghana. In the first phase of the data gathering, data were collected cross-sectionally from 158 households accounting for 847 people. The second phase involved observation, in-depth interviews, and focus group discussions to add depth, richness, and details

to the survey data. Participants of the focus group discussions were mainly households, while the participants for the in-depth interviews include households, community water managers, and government officials at the district and national levels. In addition, I employed both qualitative and quantitative approaches for data analysis using NVivo and SPSS, respectively.

This chapter extends the discussions of the previous chapters by providing how the findings from each of the objectives fit together to contribute to achieving the overall goal of this dissertation. I presented this chapter in three sections. First, I provide a summary of key findings from the chapters (4-7) that were dedicated to each of the objectives. Second, I established the policy implications of each of these findings. Thus, I argue that there is the need to assess rather than assume, the experiences of marginalized populations such as rural dwellers, women and girls, and the people with physical disabilities in policy considerations on water security. Finally, I provide a conclusion with suggested recommendations and areas for further research.

8.2 Summary of Findings

8.2.1 Rural Water Management in Ghana: A Reflection of biases against Rural Communities

As discussed in Chapter Four, Ghana adopted community-based water management to form the core of the rural water delivery model as part of economic reforms in the 1980s. As one of the pioneering countries in Africa, Ghana introduced the community-based water management model in rural areas to reduce governments' involvement in drinking water management and increase communities' role. Lauded as the best approach that allows rural communities to be in charge of their water management, the community-based rural water management in Ghana has placed extra burdens on rural communities. As found in this study, these extra burdens constitute a lack of rural capacity to effectively provide sustainable rural water supply to meet households' needs.

Assessing the rural capacity based on five dimensions, this study found that effective rural water management is usually constrained by factors such as limited institutional, financial, human resources, social, and technical capacities. The analysis of rural capacity was done with a recognition that several studies (e.g., Adadzi, Coffie, and Afetorgbor, 2019; Adank et al., 2013; Braimah, Amponsah, and Asibey, 2016; Jackson and Gariba, 2002; Opare, 2007; Sun, Asante, and Birner, 2010) have focused on general shortcomings aimed at limited rural technical, financial, and human resource capacities. However, this dissertation extended the discussion beyond these three capacities to include the institutional and social capacity gaps in rural water management.

The study reveals that despite the contributions of each of the capacity challenges to rural water management, institutional weakness and malfunctions are a major cause of ineffective and unsustainable rural water supply and management in Ghana. According to the findings, one such challenge includes poor institutional coordination among decentralized agencies in charge of rural water management. This creates challenges of integration, coordination, and data access, which result in fragmented decisions. Consequently, there are unclear descriptions of institutional roles and responsibilities among the multiple decentralized agencies, with each agency expecting another to perform certain functions. The absence of effective institutions has also given loopholes for chieftaincy interferences in rural water management. As custodians of traditional rural societies, local chiefs (as confirmed in Sekeyre Kumawu District) have found the need to take charge of water management responsibilities where effective institutions fail to exist.

The study also found that limited financial capacity intersects among all the capacity challenges of rural water management. The study reveals that the provision of rural water infrastructure depends heavily on donor funding, which has shown to be highly unreliable over the years. The rural communities also lack the required financial resources to support a sustainable

water supply due to the low-income levels of most rural households and variable seasonal income from agricultural activities. Besides, a lack of revenue collection mechanisms and skills required by rural water managers for safe record-keeping and financial management affect the collection and administration of rural water revenues.

Limited financial capacity either affects the communities' ability to contribute to water infrastructure provision and for operations and maintenance or the establishment of a robust institutional framework, recruitment, and retainment of qualified human resources with technical oversights for sustainable rural water management. For instance, the study reveals that there were no trained operators and other technical expertise in any of the study communities. This has resulted in maintenance activities that are rarely done and characterized by long delays and sub-standards.

Furthermore, the study found that urban bias contributes to water insecurity in rural Ghana. First, unlike urban areas, rural communities are required to show community cohesion and sometimes available resources to be able to benefit from rural water infrastructure. Second, the lack of economic opportunities in rural areas encourages youth rural-urban migration. This affects the ability of the rural communities to provide training on major repairs of water facilities to these young adults, who may not remain in the community permanently. Finally, most agencies (both government and non-government) charged with the responsibilities of rural water supply and management in Ghana are concentrated in urban areas. This has been exacerbated by a lack of political voice (except during elections) to lobby for rural water infrastructure. This affects the responsiveness in addressing water insecurity in rural areas.

Finally, the study found that some rural Ghanaians have responded to the limited capacity to protect their water sources by resorting the cultural practices and taboos. Several taboos and

customs are deemed efficient and effective in regulating water collection, use, and activities near water bodies. Contrary to arguments that water management approaches that focus on culture deviate considerably from the neo-classical paradigm of the knowledge system, which represents the best perspectives to prescribing solutions to water management challenges, this study regards such practices as paramount in protecting water sources to ensure continuous access for domestic and productive purposes.

8.2.2 What Constitutes Rural Water Security? A Reflection of Water Injustice against Marginalized Populations in Rural Water Security

As already established in Chapter Five, there is arguably a blurring of focus on how water security is conceptualized despite the palpable rise in its usage in contemporary academic and policy discourses. Assessing rural water security as operating within six-dimensional indicators that map water availability, access, safety, management, community preferences, and sustainability of water resources and systems, I added to the debate on water security by assessing how the concept is considered, articulated, and operationalized within the context of rural areas. The analysis mainly reveals that for rural water security to be achieved, it is important to consider all the six dimensions. The analysis also reveals that the sustainability of water resources and systems offers the highest unique contribution to achieving rural water security as compared to the other dimensions. This means that there is a need to go beyond the anthropocentric means of assessing water security to include water resources and systems' sustainability.

The findings from these analyses also show that these conceptualized dimensions of water security intersect with the experience of marginalized populations, including women, girls, and people with physical disabilities. As discussed in the previous chapters, water security intersects

with the remoteness of rural locations, gender, and disability, thereby exacerbating the vulnerabilities of women, girls, and the PWDs within the Ghanaian traditional rural societies. In the next paragraphs, I delve into a summary of the findings of each of the six water security dimensions based on household experiences. Following this, I provide key findings of how a poor function of some of these dimensions seeks to exacerbate the vulnerabilities of particular groups of people in rural Ghana.

First, this study reveals that aside from rural capacity, households consider factors such as responsive and accountable management as major contributors to the effective management of water supply in rural Ghana. The study identified limited rural capacity, unresponsive and unaccountable management as the major barriers impeding effective rural water management. Clearly, ineffective water management serves as a major barrier to achieving rural water security in most developing and even some developed countries and can impede the achievement of other dimensions of water security. As this study found, for instance, limited rural capacity affects the extent to which water resources and infrastructure are sustained in rural Ghana.

Second, the study reveals that most rural households (65%) are unable to meet the minimum requirement of water of 50 litres of water per person per day as required to meet the most basic and domestic needs and limit health concerns. This was attributed to factors such as dried boreholes and streams during the dry seasons and frequent breakdown of water facilities. Consequently, most households (60%) consider their current drinking water source as unreliable. As a coping strategy, households rely on alternative water from unmonitored water sources and water from nearby communities or towns (which is usually tedious and expensive). In addition, they reduce and reuse water with its attendant negative health implications.

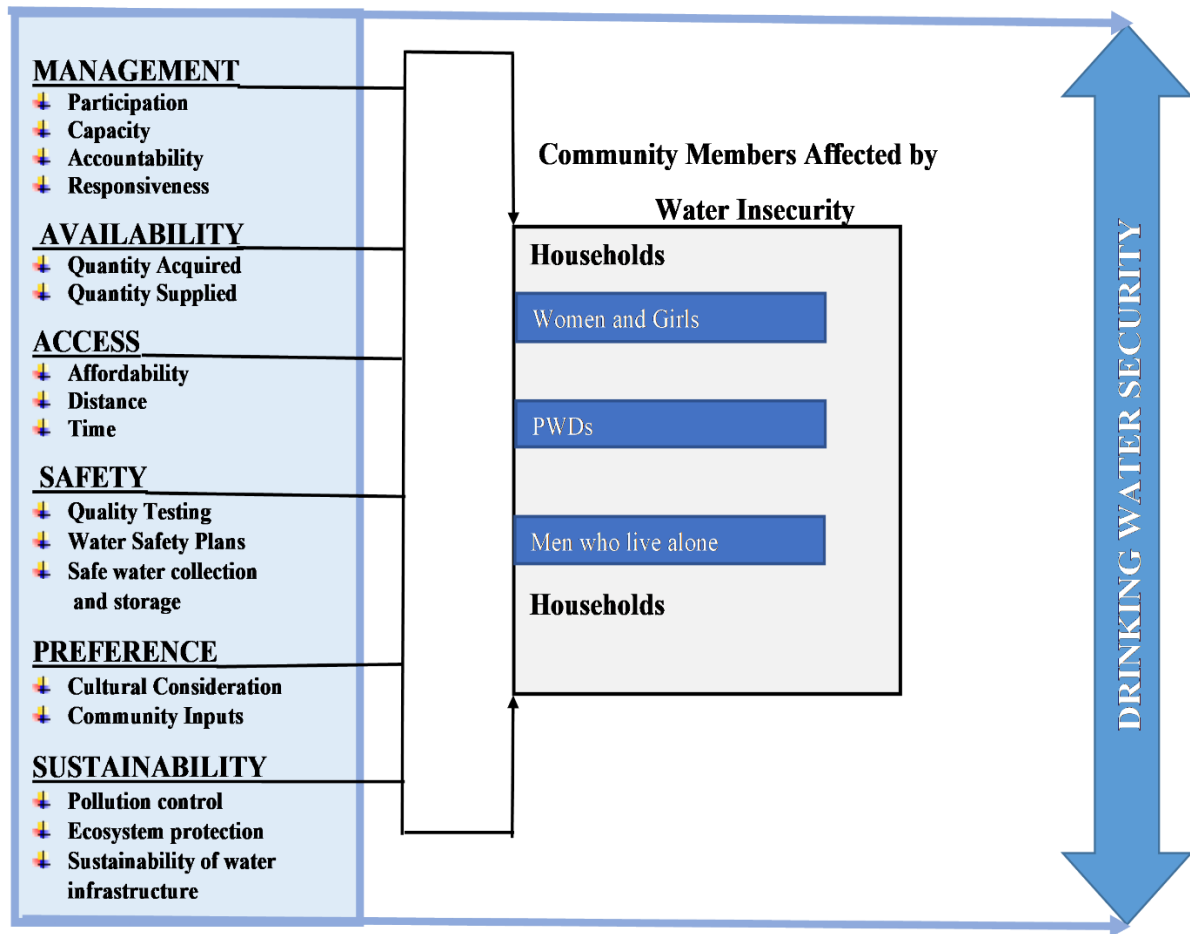


Figure 8.1: Framework for Rural Water Security

Source: Author's Construct (2020)

Third, the study findings show that households generally experience poor water accessibility. For this dissertation, access constitutes three sub-dimensions, namely, distance, time, and affordability. In terms of distance and time, the study reveals that households undertake about five trips per day, covering more than 3.7 kilometers for water collection and an average time of an hour and 48 minutes per trip. This implies that for households with five people (average household number) to meet their daily water needs, water collectors will require over seven hours for that purpose. Although most households meet the prescribed basic distance required for water collection, some travel more than a kilometer per trip for water collection.

Interestingly, only about a quarter of households can meet the basic requirement of 30 minutes for water collection. The results also reveal that monthly water expenditure exceeds 3% of some households' monthly income, making water unaffordable per the WHO's standard. Accordingly, the households that cannot afford to pay for water prefer to use water from unmonitored sources, mostly untreated before usage.

Fourth, there is a compromised water quality due to a lack of water safety plans (including source water protection), poor enforcement of water quality monitoring, and poor water haulage. Accordingly, most rural households (72%) perceived their drinking water quality, including the physical properties, as poor. Given this, some households perceive water from the streams as better than that of the boreholes in terms of quality. Finally, the study found that community preferences and cultural desirability play a crucial role in rural water supply and management. This is attributed to the fact that water management is in the hands of community members who understand the social and cultural contexts of each of the study communities.

Clearly, water insecurity exists in rural Ghana. However, despite the significant impacts of water insecurity on rural households generally, the findings of this study show that women, girls, and people with disabilities have the worst experience and are likely to be more affected than the rest of the rural population. On the part of women and girls, for instance, gender norms in rural Ghana are significant in determining domestic water collection, use, and management. To enhance the understanding of the link between the conceptual dimensions of water security and marginalized groups, I have summarized the findings from their experiences under four categories.

First, the study findings show that women are more likely to voice their frustrations about water unavailability and poor water quality than men. Women and girls are also likely to suffer

from verbal and physical abuse when there is a domestic water shortage. Second, water access is significantly associated with the involvement of women and girls and constitutes an estimate of 12 hours per day in each household. While boys are likely to exclude themselves from water collection, specifically, between 15 and 18 years old when they are enrolled in either high school education or an apprenticeship, men's involvement in water collection is either for income-generating activities such as irrigated farming or by those who live alone. Given this, the physical risks associated with water collection, such as snakes and scorpions' bites, are mostly experienced by women and girls.

Furthermore, as the study reveals, factors such as social stigma, distance, disability unfriendly water infrastructure, and water payments affect water accessibility by people with physical disabilities. For instance, the study found that people with disabilities are either unemployed or economically inactive. Accordingly, they rely on family and non-existence social supports to provide for themselves. However, PWDs are usually required to pay for potable water just like other community members. Although one of the study communities has proposed a fee exemption for the aged and PWDs, this proposal has not yet been followed. In addition, distance and disability unfriendly water infrastructure means that the PWDs mostly rely on family and friends to meet their domestic water needs. This means that gendered roles in water collection pose more difficulties for women with disabilities and further marginalize them in water collection and use. As the study reveals, this challenge was more extreme for older women and women with disabilities in male-dominated households.

Third, the study found that women and girls are mostly affected by negative health and socio-economic effects of water insecurity. As this study has shown, water insecurity is associated with negative health implications such as diarrhea, skin diseases, rheumatism, and joint pain. Aside

from the impacts of health effects on their economic and social lives, the study findings show that the unreliability of water supply, the labor-intensive nature of water collection, and the long hours associated with water collection activities affect the social and economic lives of households, particularly, people with disabilities as well as women and girls. Economically, women and girls are more likely to have fewer hours to engage in productive and educational activities, respectively. Besides, the labor-intensive nature of water collection activities affects women's overall inputs in farming activities and girls' participation in school assignments. Socially, water insecurity creates challenges in relationships between husbands and wives as well as between parents and children. As the study reveals, the psychological stress associated with water security affects how women can relate with their husbands, including sexual encounters.

Finally, despite their marginalization in rural water security, women and the PWDs have less influence in water management decisions in rural Ghana. For instance, the study found that though community water management committees are mandated to include female membership of at least one-third, women's roles are limited to mobilizing other women for sanitation purposes (e.g., sweeping and weeding around water facilities) with limited influence in major management decisions. In addition, women's contributions to water management are perceived as not meaningful because it is thought that women cannot contribute to decision-making; they are too busy, lack the skills to negotiate, or are prevented by social norms to express their concerns - exacerbating gender-based subordination. Even though the study found that PWDs are not discriminated against participating in water management, structural (e.g., distance) and social (e.g., stigmatization) barriers pose restrictions to their involvement.

8.3 Suggested Policy Recommendations to Improve Rural Water Security in Ghana

Based on the water security challenges identified and findings from this study, this section outlines possible policy recommendations that can improve rural water security in Ghana. These will be identified and explained in order of priority.

8.3.1 Enhancing community-based water management through reforms

This study's findings have shown that the community-based water management (CBWM) model has not been successful due to capacity challenges. Achieving rural water security requires providing sufficient resources for water managers to carry out their mandates. However, the current community-based management model assumes that ownership automatically translates into a community's ability to fully participate in water management. This calls for a shift in management approaches that ensures a progressive transfer of water management responsibilities to beneficiary rural communities.

This means that the current CBWM approach in Ghana can only be effective through policy reforms that recognize the need to pay and build the capacities of water managers. This requires a shift from voluntary-based water management to recruiting people who are well-compensated and equipped with the requisite skills to carry out such mandates with clearly defined roles. This might require the restructuring of rural communities into regional zones with regional WATSAN committees (with community representation). This will address human resources capacity challenges by streamlining personnel complements and making it easier to retain and finance through revenues from several water facilities in multiple communities.

With such reforms, permanent members can be recruited and equipped with the necessary skills, including proper revenue collection and bookkeeping skills in addition to the skills needed

to maintain and repair water facilities. As this study revealed, water users are willing to support a reliable supply and management of potable water. Since the communities' ability to support water management through payment of water fees is hampered by rural poverty, other internal revenue mobilization mechanisms should be explored. As Braimah et al. (2016) found in other communities, mechanisms such as donated farm harvest, cash crop deductions (*kilo kilo*), and funeral tax can complement the limited revenues from water sales. This means that with a proper system for revenue collection, management, and use in place, rural communities can raise revenues that can support operations and maintenance of rural water infrastructure, including the required human resources.

The various traditional authorities can be mandated to provide supportive supervisory responsibilities in their respective communities. This will ensure that they are not being left out in water management decisions as custodians of these communities. Therefore, there should be an emphasis on proactively integrating the traditional authorities (chiefs) in water management. As the study has shown, the traditional authorities' influence can help build horizontal linkages towards effective management.

8.3.2 Recognizing the human right to water in national policies with a focus on gender and disability lens

Ghana is a signatory to the United Nations Resolution 64/292, which recognizes access to water and sanitation as a human right. This calls for the need to enhance the water security needs of all, just as achieving the other forms of rights as stipulated in Article 29 of the 1992 Constitution. However, Ghana lacks appropriate specific policies and related legislation that are linked to the United Nations Resolution 64/292 that seeks to enhance water security.

This study's findings signal the need to transform potable water provision schemes that link water access to human rights and reflect the water needs of marginalized populations. As found in this study, women, girls, and PWDs are the most marginalized amid water insecurity. This marginalization extends from the intersectionality of geographical locations, gender, abilities, and physical conditions. Therefore, it is recommended that every policy, program, and project should strive to address their needs through the robust use of an equity lens and an intersectionality lens supported by appropriate legislation. This approach should be maintained through planning, implementation, and management processes.

Even though the WATSAN committees in each rural community require at least 40% female membership, this study found that such is usually not the case in some communities. As the findings of this study have shown, women are the main actors of water collection and use. Some women called for the need to be an integral part of water management decisions rather than continuing their current position as passive members. Interestingly, international policy recommendations (e.g., the International Drinking Water and Sanitation Decade, 1981-90, and the International Conference on Water and the Environment in Dublin in 1992) recognize the need for greater participation of women in water provision and management. These declarations reinforce the need to have a gender and intersectionality lens in water policy decisions.

Finally, the community management process should include engaging people with disabilities, especially women, by making them in charge of the day-to-day fee collection activities. As one of the study participants suggested, this will not only involve them in water management but also engage them in productive activities. Since water fee collectors are financially rewarded, engaging PWDs in such activities will not only help them financially but also exempt them from water payment.

8.3.3 Basing policy on community experience and context

This study has shown that context matters when determining how water security is defined, articulated, and operationalized. The context consideration goes beyond just considering the political, socio-cultural, economic, and environmental factors of a particular community to include water users' actual experiences. Given this, policy decisions and policy implementation should consider the context-specific information of community members. This can result in two potential outcomes. First, context-specific consideration can assess the actual, rather than the assumed, experiences of a particular community to enhance their water security. This represents a move away from the generalized decentralized water management approach for rural water management in Ghana. In addition, context considerations can identify certain socio-cultural variables that can serve as potentials to maximize opportunities for rural water management. For instance, this study reveals that traditional cultural beliefs are important approaches to protecting water sources in the study communities.

8.3.4 Enhancing water availability through the development of adaptive technologies

This study found that, aside from water unavailability resulting from the frequent breakdowns of water facilities, scarcity also occurs due to dried boreholes and streams. Therefore, it is necessary to consider adaptive technologies that can contribute to water availability. As this study has shown, unlike boreholes and hand-dug wells, rainwater harvesting (RWH) has not received sufficient consideration from government and rural water managers. The infrastructure for treating and distributing that water is underdeveloped, even though adaptations are favorably viewed as responses to water access difficulties. RWH adjacent to dwellings should be explored as alternative water collection methods as done in some communities in other jurisdictions, including in one of

Ghana's near neighbors, Nigeria (see Ishaku et al., 2012; Mercer and Hanrahan, 2017). RWH can be a better alternative in the rainy season if water quality can be improved through means such as slow sand filtration, solar technology, or membrane technology (Heinrich and Horn, 2009). This does not only enhance water availability but also access through a reduction in water collection distance, time, and payment.

8.3.5 Recognizing cultural beliefs in rural water security

There is a need to focus attention on cultural beliefs that can be institutionalized for efficient source water protection. The findings identified several taboos, myths, and customs held collectively by community members in regulating water collection, use, and activities near water bodies. Most importantly, participants connect waterbodies to the spiritual world, which has positively influenced how water sources are used and managed over the years; in this way, cultural beliefs serve as a form of source water protection mechanism. It was further shown that development interventions (Ghana Water Policy and plans of the districts) emphasize customary and traditional laws and practices for water conservation, pollution control, and protection of catchment areas.

8.4 Limitations and Areas for Future Research

Like any research, particularly in developing countries, this dissertation has both strengths and limitations. In terms of its core strengths, this dissertation employed mixed research methods that involved qualitative and quantitative data. This approach capitalized on the strengths and moderated the shortcomings of each method. This increased the depth of understanding of the issues and problems that were investigated by the study. The dissertation also draws its strength from the multiple approaches to assessing rural water security involving several dimensions. Assessing rural water security from multiple dimensions provided an innovative approach to

studying rural water security from an interdisciplinary social sciences perspective, considering the political, socio-cultural, economic, and environmental factors and how they can be applied in the real-world situation.

Like any research in a fairly new area, this dissertation has limitations that do not invalidate the findings nor affect its contributions to knowledge but may require future research. First, the study relied on context-specific information that is mostly from rural Ghana. The study concedes that each of these dimensions of water has contextual meanings, interpretations, and applicability and may be influenced by the political, socio-cultural, economic, and environmental factors of a particular jurisdiction. Given this, it will be interesting to test a similar hypothesis of how water security is conceptualized and operationalized in a different jurisdiction using the six dimensions as the basis. This area of research is part of my future research agenda. Specifically, I plan to carry out postdoctoral research, where I will conduct a study using similar approaches in a developed economy such as Canada, particularly in Indigenous communities. As shown in the literature, for instance, the drinking water security experience among some Indigenous Canadians, particularly those in remote locations, is not different from that of most developing countries in Sub-Saharan Africa (Auditor General of Canada, 2011; Hanrahan, 2017; Statistics Canada, 2012).

Second, the study assessed households' water security experience generally, without specific attention to the details of each individual within the households. For instance, information on income and the effects of water security were collected without specific reference to a particular individual within the household. Besides, the impacts of water security on the community may differ from that of individuals and households. Further research that focuses on multilevel approaches to water security that recognize and analyze the experiences at the individual,

household, and community levels will help overcome this limitation. Using multilevel modeling, water security can be tested by nesting individuals within households and geographical areas.

Finally, the study analysis assessed the predictability of water security based on the composite variable of each dimension and not the individual variables. An analysis of future research can also look at the unique contribution of all the variables of each dimension (e.g., distance, time, and affordability for access) to water security. This will give a holistic overview of the unique contributions of each variable to water security and the appropriate policy responses required rather than addressing the gap in dimension as a whole, as presented in this case. Besides, some of these dimensions are qualitative in nature, and their quantitative assessment was based on the responses from the study participants. For instance, water quality assessment was not based on water quality testing to confirm the actual quality of water from the source. Further research can look at how these qualitative variables can be assessed quantitatively towards assessing rural water security.

8.5 Conclusions

It is clear from this dissertation that multiple interpretations exist for water security in different contexts and disciplines. Even though the term has received a palpable recognition in its usage and applicability in policy and academic discourse, this dissertation uniquely focused on how water security should be conceptualized in rural communities based on the established six dimensions. Not only have these six dimensions been applied in rural water security for the first time, but also this dissertation assessed and analyzed these dimensions based on the experiences and from the perspectives of water collectors, users, and managers. As this dissertation's findings have shown, water security should be used and applied based on a context. However, its application should not

only include meeting the human needs of water (based on the human right to water) but also sustaining the water systems and resources.

As the dissertation has shown, for these factors to exist, there should be an effective management framework that incorporates both distributive and procedural approaches to rural water management. As established earlier, water management in rural Ghana is based on water services distribution but failed to account for the differences within communities based on capabilities, gender, location, and physical conditions. The results are that rural water users are disempowered to either effectively provide sustainable water services or attract external resources to supplement their efforts. Consequently, rural dwellers face water injustice by their geographical locations, which extends to women, girls, and people with physical disabilities who are more vulnerable to rural water insecurity.

Indeed, to achieve human right to water and to ensure that no one is left behind as Sustainable Development Goal 6 seeks to achieve by 2030, the welfare approach should form the basis of rural water supply and management. This approach goes beyond efficiency and fairness to include how market norms will make water inaccessible for the poor. Water, aside from its human rights aspect, is considered as a public good, given its public health implications. Given this, commodifying water rather than treating it as a public good puts water user in the category of customers rather than citizens, who have access to water through their purchase of water as a commodity, rather than the right to water supply services.

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APPENDIX

Appendix A: Household Survey Questionnaire

Part One: DEMOGRAPHIC AND SOCIO-ECONOMIC INFORMATION

1. Household composition

Sex	Ages	Relationship with the HH Head	Number of people in the HH	Ethnic Group	Occupation	Level of Education	Language Spoken
	Head... 1. 2. 3. 4. 5.		1. Male..... 2. Females....		1. 2. 3. 4. 5.	Head..... 1. 2. 3. 4. 5.	1. 2. 3. 4. 5.
1.Male 2.Female		1.Head 2.Spouse 3.Child 4.Other (specify)		1. Ashanti 2. Fante 3. Efutu 4. Other Specify	1.Farming 2.Fishing 3.Trading 4.Other (Specify)	1.None 2.Basic School 3.High School 4. Tertiary 5. Other (Specify)	1. Twi 2. Fante 3. Other (Specify)

2. Total household income per month (expressed in Ghana Cedi).....

3. Household expenditure per month (expressed in Ghana Cedi) on:

i. Rent..... ii. Food..... iii. Water..... iv. Transportation..... vi. Education.....vi.
Health..... vii. Other.....

Part Two: HOUSEHOLD EXPERIENCES IN DRINKING WATER

A. Availability

1. What are your sources of drinking water for the following activities (answer as many as applied to you)?

Type of Activity	Main source	Alternative	Volumes Required Per day (in liters)	Quantity Available (in liters)
Drinking				
Cooking				
Washing, Cleaning and Laundry				
Other (specify)				
	1.Borehole (BH) 2. Hand dug Well (HDW) 3. Stream (S) 4. River (R) 5. Rainwater Harvest (RWH) 6. Sachet/bottled water (SBH) 8.Other (Specify)	1.Borehole (BH) 2. Hand dug Well (HDW) 3. Stream (S) 4. River (R) 5. Rainwater Harvest (RWH) 6. Sachet/bottled water (SBH) 7.Other (Specify)	1. 7 liters 2. 7-50 3. Above 50	1. 7 liters 2. 7-50 3. Above 50

- 2.a. Based on the ability of the source to provide at least 95% of water year, how would you rate reliability of water from the following sources?

Water Source	Reliability Rating				
	Excellent (5)	Very Good (4)	Good (3)	Poor (2)	Very Poor (1)
Borehole					
Small Community Pipe System					
Hand Dug Well					
Stream/River					
Rainwater Harvest					
Sachet/bottled Water					

B. Access

- Where is the water source located? (a) Within the premise/the housing unit (b) Outside
- If outside the premise, please provide responses to the following with regards to your drinking water.

Sources	Distance per trip (km)	Time per trip	Quantity fetched per trip (litres)	Number of trips per day	Means of collection	Type of container used per trip	Size of the Container (in litres)	Number of container used per trip	Amount paid per container (in Ghana Cedis)
Borehole									
Hand Dug Well									
Stream									
River									
Other (Specify)									
	1.1-100 meters 2. 100-200 meters 3. 200-300 4. More than 300 (specify)	1. Less than 30 2. More than 30 minutes (Specify)	1.1-5 2.5-10 3.10-15 4.15-20 5.20-25 6.Other (specify)	1.One 2.Two 3.Three 4. Four 5.Five 6. Other (specify)	1.Walking & carrying 2. Cart 3. Bicycle 4. Motor vehicle 5. Other (specify)	Type: 1. 'Kuffour Gallon" 2.Bucket 3. Other Specify. No. of Trips 1.One 2.Two 3. Other (specify)	1.1-5 2.5-10 3.10-15 4.15-20 5.20-25 6.Other (specify)	1. 2. 3. 4. Other.....	1. less than 20 Gp 2. 20-30 Gp 3. More than 30 Gp (specify)

3. What time of the day do you collect water? (a) Morning (b) Afternoon (c) Evening

4. What is the daily estimated time spent on the following?

Domestic Activity	Time Allocated	Time Allocated
Water Management		
1. Collection		
i. Waiting		
ii. Walking/Transporting		
2. Storage		
3. Purification		
Cooking		
Cleaning and Laundry		
Others (specify)		

5. Who is responsible for water fetching?

HH Member	Gender (1- Male; 2- Female)	Age (Expressed in Years)	Users (1. Household; 2. Other [specify])
Head			
Spouse			
Others (specify)1.			
2.			
3.			
4.			
5.			
6.			
7.			

6. In terms of percentages, how are the responsibilities of water collection distributed among the households?

HH Member	Percentage (%)
Head	
Spouse (s)	
Girl-child	
Boy-child	
Other (Specify)	
Other (specify)	

C. Safety

1. How would you rate the quality of your drinking water from the source?

Water Source	Quality		
	Appearance	Taste	Smell
Borehole			
Small Community Pipe System			
Hand Dug Well			
Stream			
River			
Rainwater Harvest			

2. How would you rate the overall quality of your drinking water?

(a) Good (b) Bad

3. Do you cover water collected from the source during haulage?

(a) Yes (b) No

4. How long do you store water?

D. Management

1. Rural Capacity

Rural Capacity	Responses (1. Effective 2. Not Effective)
Institutional	
Financial	
Human resources	
Technical	
Social	

2.a. Do you in anyway participate in drinking water management in the community? (a) Yes (b) No

b. If yes, how? (a) Through meeting (b) Financial contribution (c) Communal labour (d) Other (specify)

3. Rate your perceptions about the following approaches to management?

Measurement	
Accountability	
Accountable	
Not accountable	
Responsiveness	
Responsive	
Not responsive	
Management	
Effective	
Not effective	

E. Sustainability

Rate the sustainability of water resources and systems based on the following indicators

Rank	Water resources	Water systems
	Percentage	Percentage
Highly sustainable		
Sustainable		
Unsustainable		
Highly unsustainable		
Total		

F. Perception/Desirability

1. a) Do you feel your preferences, cultural practices and traditions are respected during the provision of drinking infrastructure? (a) Yes (b) No

Part Three: RELATIONSHIPS BETWEEN DRINKING WATER SECURITY AND SOCIO-ECONOMIC AND CULTURAL FACTORS

1. In the last 12 months, have you and any member of your household experience any health-related issues as a result of your experience with drinking water? (a) Yes (b) No
2. If yes, which member of your household was affected? (a) Child (b) Spouse (c) the respondent (d) other (Specify).....

3. If yes, please respond to the following in the table.

Health Effect	Response (Yes-1; No-2)	If yes, number of times within the last 12 months	Means of Verification (1 – Through Hospital/clinic/health center; 2 – Other (Specify)
Neck Pains			
Back Pains			
General body Pains			
Diarrhea			
Cholera			
Hepatitis A			
Typhoid			
Dysentery			
Bilharzia			
Other (Specify)			

4. If yes, was it successfully treated? (a) Yes (b) No

5. Do your experiences with drinking water have an effect on the attainment of household education? If yes, which areas of education?

Aspect of Education	Yes – 1; No - 2
Attendance	
Performance	
Other (Specify)	

6. Do your experiences with drinking water have effects on the following?

	Yes – 1; No - 2
Job	
Household expenditure	
Family life	
Child care	
Cultural life	

7. Percentage terms rate (0-100) your water insecurity based on the following dimensions

Dimension	Rating
Access	
Availability	
Safety	
Management	
Perceptions/Disability	
Sustainability	

Appendix B: In-Depth Interview Guide

Part One: EXPERIENCES IN ASSESSING DRINKING WATER

A. WATER AVAILABILITY

1. How often have you experienced water shortage within the past three months?.....
2. How do you deal with drinking water shortages?.....
3. Since how long have you had improved water (Covered well, borehole, pipe borne water)?
.....
4. What was the source of drinking water before the provision of your current improved water source?.....

B. WATER QUALITY

1. What is your perception about your main source of water?.....
2. How do you would you define safe or quality water?.....
3. How do you store water?.....
4. Is it covered? (a) Yes (b) No
5. How long do you store water?.....

C. ACCESS

1. What time of the day do you collect water? (a) Morning (b) Afternoon (c) Evening
2. Please explain your choice in question (4).....
3. What is/are the risk(s) associated with collecting water from the source to the point of usage?.....
4. (a). How would you define water reliability?.....

(b). How would you rate the reliability of your drinking water source? (a) Excellent (b) Very good (c) Good (d) Poor (e) Very poor

(c). Giver reason(s) for your assessment.....

5. In terms of percentages, how would you rate the responsibilities of the following in water collection?

HH Member	Percentage (%)	Explain
Head		
Spouse (s)		
Girl-child		
Boy-child		
Other (Specify)		
Other (specify)		

6. What is the daily estimated time spent on the following?

Domestic Activity	Time Allocated	Time Allocated
Water Management		
1. Collection		
iii. Waiting		
iv. Walking/Transporting		
2. Storage		
3. Purification		
Cooking		
Cleaning and Laundry		
Others (specify)		

4. (a). Does family size contribute to excessive water use or collection? (a) Yes (b) No

5. (b). If yes, how?.....

6. (a). Do men help in household water collection? (a)Yes (b) No

(b). If yes, at what point do men help in water collection?.....

7. What is your opinion about men's involvement in household water collection?.....

8. (a). Do women use bicycle for water collection instead of carrying water? (a) Yes (b) No

(a) If no, why?.....

9. How does payment of water affect drinking water collection?.....

10. What are some of the challenges of drinking water insecurity in your community?

.....

D. SUSTAINABILITY OF WATER

1. What do know about source water protection?.....

E. PERCEPTION/DESIRABILITY

1. From your cultural background and beliefs, explain your relationship with water resources?

.....

2. Explain how drinking water security affect your cultural beliefs and practices.

.....

3. (a) Do you feel your preferences, cultural practices and traditions are respected during the provision of drinking infrastructure? (a) Yes (b) No

- (b) Explain your choice above.....

F. COMMUNITY WATER MANAGEMENT

1. How is drinking water managed in your community?

...We form a water committee and they watch over the water. They also decide who goes to the water to manage and work around it.

2. Do you in anyway participate in drinking water management in the community? (a) Yes (b) No

3. If yes, how? (a) Through meeting (b) Financial contribution (c) Communal labour (d) Other (specify).....

4. If yes, who is responsible for such participation? (a) Head (b) Spouse (do) Other (Specify)

5. Are there some restrictions or challenges to drinking water management in your community? (a) Yes (b) No

6. If yes, what are they?.....

Part Two: RELATIONSHIP BETWEEN DRINKING WATER SECURITY AND OTHER SECTORS

1. Do your experiences with drinking water have an effect on the attainment of household education? If yes, which areas of education?

Aspect of Education	Yes – 1; No - 2	Explain
Attendance		
Performance		
Other (Specify)		

2. Do your experiences with drinking water have effects on the following?

	Yes – 1; No - 2	If yes, explain.
Job		
Family life		
Childcare		

Part Three: DEFINITION OF COMMUNITY DRINKING SECURITY

1. How would define community drinking water security.....

Appendix C: Guides for Focus Group Discussions

1. Describe your general experience in household drinking water collection
 - a. Who is responsible for water collection and why?
 - b. What time of the day do you collect water and why?
 - c. What are the means of water collection?
 - d. Other experiences
2. Describe the drinking water situation in your community
 - a. How reliable is it?
 - b. Is it safe or does it meet the right color? Does it change in color at times?
 - c. Cost
 - d. Quantity
3. Describe the effects of water shortage on your household
 - a. How does it affect the relationship with your spouse?
 - b. How does it affect your health?
 - c. How does it affect your job?
 - d. How does it affect children's education?
4. Share your experiences on how your access to improved water has impacted you and your household?

- What is your opinion about the responsibilities of drinking water collection?

Appendix D: Observation Checklist

- Household Number.....
- Day of water collection (a). Monday (b) Tuesday (c) Wednesday (d) Thursday (e) Friday (f) Saturday (g) Sunday

- Age and sex of water collector(s)

Water Collector	Estimated Age	Sex – Male (1) Female (2)

- Time of the day (a) Morning (b) Afternoon (c) Evening
- Source of water (a) Borehole (b) Hand-dug well (c) Stream (d) River
- Number of trips (a) 1 (b) 2 (c) 3 (d) 4 (e) 5 or more
- Estimated distance per trip (a) 1-100m (b) 100-200m (c) 200-300m (d) more than 300m
- Time taken per trip.....
- Quantity of water collected per trip (in litres) (a) 1-5 (b)6-10 (c) 11-15(d) more than 15
- Means of water collection (a) walking & carrying (b) cart (c) bicycle (d) motor vehicle (e) other.....

Appendix E: Interview Guide Community Water Managers

PART A: DRINKING WATER MANAGEMENT

- What are the sources of drinking water in this community?

Water Source	
Small Community Pipe System	
Borehole	
Hand-dug well	
Rainwater harvest	
Stream	
River	
Others (Specify)	

2. How is water managed in your community?.....
3. How was the committee formed?.....
4. What is the composition of the committee? Men.....Women.....
5. What is/are the main mandate(s) of the committee.....
6. How often do you meet?.....
7. Are the members paid or remunerated for being part of the committee? (a) Yes (b) No
(i) If yes, how and where is the source of funding?.....
8. Are you given the opportunity to participate during the provision of water facility(ie)? (a) Yes (b) No
(i) If yes, at what stage and for how long?.....
(ii) If yes, in what form? (a) Initiative (b) Funds (c) Information (d) Others (specify)
(iii) If no, why?.....

PART B: LOCAL CAPACITIES FOR WATER MANAGEMENT

I. FINANCIAL

1. i. What are the sources of funds for the construction of drinking water facility(ies)? (a) Community contributions (b) Municipal/District Assembly (c) Community/Assembly (d) Other (Specify).....
ii. If the community contributes, how much and in what form?.....
2. i. What are the sources of funds for the maintenance of drinking water facility(ies)? (a) Community contributions (b) Municipal/District Assembly (c) Community/Assembly (d) Others (Specify).....
ii. If the community contributes, how much and in what form?.....

II. TECHNICAL AND HUMAN RESOURCE

1. How often do you experience facility breakdown?.....
(i) How long does it take to response to breakdown?.....
(ii) Do you have local operator(s)? (a) Yes (b) No

- (iii) If yes, is it a permanent or temporal position?.....
 - (iv) If yes, is it paid or voluntary activity?.....
 - (v) If no, how do you do maintenance and repair?.....
 - (vi) How do you ensure the sustainability of drinking water infrastructure?.....
2. Are there training opportunities for local people on facility(ies) maintenance and repair?
- (a) No (b) Yes
- (i) If yes, in what form?.....

III. INSTITUTIONAL

1. Do you have local by-laws that support the management of drinking water? (a) Yes (b) No
- ii. If yes, specify?
2. Do you conduct water monitoring or testing? (a) Yes (b) No
- (i) If yes, how often?.....
 - (ii) If yes, where is the water tested?.....
 - (iii) If yes, do you receive the report from the testing?.....
 - (iv) If yes, what are some of the actions taken?.....
3. Are there source water protection plan (SWP) measures in place? (a) Yes (b) No
- (i) If not, why?.....
4. Have emergencies occur? (a) Yes (b) No
- (i) If Yes, how do you respond to emergencies?.....

IV. SOCIAL

1. Apart from the Assembly, do you receive support from external agencies or individuals?
- i. If yes, explain.....
2. What is the relationship between you and the traditional authority?.....
3. What are the general challenges that affect local capacity in water management?.....

4. How would define community drinking water security?.....

Appendix F: Interview Guide for District Water and Sanitation Team (DWST)

PART A: WATER MANAGEMENT

1. How many rural communities do you have in your district/municipality?.....
 - (i) What is the total rural population in the district/municipality?.....
 - (ii) What is the total number of rural drinking water facilities available?.....
 - a. Borehole..... b. Hand dug wellc. Small community pipe water system.....d. Rain water harvest.....e. Others (specify).....
 - (iii) Rate the quality of the rural drinking water supply from the following sources?

Water Sources	Excellent (2)	Very Good (1)	Good (0)	Poor (- 1)	Very Poor (-2)
Borehole					
Hand-dug well					
Small Community Pipe System					
Rainwater Harvest					
Other (specify)					
1. Excellent is when the test results show that water is free from commination, particles and is at least 90% reliable in terms of flow/yield per annum. 2. Very good is when the test results show that water is free from commination, particles and is at least 80% reliable in terms of flow/yield per annum. 3. Good is when the test results show that water is free from commination, particles and is at least 70% reliable in terms of flow/yield per annum. 4. Poor is when the test results show that water is free from commination, particles and is at least 50% reliable in terms of flow/yield per annum 5. Very poor is when the water when the water source is contaminated and has the potential to cause infections among those who rely on it.					

- (iv) What factors determine the provision of rural water infrastructure?.....
2. How is water managed in rural communities in your district/municipality?.....
 - (i) How many rural areas have water and sanitation (WATSAN) committees?.....
 - (ii) Who oversees water management in the communities without the WATSAN committees?.....
- iii. How do you support the activities of the WATSAN committees?.....

9. Do you consult the community(ies) during the construction of water facility(ie)? (a) Yes (b) No
- (iv) If yes, at what stage?.....
- (v) How does consultation occur?.....
- (vi) If no, why?.....

PART B: LOCAL CAPACITIES FOR WATER MANAGEMENT

I. FINANCIAL

1. What are the sources of funds for the provision of water facility(ies) in the district?

Financial Sources	Percentage to Total funds	Time of Disbursement
Internally Generated Funds (communities)		
Central Government		
Donor Agency(ies) (Specify)		

2. i. What are the sources of funds for the maintenance of drinking water facility(ies)? (a) Community contributions (b) Municipal/District Assembly (c) Community/Assembly (d) Others (Specify).....
- ii. If the community contributes, how much and in what form?.....

II. TECHNICAL AND HUMAN RESOURCE

1. How often do you experience facility breakdown?.....
- i. How long does it take to response to breakdown?.....
2. Do you have local maintenance operator (s)? (a) Yes (b) No
- i. If yes, how many communities have water maintenance operators?.....
- ii. How many of these operators operate on: (a) Permanent? (b) Temporal?.....
- iii. How many are: (a) Paid?..... (b) Voluntary.....
- iv. How do you do maintenance and repair in communities without local operators?.....
3. Are there training opportunities for local people on facility(ies) maintenance and repair? ...

- (ii) If yes, in what form?.....

III. INSTITUTIONAL

1. Do you have local by-laws that support the management of drinking water? (a) Yes (b) No

ii. If yes, what are they?

2. Do you conduct water monitoring and testing? (a) Yes (b) No

i. If yes, how often?.....

ii. If yes, how many communities are the testing conducted?.....

iii. If not all the communities, why?.....

iv. If yes, do you receive the reports from such testing?.....

v. If yes, what are some of the actions taken.....

3. Are there source water protection measures in place? (a) Yes (b) No

(i) If yes, how many places are protected?.....

(ii) If no, why?.....

4. Have emergencies occurred in the district or municipality?

(i) If yes, how many communities?.....

(ii) If yes, how many times within the past 12 months?.....

(iii) How do you respond to emergencies?.....

IV. SOCIAL

1. Apart from the Assembly, do you receive support from external agencies or individuals?

i. If yes, explain.....

2. What is the relationship between the assembly and the traditional authority rural water management?.....

3. What are the general challenges that affect rural water in water management?.....

PART C: NATIONAL WATER POLICY ISSUES

1. What is your understanding of the National Water Policy?.....
2. How does the National Water Policy affect your activities in rural water management in the district/municipality?.....
3. Do you have policy targets your district/municipality is required to meet?.....
4. If yes, are you able to meet these targets?.....
5. Please explain any difficulties you have in meeting these targets.....
6. What is your understanding of the Millennium Development Goals (MDGs) and the Sustainable Development (SDGs) on water?.....
7. Did you meet the MDG target in 2015 in rural water security?.....
8. Please explain any difficulties you have in meeting these targets.....
4. How would define community drinking water security?.....

Appendix G: Interview Guide for Community Water and Sanitation Agency (CWSA)

PART A: WATER MANAGEMENT

1. What factors determine the provision of rural water infrastructure?.....
2. How is water managed in rural Ghana?.....
 - (iii) How many rural areas are under the CWSA?.....
 - (iv) How many rural areas have (a) water and sanitation (WATSAN) committees?.....(b) Water and Sanitation Development Board (WSDB)?.....
 - (v) Who oversees water management in a communities without the WATSAN committees or WSDB?.....
 - (vi.) How do you support the operations of the WATSAN committees or WSDB.....
3. Do you consult the community(ies) during the construction of water facility(ie)? (a) Yes (b) No
3. If yes, at what stage?.....
4. How does consultation occur?
5. If no, why?.....

PART B: LOCAL CAPACITIES FOR WATER MANAGEMENT

I. FINANCIAL

1. What are the sources of funds for the provision of water facility(ies) in rural communities?
.....
2. i. What are the sources of funds for the maintenance of drinking water facility(ies)? (a)
.....
- ii. If the community contributes, how much and in what form?.....

II. TECHNICAL AND HUMAN RESOURCE

1. On the average how often do communities experience facility breakdown?.....
 - (i) How long does it take on the average to response to breakdown?.....
2. Do you have local maintenance operators? (a) Yes (b) No
 - (i) If yes, how many MMDAs have water maintenance operators?.....
 - (ii) How many of these operators operate on: (a) Permanent .. (b) Temporal.....
 - (iii) How many are: (a) Paid..... (b) Voluntary.....
 - (iv) How do you do maintenance and repair in communities without local operators.....
3. How many MMDAs have local spare parts supply?.....
 - (i) What are the sources of supply for the MMDAs without local spare parts supply?.....
4. Are there training opportunities for local people on facility(ies) maintenance and repair?
.....
 - (iii) If yes, in what form?.....

III. INSTITUTIONAL

1. Who is responsible for conducting water quality monitoring and testing in rural areas?.....
2. What is the attitude towards water quality monitoring and testing in rural areas?.....
3. How do you track water quality monitoring and testing in the various MMDAs?.....

4. Are there source water protection (SWP) measures in place? (a) Yes (b) No
 - (i) If yes, how many MMDAs have SWP plans?.....
 - (ii) If no, why?.....
 - (iii) How do you respond to emergencies in rural communities?.....

IV. SOCIAL

1. What is the relationship between the CWSA and the local level governments including the traditional authorities?.....
2. What are the general challenges that affect rural water management?.....

PART C: NATIONAL WATER POLICY ISSUES

1. How does the National Water Policy guide your activities in rural water management?
.....
2. Do you have policy targets for the various MMDAs in rural water supply?
3. If yes, are they able to meet these targets?.....
4. Please explain some of the difficulties MMDAs face in meeting these targets.....
5. Do you have pro-poor drinking water programs in rural communities? (a) Yes (b) No
 - i. If yes, what are some of these programs?.....
6. Do you have Gender sensitive programs on water security in rural communities?.....
 - i. If yes, what are these programs?.....
 - ii. How do you accelerate the representation of women at all levels and in all spheres of rural water management activities?.....
7. Twelve (12) years down the line and six more years to go, what is the current status of the Ghana's Water Vision for 2025 in terms of rural water supply?.....
8. Do you have programs on water security in rural communities for people living with physical disabilities?.....
 - (i) If yes, what are these programs?.....
 - (ii) How do you accelerate the representation of people living with disabilities at all levels and in all spheres of rural water management activities?
.....

PART D: DEFINITION OF DRINKING WATER SECURITY

1. How would define community drinking water security?.....
2. How do ensure the sustainability of rural water infrastructure?

