**DETERMINANTS OF SUSTAINABLE WATER SUPPLY MANAGED BY COMMUNITY-BASED ORGANIZATIONS IN TANGANYIKA DISTRICT**

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**2024**

# CERTIFICATION

The undersigned certifies that he has read and hereby recommends the acceptance by the Open University of Tanzania a dissertation entitled **“Determinants *of Sustainable Water Supply Managed by Community-Based Organizations in Tanganyika district”*** in partial fulfillment of the requirements for the award of Degree of Master of Project Management (MPM)



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# DEDICATION

I wholeheartedly dedicate this dissertation to my extraordinary wife, whose unwavering encouragement and unwavering emotional support has been the cornerstone of my journey through my studies.

# ACKNOWLEDGEMENTS

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# ABSTRACT

This study investigated the factors influencing the sustainability of water supply schemes managed by communities in the Tanganyika district. Specifically, the study assessed the role of economic factors in promoting the sustainability of community water-based organizations, role of institutional factors in promoting the sustainability of community water-based organizations and role of technical factors in promoting the sustainability of community water-based organizations in the Tanganyika district. The quantitative survey and structured questionnaire were employed to collect data from water scheme managers. The study sample included 380 respondents who were randomly selected from a population of 16,008 families. The study employed regression analysis. The research findings revealed that economic, technical, and institutional factors positively and significantly influenced the sustainability of community water-based organizations in the Tanganyika district. The study recommends community water-based organizations to foster economic viability through financial support mechanisms and improve technical expertise through training programs. The study further recommends strengthening institutional governance structures to ensure transparent decision-making and accountability in community water-based organizations. The Governance theory was applied to assess how economic, institutional, and technical factors promoted the sustainability of community water-based organizations in the Tanganyika district.

**Keywords:** *Determinants, Sustainability of Community water Based Organizations, Tanzania*

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# LIST OF ABBREVIATIONS AND ACRONYMS

CBWSO Community-based water supply organizations

CBNRM Community-based natural resource management

SDG Sustainable Development Goals

UNICEF United Nations Children Fund

UN United Nation

WHO World Health Organization

# CHAPTER ONE

# INTRODUCTION

# 1.1 Overview

This chapter discusses the study’s background, statement of the problem, research objectives, significance of the study, scope of the study, structure and limitations.

# 1.2 Background to the Study

The sustainability of the water scheme is the dream of every developing country (Boakye & Akpor, 2012). Clean water is vital for promoting good health, facilitating economic productivity, and preserving the environment in developing countries (WHO/UNICEF, 2019). Nevertheless, many developing countries, including Tanzania, face significant challenges in ensuring access to safe water, particularly in rural and peri-urban areas (Dos Santos et al., 2017). In Tanzania, community-based water supply organizations (CBWSO) have emerged as key players in bridging the water access gap. Since 2019, the management of rural water supply has shifted from local communities to Community-based Water Supply Organizations (CBWSOs), which are established and registered by the Water Supply and Sanitation Act No. 5 of 2019 (Mdemu et al., 2020).

The implementation of community-managed water supply schemes has faced numerous sustainability challenges, encompassing concerns associated with governance structures, socio-economic conditions, and technical facets. Water scheme sustainability, in its broad sense, entails the capacity of a water supply system or project to consistently furnish clean, safe, and dependable water services to a community or region, while also addressing economic, social, environmental, and technical considerations (Wijesinghe et al., 2019). Recognizing the complexity of these challenges, the present study examined the relationship between socio-economic factors, governance structures, and technical elements to strengthen their collective impact on the sustainability of water supply schemes. By comprehensively assessing the dynamic relationships among these factors, this research endeavored to contribute to a fuller understanding of how the sustainability of water schemes can be achieved and maintained in the Tanganyika district, offering valuable insights for sustainable water resource management in similar contexts globally.

The researcher was motivated to assess the influence of factors on the sustainability of water supply managed by community-based water supply organizations in Tanganyika District. Tanganyika District Council hosts a substantial population, with a reported 371,836 people, according to the 2022 National census, distributed across approximately 69,100 families. This sizable population highlights the critical importance of access to sustainable water supply services. Secondly, the district features an irrigation scheme spanning 6,660 hectares, predominantly utilized for growing paddy, sunflower, and sesame, indicating a reliance on water resources for agricultural activities. Understanding the economic dynamics surrounding water supply management in this context is crucial for ensuring its long-term viability and equitable distribution (URT, 2024).

Additionally, the district's dependence on livestock, with a notable chicken population of approximately one chicken per person, further underscores the economic significance of water resources for supporting livelihoods and sustaining local economies (URT, 2024).

 Lastly, community-based forest management initiatives indicate a community engagement in natural resource management, warranting an investigation into the factors influencing the sustainability of water supply projects managed by community-based organizations (URT, 2024). Overall, the study aims to shed light on the dimensions shaping the sustainability of water supply services in Tanganyika district, which is crucial for informing policy decisions and resource allocation strategies.

Despite numerous studies that have assessed the challenges surrounding community-based water supply projects, scanty studies have been done in Tanzania. The literature review reveals that most studies concentrate on the governance structures and the capacity and effectiveness of community-based water supply organizations (CBWSOs) in water resource management. Therefore, studies have failed to investigate how these factors influence the long-term sustainability of these projects in the Tanzanian context.

Zozmann et al. (2022) reviewed the Tanker water markets (TWM) on the sustainability of global water access in the urban area. The findings indicated that TWM has opportunities to serve low-income communities in urban areas. However, the study did not focus on community-based water organizations. Gomez et al. (2019) revealed that gross national income, primary school female completion rate, agriculture, rural population growth and governance indicators, political stability, corruption control, and regulatory quality influenced water access in developing countries. However, the study did not examine how individual income, technical, and institutional factors influenced water access.

Molinos-Senante and Donoso (2016) showed that introducing the suggested water rate encouraged and provided incentives for enhancing both the sustainability of water usage and the equitable distribution of resources among users potentially and improved the affordability of water services sustainability of water service in Chile. However, the study did not assess how the income level of users influenced the sustainability of community water-based organizations.

Maryati et al. (2022) demonstrated that structured organizations, community participation, and financial resources ensured the sustainability of decentralized water supply systems in Bandung City, Indonesia. However, the economic and institutional factors were not analysed. Tyhotyholo and Ncube (2023) reported that limited community participation in urban water governance results in persistent inequality in access to water and sanitation services in South Africa. However, the study did not assess in detail how institutional, economic, and technical factors influenced the sustainability of community water-based organizations.

Chukwuma (2016) observed that the limitations of technology selection and participation of ceremonial village water committees deterred the sustainable functioning of water projects in Enugu state, Nigeria. However, the economic and technical factors were not covered. Kumasi et al. (2019) found that access to timely water service monitoring data at the district level, financial and human resources, and a planning and budgeting framework are necessary for upgrading Ghana's rural water management assets. However, the study did not involve the technical factors in the analysis.

Tantoh and Mckay (2021) assessed the influence of governance systems on community-based water management and in North-West Cameroon. However, the study did not assess how the economic and technical factors influenced the sustainability of community-based water organizations. Kamtukule (2007) found that the water and sanitation sector's institutional framework had the potential to promote efficient multisectoral collaboration and integration of sustainable rural water and sanitation service provision at the district level in Malawi. Moreover, the study further revealed that the districts' limited capability undermined the system's efficacy. Nevertheless, the study did not examine how the economic and technical factors influenced the sustainability of community water-based organizations.

Muraya and Rambo (2019) showed that information technology, management skills, community participation and cultural practices positively and significantly affected project sustainability in community-based water supply organizations in Kenya. However, the economic and institutional factors were not covered. Similarly, in Laikipia County, Kenya, Speranza et al. (2018) assessed the effects of community-based water development projects. The study revealed that the water projects improved living conditions but economic factors were not covered. Githinji (2019) indicated that the financial resources, technology, and socioeconomic factors positively influenced the sustainability of water-based projects in Kenya. However, the study did not consider economic factors.

Furthermore, Ananga et al. (2020) established positive associations between participatory variables and beneficiary satisfaction. However, they omitted to explore the relationship between the governance structure and CBWSOs' capacity and effectiveness in Kisumu, Kenya. Furthermore, the study did not focus on economic and technical factors.

Mdemu et al. (2020) demonstrated that smallholder irrigation systems were a valuable resource for individuals living at or below the poverty line in Tanzania. However, the study did not associate users’ income levels with the sustainability of community water supply schemes. Moreover, the study did not assess how the income of the users affected the sustainability of community water schemes in rural areas.

Msuku (2020) revealed that study community participation, skills of the water management committee, and monitoring and evaluation influenced the sustainability of community-based water projects in Dar es Salaam, Tanzania. However, the study did detail how the institutional and technical factors influenced the sustainability of community water-based organizations. Tankha (2008) revealed that the community participated in the promoting the sustainability of the water project at Yombo Dovya and Barabara ya Mwinyi in Dare es salaam Tanzania by paying the water contribution at early stages. However, the study did not assess how the technical and institutional factors influenced the sustainability of rural community water organizations.

The existing literature on community-based water supply organizations reveals several gaps in understanding the factors influencing project sustainability, particularly in the context of governance structure, community participation, and skills development. For Governance Structure, Tyhotyholo and Ncube (2023) found a gap in community participation in water governance and pricing in urban South Africa. Tantoh and McKay (2021) did not specify governance structures at the community level in North-West Cameroon. Muraya and Rambo (2019) did not explore the impact of governance structures on project sustainability in Isiolo County, Kenya. For Community Participation, Speranza et al. (2018) did not examine the community-based organizations' governance structure and capacity in water projects in Laikipia County, Kenya. Githinji (2019) did not investigate the influence of the capacity and effectiveness of community-based organizations on project sustainability in the Kajiado Central sub-county, Kenya. Akhmouch and Clavreul (2016) focused on stakeholder engagement but still did not address the capacity and effectiveness of community-based organizations and water governance. Ananga et al. (2020) found positive correlations between participatory variables and beneficiary satisfaction in Kisumu, Kenya, but the study did not explore the influence of organizational governance structures and capacities. Chukwuma (2016) revealed the limited community involvement in project stages without exploring factors hindering effective participation. Overall, studies conducted in Tanzania lack the integration of economic, institutional, and technical factors, motivating further research.

The findings from the literature indicate that, to the best of the researcher’s knowledge, none of the study has integrated the economic, technical and institutional factors. To addressing this gap provides researchers and policymakers with a more comprehensive understanding of the intricate dynamics at play in community-based water supply projects. This knowledge is vital for making informed decisions and formulating effective strategies to ensure the long-term sustainability of such projects.

This study applied the governance theory which provides a framework for understanding how various factors contribute to the sustainability of organizational initiatives (Bowen et al., 2017). The governance theory examines dynamics that impact the sustainability of organizations. (Bevir, 2013). The governance theory in this study is used to highlight how governmental structures influence economic factors, such as funding mechanisms and financial allocation. Therefore, better management of governance and economic factors promote the viability of community-based organizations (Lazaro et al., 2023). Moreover, the theory elucidates how the technical factors, including infrastructure maintenance and technological innovation, influence the reliability and efficiency of water supply schemes. Furthermore, the institution theory designates how institutional factors, such as governance structure and stakeholder engagement, shape the overall governance framework within which these organizations operate (Pahl-Wostl, 2013).

 Integrating the economic factors in promoting the sustainability of community water-based organizations and the role of institutional factors promotes perspective, which allows for a comprehensive analysis of the challenges and opportunities facing such initiatives, ultimately informing strategies for improving water access and management in Tanganyika district.

# 1.3 Statement of the Problem

Globally, many communities face issues related to water scarcity, inadequate infrastructure, and inefficient management of water resources (Zozmann et al., 2022). These challenges often lead to unreliable access to clean water, which impacts public health, economic development, and overall well-being.

In response to these challenges, community-based organizations often manage water resources and ensuring access to safe water for local populations (Daluwatte & Sivakumar, 2018). However, sustaining these organizations and their efforts over time requires addressing various economic, technical, and institutional factors. Community water-based organizations are essential for developing effective strategies to address water-related challenges and improve access to clean water for communities (Kifanyi et al., 2018).

The literature on community-based water supply organizations’ sustainability highlights a study gaps concerning project, particularly regarding governance structure, community participation, and skills development. Tyhotyholo and Ncube (2023) noted a deficiency in community participation in water governance and pricing in urban South Africa. Tantoh and McKay (2021) did not specify governance structures at the community level in North-West Cameroon. Muraya and Rambo (2019) did not explore the impact of governance structure on sustainability in Isiolo County, Kenya. Regarding community participation, Speranza et al. (2018) overlooked community-based organizations' governance structure and capacity in water projects in Laikipia County, Kenya, and Githinji (2019) failed to examine the influence of capacity and effectiveness on sustainability in Kajiado Central sub-county, Kenya. Akhmouch and Clavreul (2016) focused on stakeholder engagement but did not address community-based organizations' capacity and effectiveness in water governance. Ananga et al. (2020) found positive correlations between participatory variables and beneficiary satisfaction in Kisumu, Kenya, yet the study did not explore organizational governance structures and capacities. Chukwuma (2016) identified limited community involvement in project stages without exploring hindering factors. The literature indicates that studies conducted in Tanzania did not integrate economic, institutional, and technical factors, urging further research.

The literature on community-based water supply organizations shows gaps in project sustainability, particularly in governance structure, community participation, and skills development. Studies in urban South Africa, North-West Cameroon, Kenya, and Tanzania have highlighted the need for further research on these areas. Studies in Kenya and Tanzania have identified limited community involvement and hindering factors, while further research is needed to integrate economic, institutional, and technical factors.

Access to clean and reliable water remains a persistent challenge in rural and peri-urban areas of Tanzania (Mdemu et al. 2020). To tackle this pressing issue, community-based water supply organizations have emerged as key players in delivering essential water services to these underserved communities (Wright et al., 2015). Challenges have come to light, encompassing social-economic, governance, and technical dimensions. To ensure the long-term success and sustainability of community-based water supply initiatives, it is imperative to consider factors related to governance, organizational capacity, effectiveness, and community participation. These factors play a pivotal role in achieving enduring improvements in both water access and quality (Alexander et al., 2016).

Despite the existing body of research on water supply sustainability in Tanzania and other contexts, a noticeable gap exists when it comes to studies specifically focused on the Tanganyika district. The unique local context, socio-economic conditions, and governance structures within Tanganyika district required necessitate tailored approaches to effectively address sustainability challenges. The significance of addressing this issue cannot be overstated, as it aligns with the broader goal of ensuring universal access to safe water, fostering sustainable development, and contributing to the achievement of United Nations Sustainable Development Goal 6 in Tanzania (Nkiaka et al., 2021). This motivation serves as the driving force behind the initiation of this study.

# 1.4 Objectives

The objectives of the study comprise both general and specific objectives:

# 1.4.1 Overall Objective

The overall of this research was examining the factors that influenced the sustainability of water supply schemes management by community-based water supply organizations (CBWSOs) in the Tanganyika district of Tanzania.

# 1.4.2 Specific Objectives

The following are specific objectives that guided this study:

1. To assess the influence of economic factors on sustainability of water supply managed by community-based water supply organization in Tanganyika district.
2. To assess the influence of institutional factors on sustainability of water supply managed by community-based water supply organization in Tanganyika district.
3. To assess the influence of technical factors on sustainability of water supply managed by community-based water supply organization in Tanganyika district.

# 1.5 Significance of the Study

This research is highly significant as it addresses a critical knowledge gap by investigating the factors influencing water scheme sustainability in the Tanganyika district. The study's focus on this specific area provides valuable context-specific insights, benefiting various stakeholders, including policymakers and water supply organizations. Moreover, the research aligns with UN Sustainable Development Goal 6, contributing to improved access to safe water and sanitation in Tanzania and supporting progress towards SDG targets.

This research holds significant importance for several compelling reasons. Firstly, it addresses a critical knowledge gap by specifically investigating the factors that influence the sustainability of water schemes managed by community-based organizations in the Tanganyika district. Secondly, the findings of this research have practical implications for various stakeholders, including policymakers, the rural water supply and sanitation agency, community-based water supply organizations, and development practitioners. By identifying the key factors that influence the sustainability of water schemes, this study may enable these stakeholders to design and implement effective strategies and interventions.

This study makes a significant contribution to governance theory. The study offers insightful information about the larger governance structure by examining economic, institutional, and technical factors in the context of community water-based organizations' sustainability. The economic aspect clarifies CBOs' financial sustainability and resource mobilization capacity for sustainable water management. The technical aspects examined provide a more transparent comprehension of the technological capabilities and operational difficulties essential to efficient governance. In addition, the study's examination of institutional factors sheds light on how formal and informal structures influence the governance environment.

# 1.6 Scope of the Study

This study maintains a specific focus on examining the factors that impact the sustainability of water supply schemes managed by community-based water supply organizations (CBWSOs) within the Tanganyika district of Tanzania. The study centers its attention on the critical stakeholders intricately involved in the management of water supply resources within this district. The choice of the Tanganyika district is deliberate, driven by the presence of 23 distinct water supply projects managed by CBWSOs. The Tanganyika district serves as an ideal setting for this research due to its notable concentration of community-based water supply initiatives. These projects offer valuable insights into the dynamics and challenges faced by CBWSOs in ensuring the long-term sustainability of water supply schemes. By focusing on this specific geographical area, the study aims to provide a comprehensive understanding of the factors influencing water supply scheme sustainability in a real-world context.

Through a thorough examination of the Tanganyika district's CBWSOs and their associated water supply projects, this study seeks to shed light on the interplay between socio-economic factors, technical aspects, governance structures, and community participation in the realm of water supply sustainability. The findings generated from this focused investigation can offer practical implications and informed recommendations for improving the effectiveness and longevity of community-managed water supply systems not only within the Tanganyika district but also in similar regions facing similar challenges. In essence, this study's scope is intentionally confined to the Tanganyika district, leveraging its rich array of CBWSOs and water supply projects sustainability.

# 1.7 Limitation of the Study

Research limitations serve as guideposts for future studies, highlighting areas where additional research efforts can further enrich our understanding and bridge knowledge gaps. In this context, it is essential to acknowledge potential limitations that warrant consideration:

i. The study's primary focus was on assessing the factors that influenced water scheme sustainability within the unique context of the Tanganyika District. Consequently, while the findings are invaluable for this specific region, their direct applicability to other populations or dissimilar contexts requires careful consideration. Future research may explore how these factors manifest and interact in different geographic, social, or cultural settings, thus broadening the generalizability of findings.

ii. The research faced time and financial constraints. These limitations, in particular, had affected the depth and breadth of data collection and analysis, potentially impacting its comprehensiveness.

# 1.8 Organization of the study

The research study is structured into five distinct chapters, each with a well-defined purpose and contribution to the overall investigation. An introduction chapter serves as the gateway to the research study, providing readers with essential context regarding the subject matter. It outlines the historical and contemporary backdrop against which the research is situated. Within this section, the research problem is articulated, shedding light on the critical issues that the study seeks to address. It identifies gaps in existing knowledge or challenges that necessitate investigation. The chapter specifies the research objectives, which elucidate the overarching goals of the study, guiding the research process. Additionally, it presents the research questions, which serve as the focal points for inquiry and exploration. Lastly, the scope section delineates the boundaries of the research, clarifying the geographical, temporal, and contextual parameters within which the study operates. It sets the stage for a clear understanding of the study's focus.

Comprehensive literature review is done in the chapter two. This chapter provides an in-depth literature review, organized into cohesive subheadings. It offers a deep review of the existing body of knowledge related to the research topic, synthesizing prior research, theories, and concepts. The literature review identifies recurrent themes, trends, and emerging areas of interest within the field of study. It highlights key findings and insights from previous research, positioning the current study within the broader academic landscape.

A research methodology is on chapter three. In this chapter, the research methodologies employed in the study are accurately described. It elucidates the research design, approach, and rationale behind the chosen methods. The chapter specifies the data collection techniques, outlining the strategies used to gather primary and secondary data. It includes details on surveys and questionnaire data collection techniques. This section expounds upon the techniques and tools utilized for data analysis, elucidating how collected data is processed, interpreted, and transformed into meaningful findings. The chapter presents the research tool's validity enhancement and reliability testing. The chapter also describes the variables and measurement procedures.

The chapter further presents the research tool's validity enhancement and reliability testing. The chapter also describes the variables and measurement procedures. Ethical guidelines and considerations governing the research are discussed in this chapter. It highlights the steps taken to ensure the ethical integrity of the study. The chapter also acknowledges potential limitations and constraints that may impact the research methodologies or findings. These limitations provide transparency about the study's boundaries.

As the research study progresses, subsequent chapters, including chapters four and five, which contribute further to the understanding of the research findings, their implications, and potential recommendations. This structured approach ensures that the research process is coherent, transparent, and methodologically sound, ultimately culminating in a comprehensive and insightful contribution to the chosen field of study. Therefore, while chapter four presents the findings and discussions, chapter five entails the conclusion and recommendations of the study. The chapter presents the synopsis of findings, the conclusion, the study's implications, and directions for further studies.

# CHAPTER TWO

# LITERATURE REVIEW

# 2.1 Overview

This chapter comprehensively examines studies on social, economic, and institutional factors. The review also involves analyzing existing theories supporting the research topic. The chapter also presents empirical research conducted by scholars. By doing so, the literature review highlighted gaps in the current body of knowledge, which necessitated further investigation. The chapter also presents the conceptual framework.

# 2.2 Concepts and Definitions

The following section presents the conceptual definitions.

# 2.2.1 Community Based Water Organizations Water Scheme Sustainability

Water scheme sustainability, when considering social-economic factors, technical aspects, and governance, refers to the ability of a water supply system or project to provide reliable and safe water services to a community over the long term while simultaneously addressing economic considerations, technical requirements, and adhering to principles of good governance (Mussa, 2020). This enduring provision of water services necessitates a harmonious balance, addressing the fundamental aspects of safety and reliability and embracing economic viability, technical robustness, and the tenets of effective governance (Kifanyi et al., 2018). In essence, water scheme sustainability embodies the capacity to endure and adapt in the face of evolving challenges. It signifies the ability to meet the water needs of a community not only today but also in the future, considering the socio-economic dynamics, technical innovations, and governance frameworks that shape the water supply landscape (Rostow, 2013). Achieving water scheme sustainability demands an integrative approach that acknowledges the multifaceted nature of this endeavor and strives to align the interests of communities, technology, economics, and governance in a synergistic and resilient manner (Madrigal-Ballestero et al., 2013).

# 2.2.2 Affordability of water services

Affordability of water services encompasses the capacity of individuals, households, or communities to not only access but also financially sustain safe and dependable water supply and sanitation services, all without undergoing significant financial strain (Hutton & Chase, 2016). This concept underscores the importance of making water services accessible and sustainable for all, regardless of socioeconomic status. It entails ensuring that the cost of water services, including access fees, tariffs, and maintenance expenses, remains reasonable and does not impose an excessive financial burden on individuals or households (Gomez et al., 2019).

Affordable water services are fundamental to achieving universal access to clean and safe water, in line with Sustainable Development Goal 6 (Nkiaka et al., 2021). It directly relates to ensuring equitable access to essential services, where no one is left behind (Pierce et al., 2021). Policymakers, researchers, and water service providers must consider affordability as a central tenet in designing and implementing water supply and sanitation programs, as it plays a pivotal role in enhancing communities' overall well-being and quality of life (Tantoh & Mckay, 2021).

# 2.2.3 Capacity and Effectiveness of Community-Based Water Supply Organizations

The capacity and effectiveness of community-based water supply organizations (CBWSOs) encompass their aptitude and proficiency in inefficiently and durably overseeing and operating water supply systems. These organizations are pivotal in ensuring communities have consistent access to clean and dependable water services (Tantoh & McKay, 2021). Capacity in this context signifies the resources, knowledge, skills, and infrastructure CBWSOs possess to carry out their functions effectively. It relates to their ability to plan, manage finances, maintain infrastructure, and address technical challenges associated with water supply systems. Building capacity involves equipping these organizations with the necessary tools and competencies to perform their roles competently (Alexander et al., 2016).

Conversely, effectiveness pertains to the actual performance of CBWSOs in delivering water services to the community. It involves assessing their ability to meet water quality standards, provide an uninterrupted water supply, manage finances efficiently, and engage with the community in decision-making processes related to water management (Madrigal-Ballestero et al., 2013). An effective CBWSO ensures the water supply system operates smoothly, adheres to regulatory standards, and satisfies the community's needs (Kifanyi et al., 2018). These two aspects, capacity and effectiveness, are closely intertwined. A well-equipped CBWSO with a competent workforce is more likely to provide reliable water services effectively. Conversely, an effective CBWSO builds its capacity by efficiently managing resources and addressing challenges (Daluwatte & Sivakumar, 2018).

Enhancing the capacity and effectiveness of CBWSOs is crucial for achieving sustainable and equitable access to clean water. It ensures that communities can rely on their local organizations to manage and maintain water supply systems efficiently, promoting the well-being and health of the populations they serve (Oino et al., 2015).

# 2.2.4 Community Based Water Organizations

Community-Based Water Organizations are organizations formed by the community to manage water resources in a particular location (Daluwatte & Sivakumar, 2018). In rural areas, community-based drinking water organizations decentralize government frameworks for overseeing water management (Madrigal-Ballestero et al., 2013). Community Water Based Organizations (CBOs) facilitate community participation in development projects (Kifanyi et al., 2018).

# 2.3 Theoretical Framework: Governance Theory

This study used the governance theory to examine the determinants that shape the sustainability of water supply schemes managed by community-based water supply organizations in the Tanganyika district of Tanzania. The study explored socio-economic, institutional, and technical factors as independent variables that potentially influence and impact the sustainability of these water schemes. Given that the study area revolves around community-managed water schemes, our theoretical framework focused on community-based natural resource management. The study employed governance theory as a supporting framework. The theory provides valuable insights into how the community-based water structure fulfills its obligations in sustaining the water scheme within the region (Zogheib et al., 2018).

Governance theory was developed by Max Weber and Woodrow Wilson (1990). The strengths of the agency theory include: The theory has evolved over many years and has been influenced by various thinkers and scholars from different disciplines (Rhodes, 1996). However, it gained significant prominence in the latter half of the 20th century and has continued to evolve. It focuses on understanding how societies, organizations, and systems are governed and how decisions are made, implemented, and controlled (Bevir, 2013). It explores the processes, structures, and mechanisms through which authority, power, and control are exercised and how different actors interact to achieve collective goals and manage resources. This perspective focuses on institutions, policies, and power dynamics (Peters & Pierre, 2006). Therefore, the theory sheds light on the influence of resource management outcomes in community-based water supply organizations and the sustainability of water supply schemes (Kooiman, 1993). The governance theory variables include institutional arrangements, decision-making processes, accountability mechanisms, community participation, capacity and effectiveness, governance structure, and ethics (Mayntz, 2003; Alexander et al., 2016; Peters et al., 2012).

The strengths of the governance theory include its ability to capture multiple academic disciplines, including political science, economics, sociology, public administration, and more. Moreover, governance theory can be applied to various contexts, from government institutions and nonprofit organizations to corporate governance and community-based initiatives (Kooiman, 1993). However, the Governance theory possesses the following areas for improvement. It often provides descriptive frameworks for understanding governance systems but may have limited predictive power in forecasting specific governance outcomes or behaviors (Kersbergen & Waarden, 2004).

Moreover, the flexibility of governance theory can sometimes be a drawback because its ideas might be implemented differently depending on the situation. Therefore, it is difficult for the theory to create effective prescriptions everywhere since what works well in one context can differ from another (Peters & Pierre, 2006). Governance theory sometimes underrates the influence of power dynamics influence in decision-making processes. Furthermore, the theory overemphasizes collaborative networks, which may result in power imbalances (Rhodes, 2007).

The present study adopted governance theory as a foundational framework to elucidate the pivotal role of CBWSOs in ensuring the sustainability of water schemes. This theoretical framework investigated essential governance theory variables: governance structures, capacity and effectiveness, community participation and ownership. The theory investigated the community's involvement in contributing significantly to the long-term sustainability of community water-based organizations.

Various studies have used the governance theory. For instance, Bowen et al. (2017) showed that good governance facilitated decision-making. The study by Lazaro et al. (2023) insisted that environmental governance required collaboration. The study also revealed that various types of stakeholders were often unwilling to deliberate and contribute to jointly negotiated solutions to water management. Also, Pahl-Wostl (2013) presented a conceptual framework for analyzing adaptive capacity and multi-level learning processes in resource governance regimes. The study emphasized the importance of stakeholder interactions and collaborative learning in fostering adaptive governance systems. The study highlighted the need for effective communication, knowledge sharing, and collective decision-making among stakeholders to address water resource management challenges and enhance water supply schemes' sustainability.

Transparent and accountable governance practices are institutional factors that ensure that resources are allocated efficiently and decisions are made in the community's best interest. Good governance helps address conflicts, resolve disputes, and ensure the fair and equitable distribution of water resources, ultimately contributing to the sustainability of the water scheme (Pahl-Wostl et al., 2013).

The researcher applied governance theory to assess the role of economic, institutional, and technical factors in promoting the sustainability of community water-based organizations. Economic factors promote adequate resource allocation (Behnke et al., 2017). Institutional factors promote the achievement of goals and objectives by ensuring the organization performs by adhering to the rules, norms, and culture (Geels, 2010). The Technical factors promote the organization's proper functioning (Farrokhi & Pokoradi, 2013). Therefore, the governance theory variables of institutional arrangements, decision-making processes, accountability mechanisms, community participation, capacity and effectiveness, governance structure, and ethics are featured within the economic, institutional, and technical factors.

# 2.4 Empirical Analysis of Relevant Studies

The empirical literature review presents the studies conducted to assess the factors that influence the sustainability of water schemes managed by community-based organizations (CBOs).

Zozmann et al. (2022) reviewed the Tanker water markets (TWM) on the sustainability of global water access in the urban area. The findings indicated that TWM has opportunities to serve low-income communities in urban areas. However, high prices were a barrier to extending the service to the urban community. The findings further showed that ineffective governance threatened the urban governance of TWM. However, the study did not analyze how the income of the users affected the sustainability of community water schemes in rural areas.

Molinos-Senante and Donoso (2016) examined how the affordability of water services improved the sustainability of water service in Chile by using a water rate model design. The results showed that introducing the suggested water rate encouraged and provided incentives for enhancing both the sustainability of water usage and the equitable distribution of resources among users. However, the study did not assess how the income level of users influenced the sustainability of community water-based organizations.

Gomez et al. (2019) examined the relationship between specific socioeconomic factors and access to improved water sources in rural areas of developing countries using regression analysis. The findings indicated that that gross national income, primary school female rate of completion, agriculture, rural population growth, and governance indicators, including political stability, corruption control, and regulatory quality influenced water access. However, the study did not assess how the individual income, technical and institutional factors influenced the water access. Moreover, the study did not focus on the community water organizations.

Maryati et al. (2022) used descriptive analysis to assess the sustainability of two types of drinking water supply systems in Bandung City, Indonesia. The study examined the critical sustainability factors and provided policy recommendations. The study emphasized the importance of structured organizations, community participation, and financial resources management for ensuring the sustainability of decentralized water supply systems. However, the economic and institutional factors were not analyzed.

Behnke et al. (2017) examined the resource mobilization strategies used by community water committees in rural areas of Ghana, Kenya, and Zambia. Through thematic analysis, the researchers identified non-monetary and non-fee mechanisms employed by these committees, including mobilizing personal and community assets, community institutions, and community labor. Factors such as season, community economic characteristics, and the presence of community institutions influenced resource mobilization decisions that helped water scheme sustainability. However, the study did not assess the influence of technical and institutional factors.

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Chukwuma (2016) investigated the level of community participation in rural water supply schemes in Enugu state, Nigeria. The study assessed the extent of community involvement, identified challenges, and proposed strategies for improving service delivery. The study adopted a qualitative and descriptive approach. The results revealed that the limitations of technology selection and ceremonial village water committees' participation deterred the sustainable functioning of water projects. However, the economic and technical factors were not covered.

Using the content analysis, Kumasi et al. (2019) showed that access to timely water service monitoring data at the district level, financial and human resources, and a planning and budgeting framework were all necessary for upgrading Ghana's rural water management asset. The study further found that abandoned asset maintenance systems were likely that Ghana's rural water systems continued to provide unsustainable services. However, the study did not show other factors that hindered the technical support of the project.

Adjakloe (2021) assessed the customary water governance system in the Faase community of Ghana and assessed its sustainability and relevance in the face of the statutory system of water governance. The study examined the structures and mechanisms of the customary system and provided recommendations for integrating them into water resources governance in Ghana. Data were thematically analyzed. The findings indicated that customary water governance played a significant role in the community. The study noted that the water governance system was effective due to the established structures and mechanisms that led to water scheme sustainability. However, the study did not involve the economic and technical factors.

Using a cultural theory and systems approach, Tantoh and Mckay (2021) assessed the influence of governance systems on community-based water management in North-West Cameroon. The study examined the challenges and dynamics of water resource management. The study applied the cultural theory and systems thinking analysis (STA) to classify social groups, evaluate stakeholder relationships, and develop a policy intervention mechanism for sustainable community-based Water Management (CBWM). The findings revealed a significant hurdle in domestic water provision due to centralized governance and the concentration of decision-making power at the national level. However, the study did not assess how the economic and technical factors influenced the sustainability of community-based water organizations.

Tyhotyholo and Ncube (2023) used a contextual analysis of community participation to study water governance in urban South Africa since 1994. The findings found that limited community participation in urban water governance results in unequal access to water and sanitation services. The findings emphasized that new strategies and effective mechanisms are needed to include communities in water governance and pricing. However, the study did not assess in detail how institutional, economic, and technical factors influenced the sustainability of community water-based organizations.

Boakye and Akpor (2012) investigated the meaningfulness of community participation in the Catchment Management Forum (CMF) in South Africa, particularly for disadvantaged communities. The study adopted a qualitative research approach and the data were analyzed thematically. The findings indicated a limited understanding of the technical aspects of water resource management hinders their meaningful engagement. The study highlighted the importance of skill development and capacity building to enhance water scheme management and sustainability. However, the economic and institutional factors were not considered.

Thematically, Kamtukule (2007) found that the water and sanitation sector's institutional framework had the potential to promote efficient multisectoral collaboration and integration of sustainable rural water and sanitation service provision at the district level in Malawi. However, the study further revealed that the districts' limited capability undermined the system's efficacy. The findings further found that the district assemblies faced difficulty in mobilizing financial resources. Hence, they depended on outside assistance instead of locally produced income from rural water supply systems. The study did not cover the influence of technical factors.

Muiruri and Mutiso (2021) studied the factors that contribute to the sustainability of water projects in Murang’a County, Kenya. The collected data were analyzed using correlation and regression analysis. The study’s findings revealed a significant and positive correlation between the competencies of the project team, project financing, and the overall sustainability of water projects. However, it is important to note that the study did not explicitly address community engagement in water management or consider institutional factors within its research scope.

Muraya and Rambo (2019) examined the factors influencing the sustainability of rural water projects in Isiolo County, Kenya. Data were analyzed using descriptive and regression analysis. The findings showed that information technology, management skills, community participation and cultural practices positively and significantly affected project sustainability in community-based water supply organizations in Kenya. However, the economic and institutional factors were not covered.

In Laikipia County, Kenya, Speranza et al. (2018) used content analysis to reveal that community-based water development projects improved living conditions and community cohesion. The key factors that promoted the project's success included community participation, community ownership and public-private partnerships. However, lack of resources, inadequate skills, inequity, poor accountability and leadership encouraged the failure of community-based water projects. However, the study did not include economic factors.

Githinji (2019) by using descriptive and correlation analysis examined the factors affecting the sustainability of community water-based projects in Kajiado Central sub-county in Kenya. The findings indicated that the financial resources, the technology and socioeconomic factors influenced positively the sustainability of water-based projects in Kenya. However, the technical factors were not focused. Moreover, the study did not investigate how the CBWSOs' capacity and effectiveness on project sustainability, but focused solely on CBWSOs’ stakeholder engagement.

Ananga et al. (2020) in Kisumu, Kenya, by using logistic regression established positive associations between participatory variables and beneficiary satisfaction. The findings indicated that beneficiary satisfaction was correlated with labour, meeting attendance, vandalism intervention, financial contribution, and timely payments of water. However, the study omitted exploration of governance structure, CBWSOs' capacity and effectiveness.

Oino et al. (2015) explored the significance of capacity and effectiveness in the implementation of water service projects in Kenya using the conceptual analysis and literature review. The findings revealed that the majority of these projects prioritized both effectiveness and sustainability. The findings concluded that lack of commitment and stakeholders’ ownership were the reasons for project failure. The findings further revealed that development agencies’ awareness of cultural, political and socio-economic factors influenced planning design, implementation, monitoring and support. However, the study did not consider how the economic, institutional and technical factors influenced the community-based water organizations.

Mdemu et al. (2020) using descriptive analysis demonstrated that smallholder irrigation systems had proven to be a valuable resource for individuals living at or below the poverty line in Tanzania. These systems had enabled them to afford water services, and their ability to pay for these services had contributed significantly to the sustainability of the water scheme. While community-based water management had been extensively researched for its potential to achieve water management sustainability and some studies had highlighted challenges in water infrastructure, limited attention has been given to understanding the poverty levels of individuals living in proximity to these water projects. However, the study did not assess how users’ income levels affected the sustainability of community water supply schemes.

Tankha (2008) assessed the community participation in water supply and sanitation services at Yombo Dovya and Barabara ya Mwinyi in Dare es salaam Tanzania using descriptive and thematic analysis. The findings demonstrated that participation of the community promoted the sustainability of the water project. The findings indicated that at the early stages the community paid the maintenance costs than at later stages. Moreover, capacity building positively promoted the performance of the water project*.*

Msuku (2020) assessed the factors influencing the sustainability of community-based water projects in Dar es Salaam, Tanzania. The study focused on community participation, the skills of the water management committee, and monitoring and evaluation as crucial factors. Correlation and multiple regression analysis were employed to analyze the data. The findings indicated that community participation, skills of the water management committee, and monitoring and evaluation significantly influenced the sustainability of the water projects. The study mentioned the water management skills as promoters for water project sustainability. However, the analysis did not involve the technical factors. Furthermore, the study detailed how institutional and technical factors influenced the sustainability of community water-based organizations.

# 2.5. Hypotheses

Based on the empirical review the following hypotheses were formulated:

1. Hypothesis (H₁): There is a significant and positive relationship between economic factors and the sustainability of community water schemes in Tanganyika district.
2. Hypotheses (H2): There is a significance and positive influence of the institutional factors on the sustainability of community water schemes in Tanganyika district.
3. Hypothesis (H3): There is a significance and positive influence of the technical factors on the sustainability of community water schemes in Tanganyika district.

# 2.6 Research Gap

In terms of governance structure, the study by Tyhotyholo and Ncube (2023) focused

on community participation in urban South Africa did not investigate the inclusion of communities in water governance and pricing, leaving a gap in understanding effective mechanisms for community involvement. The study by Tantoh and McKay (2021) in North-West Cameroon did not specify the existence of governance structures at the community level, which limited the understanding of how governance systems contributed to water resource management. The study by Muraya and Rambo (2019) in Isiolo County, Kenya did not explicitly explore the impact of governance structures and the capacity and effectiveness of community-based water supply organizations on project sustainability.

In terms of community participation, the study by Speranza et al. (2018) in Laikipia County, Kenya did not consider factors such as governance structure and capacity and effectiveness of community-based water supply organizations in analyzing community-based water projects. Further, the study by Githinji (2019) in the Kajiado Central sub-county, Kenya, did not examine the influence of the capacity and effectiveness of community-based water supply organizations on project sustainability.

Furthermore, the study by Akhmouch and Clavreul (2016) focused on stakeholder engagement but did not address the capacity and effectiveness of community-based water supply organizations as a critical factor in water governance. Ananga et al. (2020) in Kisumu, Kenya, found a positive correlation between participatory variables and beneficiary satisfaction but did not explore the impact of governance structure and capacity and effectiveness of community-based water supply organizations. Lastly, the study by Chukwuma (2016) in Enugu state, Nigeria identified limited community involvement in crucial project stages but did not assess the factors, such as governance structure and capacity and effectiveness of community-based water supply organizations, that hinder effective participation. The study study further revealed that a lack of competence among CBWOs staff but did not specify whether it pertained to the technical or financial department. Furthermore, the study did not pinpoint the specific areas of deficiency and explore the implications for water project sustainability, considering governance structures and their influence.  The literature reveals that studies done in Tanzania have not integrated the variables of economic, institutional and technical factors. This reason motivated the researcher to conduct this study.

# 2.7 Conceptual Framework

A conceptual framework is crucial in providing a roadmap for understanding, analyzing, and interpreting a specific phenomenon or topic of study. It lays the groundwork by establishing the fundamental concepts, variables, relationships, and assumptions that steer the research or study (Imenda, 2014). In quantitative research, a conceptual framework is particularly significant as it structures the definition and operationalization of key concepts, specifies the relationships between variables, and guides the research process (Almeida, 2018). The present study was guided by three sub-objectives, all of which are underpinned by this conceptual framework.

The first objective predicted the relationship between social and economic factors and community water sustainability. Thus, the economic factor is an independent variable, and the sustainability of the community water scheme is the dependent variable. The second objective predicted whether institutional factors influenced the sustainability of water schemes. The third objective assessesed how the technical factors promoted the sustainability of the community water supply schemes.

The study's conceptual framework depicts that income per month, cost structures, and community affordability was the components of the economic factors. CBWOs' financial capabilities influenced their capacity to make investments in technology, infrastructure, and human resources. Cost-effectiveness, revenue generation, and fundraising strategies were essential to CBWOs' economic viability. The availability of funding for infrastructure upkeep and repair directly influenced the lifespan of community water supply systems.

Technical aspects included infrastructure upkeep, water quality control, and the suitability and efficiency of water supply technology. Technological aspects improved the community water organizations' processes and procedures. The efficient and effective technical procedures encouraged sustainability of water extraction, treatment, and distribution, hence augmenting the dependability of water supply. For water systems to continue operating and to adapt to changes in the environment, CBWOs' technical capability was essential.

The administration of regulatory frameworks, community involvement, and governance structures improves the institutional practices of community water organizations. Robust institutions guarantee efficient decision-making, active participation from the community, and adherence to legislative mandates. Transparent communication lines, local government supervision, and community ownership promote the sustainability of community water organizations. Figure 2.1 indicates the conceptual framework of the study.

**Economic Factors**

- Income per Month

-Water Bill per Month

-Affordability

 **Independent variables**

**Dependent Variable**

**Institutional Factors**

-Governance structure

-Community participation and ownership

-Capacity and Effectiveness

Sustainability of water schemes

**Technical factor**

-Technical Support

-Infrastructure upkeep,

-Water quality control,

-Suitability and efficiency of water supply technology

**Figure 2.1: Conceptual Framework of the study**

**Source:** Compiled from empirical literature review

# CHAPTER THREE

# RESEARCH METHODOLOGY

# 3.1 Overview

This chapter explains the research techniques. The chapter comprises research philosophy and design, population and sample, study area, sampling procedures, sampling size, data gathering strategy, data processing and analysis tools, research tools' validity enhancement, reliability testing, and study ethics.

# 3.2 Research philosophy

This study was based on positivism philosophy. Positivism is a philosophical perspective rooted in empiricism and scientific inquiry. It contends that genuine knowledge can only be derived from empirical observation and verifiable evidence. It rejects notions of metaphysical speculation or subjective interpretations and emphasizes the importance of rigorous scientific methods in understanding the world (Creswell & Creswell, 2017; Saunders et al., 2019).

The positivism philosophy allowed researchers to test the hypotheses to reveal the relationship between the social economic factors, institutional factors and technological factors and sustainability of community managed water supply schemes.

The positivism philosophy served as a guiding framework for researchers seeking to empirically test hypotheses regarding the relationship between social and economic, institutional, technological and the sustainability of community-managed water supply schemes. Through rigorous quantitative analysis, the researcher examined such schemes' long-term viability and effectiveness. By employing positivist principles, researchers uncovered objective truths and patterns within the data, shedding light on the interplay between various determinants of sustainability.

# 3.3 The research design

This study used a cross-sectional explanatory survey design. Due to financial and time limitations, a cross-sectional survey design promoted the research to collect data once. The explanatory design assisted the researcher in testing the study's hypotheses (Creswell & Creswell, 2017; Pallant, 2020).

The cross-sectional explanatory design was used due to its ease of collecting data from diverse participants at a single point in time. This design enabled researchers to uncover relationships between variables and explain how economic, institutional, and technical factors promoted the sustainability of the CBWOs in the Tanganyika district.

This design allowed the testing of the hypotheses and explained the relationship between the determinants and sustainability of CBWOs in the Tanganyika district. The cross-sectional explanatory design was used due to its ease of collecting data from diverse participants at a single point in time. This design enabled researchers to uncover relationships between variables and explain how economic, institutional, and technical factors promoted the sustainability of the CBWOs in the Tanganyika district. This design allowed the testing of the hypotheses and explained the relationship between the determinants and sustainability of CBWOs in the Tanganyika district.

# 3.4 Population to be surveyed

The population is the complete set of individuals or entities that share a common characteristic and are of interest to the researcher (Creswell & Creswell, 2017). In this study, the targeted population was the community surrounding water projects in Tanganyika district. Specifically, the stakeholders involved in the water projects, including those who use the water and those involved in planning for the maintenance of the projects, are the focus of the research.

The Tanganyika district has a population of 371,836 individuals (or around 69,100 families) according to the 2022 National Census. The RUWASA Tanganyika annual report (2022) stated that water delivery projects saved 80,036.84 people, or around 16,008 households. Through examining this group, the researchers were able to learn more about the community's experiences with the water projects.

# 3.5 Sampling Design

Sampling design entails the techniques to select a subset of individuals, entities, or observations from a larger population to participate in a study. It involved determining the method and procedures for choosing the sample and ensuring that it represented the population of interest (Levy & Lemeshow, 2013). A well-designed sampling strategy was crucial for obtaining for promotion precision of the findings (Etikan & Bala, 2017). The selection of sampling techniques in quantitative research is influenced by the specific research goals, the nature of the research question, the characteristics of the target population, and the available resources (Creswell & Creswell, 2017).

# 3.5.1 Sampling Frame

The sample frame for this study was all community water users under CBWSOs in the Tanganyika district in the Katavi region. The sampling frame for this study consisted of all members of community-based organizations (CBWOs) involved in managing water supply schemes within the Tanganyika District. Therefore, the sampling frame included individuals actively participating in decision-making processes, implementation, and maintenance activities related to the operation of community water-based organizations. The sampling frame was obtained from CWBOs membership rosters and official records.

# 3.5.2 Sample Unit

The sampling unit refers to the individual element or entity from which data is collected in a research study (Saunders et al., 2019). It represents the primary focus of the investigation and is the unit to which the researcher applies the research methods and analyzes the data (Creswell & Creswell, 2017). The choice of the sample unit is a critical decision in research, as it directly influences the scope and generalizability of the study's findings. Important is that the unit of analysis should align with the research objectives and the level of detail required to address the research question effectively (Kumar, 2018). In addition to that, the characteristics of the sample unit, along with the sampling method employed, play a crucial role in determining both the accuracy and precision of the sample (Creswell & Creswell, 2017).

A well-designed sampling strategy, considering the heterogeneity, clustering effects, sample size, and variability of the population, can yield a sample that offers accurate and precise estimates. This precision, in turn, enhances the reliability and validity of the research findings, underscoring the importance of a proper sampling strategy (Kumar, 2018).

As recommended by Creswell and Creswell (2017), during the selection of sample units using the random sampling technique, the researcher carefully selected the appropriate respondents, ensuring no duplication in their choices. Each chosen respondent was unique, representing a single member from each targeted family, which helped provide sufficient and comprehensive information for the study's needs.

# 3.5.3 Sample Size

Sample size determination is a critical process in statistical sampling, where the number of representatives to be included in the sample is carefully chosen (Creswell & Creswell, 2017). This step holds significant importance in studies aiming to draw inferences about a larger population based on the gathered sample data. In the context of this study, the sample size was determined using established rules of thumb for sample size calculation. For this purpose, the researcher employed the Slovene formula to obtain the appropriate sample size, enabling the selection of respondents from individual populations. Specifically, the study focused on approximately 16,008 families in the Tanganyika district. By determining the optimal sample size through rigorous calculations, the study yielded robust and reliable results, ensuring that the sample adequately represents the broader population of interest. Respondents were community water-based organization members.

Slovene’s Formula is given as follows:

n = N/ (1+Ne²), Where n= sample size; N = population; e² = level of significance which is 0.052

N= 16,008 families in Tanganyika district

 n= 16,008 / (1+16,008 (0.05²)

n= 390.2 families

Hence, the anticipated sample size for this study was 391 families in the Tanganyika district. However, the researcher obtained responses from 380 participants, which accounted for 97 percent of the desired sample size. A commonly accepted guideline is to have a minimum of 20 observations per independent variable in a regression analysis. Consequently, if a researcher is working with just one independent variable, 20 data points may suffice. However, when dealing with three independent variables, aiming for a minimum of 120 data points was generally advisable (Schmidt et al., 2018). Given these considerations, it is evident that our sample size was sufficient to yield robust and reliable results for this study.

# 3.5.4 Sampling procedure

The representative sample of water supply schemes and households within the Tanganyika District was randomly selected. Random sampling ensured that each water supply scheme and household within the district had an equal chance of being included in the study. This approach increased the likelihood of obtaining a sample that accurately reflected the characteristics and diversity of the district's water supply schemes and households. By employing random sampling, the findings could be generalized to a broader population, providing a more robust understanding of the factors influencing water supply scheme sustainability in the Tanganyika District (Wijesinghe et al., 2019; Nyakwaka et al., 2019; Mussa, 2020).

The sampling design employed in this study involved random sampling techniques to ensure a representative selection of participants from the Tanganyika district. Random sampling ensured the proper selection of participants from the community water organizations in the district. The study's random sampling gave an equal chance for every respondent to participate in the survey. This process minimized the bias and increased the generalizability of findings to the community-managed water supply schemes in the district. Random sampling ensured the robustness of the research findings. It enabled researchers to draw more accurate conclusions about the factors influencing the sustainability of community water-based organizations in the Tanganyika district.

# 3.6 Data Collection

Quantitative data was collected through structured surveys administered to households and water scheme managers. These surveys provided numerical data on various aspects related to water supply sustainability. A representative sample of water supply schemes and households within the Tanganyika district was randomly selected. The sample size was decided based on statistical considerations to ensure sufficient power and representativeness of the findings. The surveys captured information on socio-economic characteristics of the households, technical aspects of water supply schemes (such as infrastructure, maintenance practices, and water quality), community participation levels, and financial mechanisms (such as user fees, funding sources, and cost recovery).

The survey instruments were designed based on validated tools and adapted to the local context, ensuring the relevance and reliability of the data. Data collection involved the use of questionnaires. To ensure accuracy and validity, the questionnaire underwent a translation process, transitioning from English to Swahili and back to English. Trained enumerators administered the surveys, ensuring consistency and accuracy in data collection. Data quality control measures were implemented, including regular monitoring of data collection processes.

# Data cleaning and verification

The researcher distributed 391 questionnaires, but only 380 were returned. This was equivalent to a 97% response rate. According to Hair Jr et al. (2010), a response rate of 30% and above allows data analysis to be carried out. During the data cleaning exercise, the researcher checked for data errors. Then, the researcher looked for missing values and Outliers. Through the researcher's rigorous approach to data supervision, errors were diligently checked for and promptly addressed in the initial stages. A comprehensive examination of missing values and outliers was then conducted. The results should be a dataset free from errors, outliers, and missing values. This approach significantly promoted the reliability of the research findings. Subsequently, the cleaned data underwent a meticulous coding process. This involved assigning numerical codes to categorical variables and organizing the dataset into a format suitable for statistical analysis. The coded data was then entered into SPSS data software for comprehensive analysis. Using SPSS software, the researcher conducted a thorough analysis of the coded data.

# 3.7 Data Analysis

The quantitative data collected through structured surveys was analyzed using appropriate statistical methods. Ordinary Least Square Multiple Regression analysis in SPSS was employed. Regression analysis is a statistical method used to examine the relationship between one dependent variable and one or more independent variables. It aims to model and understand the relationship by estimating the impact of independent variables on the dependent variable (Chatterjee & Hadi, 2013). This analysis helped the researcher identify the strength and direction of the relationships between economic factors and the sustainability of the sustainability of community-managed water supply schemes. The Multiple Linear Regression Analysis (MLRA) incorporated the regression assumptions, such as linearity, independence of errors, homoscedasticity, normality of residuals, and Multicollinearity.  The model is as follows: Y = β0 + β1X1 + β2 X2 + β3 X3 + Ɛ

Parameters used in these equations interpreted are as follows:

Y = Water Scheme Sustainability (Dependent variable)

β0 = Intercept /Regression Constant Term

β1 – β3= Coefficient of Xn

X1 = Economic factors (Independent variable),

X2 = Institutional factors

X3 = Technical factors

Ɛ = disturbance/error term

# 3.8 Variables and measurement

The study measured the validity of the items and assessed the relationship between the independent and dependent variables. The dependent variable was the financial viability of community-managed water supply schemes, i.e., revenue generated, and the independent variable was economic factors, i.e., income per month, water bill per month, and community affordability. Institution factors were measured by governance structure, community participation, and ownership, capacity, and effectiveness. The technical factors were measured by technical support, infrastructure upkeep, water quality control and Suitability and efficiency of water supply technology.

The dependent variable was the sustainability of community-managed water supply schemes measured by the revenue generated through water tariffs and grants received if any. Five Likert scale items were used to measure the variables. The Likert scale varied from (1) strongly disagree, (2) disagree, 3 neither disagree nor agree, (4) agree and (5) strongly agree. The number of variables and where they have adopted is shown in Table 3.1.

Table 3.1: Variables and measurement

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variables**  | **No of indicators** | **Code**  | **Sub-variables** | **Source** | **Type of Scale** |
| Sustainability of water Scheme | 1 | WSS | Revenue Generated | Mugumya (2013) | Ratio |
| Economic Factors | 3 | EF | SEF1: Income per MonthSEF2: Water tariff per MonthSEF3: Affordability of water services | Mugumya (2013) | Interval |
| Institutional Factors | 3 | IF | IF1: Governance structureIF2: Community participation and ownershipIF3: Capacity and Effectiveness | Jiménez et al. (2019)Tankha (2008)Tankha (2008) | Ordinal |
| Technical factor | 4 | TF | TF1: Technical SupportTF2: Infrastructure upkeep TF3: Water quality controlTF4: Suitability and efficiency of water supply technology | Tankha (2008) | Ordinal |

**Source:** Empirical Literature Review

# 3.9 Validity and Reliability

In this study, validity was enhanced, and reliability was measured to confirm the precision of the data and the research tool.

# 3.9.1 Validity

Validity is the extent to measure what was intended to be measured accurately (Cooper & Schindler, 2014). The validity is enhanced by the proper construction of the research tool, which captures all variables of the specific objectives (Sharma, 2016). Moreover, consulting the experts in the relevant field and piloting is essential for ensuring the validity of the research tool (Ary et al., 2010). In this study, the validity was enhanced through using the expertise of the supervisors and community water organization experts. Moreover, the study variables were adopted from previous studies. The pretesting of the questionnaire was done on 10 respondents before administrating it to the intended respondents. The questions that were doubtful and those that could not fit the purpose of the study were deleted or amended.

# 3.9.2 Reliability

Reliability is the ability of measurements and research tools to maintain consistency in different periods (Cooper & Schindler, 2014). In this study, the reliability was tested through the Cronbach alpha coefficients. The Cronbach alpha coefficients measured the extent to which the variables correlated. The Cronbach alpha values signify that the variables are reliable if they are highly correlated and if the findings of Cronbach alpha are 0.7 and above (Sharma, 2016). The Cronbach alpha coefficient was tested through the reliability scale in the SPSS IBM statistics software. The findings of the reliability analysis are presented in Table 3.3. Based on Sharma (2016), the Cronbach alpha coefficients for all variables yielded a value of 0.7 and above, confirming that the data and research tool were reliable.

Table 3.2: Results of Reliability Analysis

|  |  |  |
| --- | --- | --- |
| Type of variables | Number of items | Cronbach alpha |
| Demographic items | 6 | 0.845 |
| Economic factors | 3 | 0.729 |
| Institutional factors | 3 | 0.882 |
| Technical factors | 4 | 0.779 |

# 3.10 Ethical Considerations

The researcher sought informed consent from participants before their involvement in the study. Participants were provided with clear and comprehensive information about the research purpose, procedures, potential risks, and benefits. All personal information and collected data were anonymized and stored securely. Participants were assigned unique codes or numbers to ensure their identity's confidentiality. Only the researcher accessed the data during the analysis and reporting stages. Privacy and freedom to withdraw from the study were ensured at any time during the data collection. Withdrawal procedures were clearly communicated to the respondents. If they chose to withdraw, their data were excluded from the analysis.

Data fabrication, falsification, and plagiarism were considered severe ethical issues in research and academic settings and were discouraged. To avoid these, the researcher familiarized himself with ethical guidelines and policies provided by institutions. The researcher ensured proper data collection, storage, and management practices to maintain data integrity. Detailed records of research procedures, methods, and raw data were maintained to support research transparency and replicability. Appropriate citation and referencing practices were followed, crediting the original authors and sources. Guidance was sought from mentors, supervisors, and ethical review boards when faced with ethical dilemmas or uncertainties.

# CHAPTER FOUR

# RESEARCH FINDINGS AND DISCUSSION

# 4.1 Overview

This chapter delivers the results of the study. The primary aim of this research was to comprehensively examine the factors that influence the sustainability of water supply schemes, specifically those under the management purview of community-based water supply organizations (CBWSOs) in the Tanganyika district of Tanzania. It starts by presenting the demographic and results, followed by the results from the multiple regression analysis. The regression assumptions of multicollinearity, homoscedasticity, and normality had also been tested.

# 4.2 Demographic characteristics of the respondents

This section highlights the study's participants' general characteristics. It discusses elements such as respondents' gender, age, educational level, occupation, and other characteristics, as seen in Table 4.1.

Table 4.1: General Demographic Characteristics of Respondents

|  |  |  |
| --- | --- | --- |
| Characteristics of Respondents | Frequency | Percent |
| Gender | Male | 253 | 66.7 |
| Female | 127 | 33.3 |
| Education Level | Non-formal education  | 4 | 1.1 |
| Primary | 196 | 51.6 |
| Secondary | 135 | 35.5 |
| College | 29 | 7.5 |
| University | 16 | 4.3 |
| Occupation | Farming/ Livestock Faming  | 245 | 64.5 |
| Business | 61 | 16.1 |
| Employment  | 41 | 10.8 |
| Artisan | 16 | 4.3 |
| Hand Craft  | 16 | 4.3 |
| Income per month | Below 10,000  | 21 | 5.4 |
| 10,001-50,000  | 155 | 40.9 |
| 50,001-100,000  | 90 | 23.7 |
| 100,001-300,000  | 41 | 10.8 |
| Over 300,000  | 73 | 19.4 |

# 4.2.1 Sex of the respondents

In the context of our current study, the researcher conducted an extensive data collection process involving a sample of 380 respondents. The findings indicate that 253 (66.7%) were males and 127 (33.3%) were females. These gender distributions indicate the diverse representation of both male and female perspectives, reinforcing the comprehensive nature of our investigation. Hence, the male respondents exhibited a slight numerical advantage over their female counterparts, constituting 33.4% more of the overall sample size. The results are compared with Maganga (2022), who revealed that respondents of CBWSOs in rural water projects in Karatu district were 56% males and 44% females. The data are indicated in the Table 4.1.

# 4.2.2 Education Level of the Respondents

Most respondents (196) in the district, accounting for over half (51.6%) of

respondents, had completed their primary education. The findings suggest that a portion of the population had at least a basic level of education, which is often significantly considered essential for various aspects of personal and societal development. A substantial portion (135), approximately 35.5%, had completed their secondary education. Secondary education typically represents a more advanced level of schooling.

Moreover, a smaller percentage, 29 (7.5%), had completed college education. The data indicates that a relatively limited number of respondents in the district had pursued post-secondary education beyond high school. The data further show that only a tiny percentage, 16(4.3%), had completed university education. University education is typically associated with higher academic and professional qualifications but was limited in the surveyed district.

Therefore, the data suggests that the Tanganyika district had a significant proportion of individuals with at least primary and secondary education, indicating a foundational level of education among the population. However, the number of individuals with college and university education was relatively low, suggesting limited access to higher education or a preference for entering the workforce at earlier stages. This information provided a valuable understanding of the educational landscape and its potential implications for the district's workforce development and economic opportunities. The results are compared with Konde (2022), who revealed that 51.35% of Kenya's community water-based organization members had primary education, 25.68% secondary level, and 2.7% university level. The data are presented in Table 4.1.

4.2.3 Occupation of Activity Conducted by Respondents The largest group among the respondents, comprising 245 (64.5%), engaged in farming and livestock activities. This statistic suggests that agriculture and animal husbandry were the predominant livelihoods in the Tanganyika district. Such a high percentage highlights the district's reliance on these traditional, primary industries, which often played a central role in the local economy.  Additionally, a significant but smaller portion (61), accounting for 16.1% of the respondents, were business owners. This group likely included entrepreneurs and individuals involved in various commercial activities. Their presence suggests a level of economic diversity in the district. Also, approximately 41 (10.8%) of the respondents were employed, which implies that they were working for someone else. This group reflects a segment of the population that is part of the wage-earning workforce.

Lastly, smaller subsets of 32 respondents, representing 8.6%, were artisans involved in handcraft or skilled manual work. This group included individuals who created artisanal products, such as traditional crafts or handcrafted items. Their presence underscored the importance of cultural and craft activities in the district.

Therefore, the data suggests that the primary livelihoods in the Tanganyika district were closely tied to farming and livestock, which served as the backbone of the local economy. Business ownership was also a substantial occupation, indicating entrepreneurial activities. Employment in formal job roles and artisanal work were less prevalent but contributed to the district's economic landscape. Understanding these occupational distributions helps local authorities, researchers, and policymakers make informed decisions regarding the district's economic development and resource allocation. The results are compared with Konde (2022), who revealed that (50%) of community-based organization members in Kilifi Country, Kenya were farmers. The occupation of the respondents is shown in the Table 4.1.

# 4.2.4 Income per month of the respondents

The findings indicated that 155 respondents, marked as 40.9%, generated Tshs 10,001 to 50,000 per month. Moreover, 90 (23.7%) respondents generated Tshs 50,001 to 100,000 monthly. Also, 41(10.8%) respondents generated Tshs 100,001 to 300,000 per month. Lastly, 73(19.4%) generated over Tshs 300,000 in the Tanganyika district. The study determined whether the local society's economic activities contributed to the sustainability of a water scheme. Income per month was considered a critical factor in this context, as it indicates the financial capacity of the community to support such infrastructure. The largest group among the respondents, representing 40.9%, earned Tshs 10,001 to 50,000 income range.

This group earned a modest monthly income, indicating that a substantial portion of the population had limited financial resources. The findings suggest that they face financial constraints in contributing significantly to the sustainability of a water scheme.

The next significant group, comprising 23.7% of the respondents, falls within Tshs 50,001 to 100,000 monthly income. Their slightly higher income levels indicate a somewhat improved financial capacity to support the water scheme compared to the first group. The findings showed that 10.8% of the respondents earned a moderate monthly income of about Tshs 100,001 to 300,000. The financial resources of this group were relatively better, which could make them potential contributors to the sustainability of the water scheme. The last group comprised 19.4% of the respondents who earned over Tshs 300,000 per month. This group had a more robust financial capacity to support the water scheme and other community initiatives. Therefore, the distribution of income levels among the respondents suggests that a significant portion of water users had low incomes. A notable percentage also earned higher incomes. The findings indicate a diversity in the community's economic capacities. The data is shown in the Table 4.1.

The findings are compatible with Maryati et al. (2022), who emphasized the role of financial resources in promoting the sustainability of the water supply system in Bandung City, Indonesia. Moreover, Kumasi et al. (2019) recognized the role of financial resources in upgrading Ghana's rural water management assets. Kamtukule (2007) revealed that inadequate financial resources limited the capability of the water system in Malawi.

# 4.3 Testing the Assumptions of Multiple Linear Regression Models

The study has performed several analytic procedures to test whether the data were normally distributed and free from the influence of outlier cases. Also, some tests were conducted to assess concerns for multicollinearity. The results of these analytical procedures are presented as follows:

# 4.3.1 Multicollinearity and singularity

The study examined concerns for multicollinearity using the Variance Inflation Factor (VIF) scores. A VIF value greater than 10 strongly suggests a concern for Multicollinearity (Kyriazos & Poga, 2023). The tolerance scores and VIF values have remained consistent with the recommended cutoff points in this study (Tabachnick & Fidell, 1996). However, it is essential to note that VIF values have stayed within the recommended cutoff points. This implies that the study's regression model does not suffer from severe multicollinearity issues. In other words, the independent variables included in the analysis do not exhibit excessively high correlations with one another, which could have compromised the reliability and interpretability of the regression results. Overall, this assessment provides confidence in the independence of the chosen variables within the regression model, ensuring that the relationships between these variables and the dependent variable can be analyzed with a higher degree of reliability and precision. The results of VIF are presented in Table 4.2.

Table 4.2: The variance inflation factor (VIF)

|  |  |
| --- | --- |
|  Variable |  VIF |
| Water bill per month | 2.338 |
| Technical factor  | 1.698 |
| Income per month | 1.758 |
| Governance structure  | 1.782 |
| Capacity and effectiveness | 2.235 |
| Community participation and ownership | 2.321 |

# 4.3.2 Normality and linearity

The maximum likelihood estimation approach accepted in this study required the data to satisfy multivariate normal assumptions. However, there is no direct test for regression normality (VanVoorhis & Morgan, 2007). Therefore, the study checked univariate normality by inspecting the histogram plot, the normal probability graph or plot (Q-Q) of the regression standardized residual, and the scatterplot of each variable. For illustration, the normality results for the dependent variables are presented in Figure 4.2.



**Figure 4.1: Q-Q Plot of the regression standardized residual for Sustainability of water schemes**

As shown in Figure 4.2, the histogram has a bell-shaped curve, indicating that the data for the sustainability of water schemes is normally distributed around the mean. The residuals are concentrated along the zero point and take a fairly rectangular distribution shape. This distribution pattern strongly provides additional evidence for the normal distribution of the variable.



**Figure 4.2: Histogram plot showing normal distribution of the Sustainability of water schemes**

**Source:** Field Data (2023)

**Table 2.3: Regression model summary**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .733a | .537 | .531 | .86798 | .537 | 85.768 | 4 | 296 | .000 |

**Source:** Researcher (2023)

# 4.4 Multiple Linear Regression Results

Using SPSS software, the study utilized regression analysis, a robust statistical technique employed to scrutinize the relationships between variables. In particular, it assesses the connections between a single dependent variable and one or multiple independent variables. This analytical approach serves the purpose of constructing a model that enhances our comprehension of these relationships. By estimating the influence of independent variables on the dependent variable, the researcher gains valuable insights into the dynamics interplay between independent and dependent variables (Chatterjee & Hadi, 2013). The researcher analyzed the relationship between socio-economic, technical, and institutional factors and the sustainability of community-managed water schemes through regression analysis. Table 4.4 shows the results of the multiple linear regression analysis.

Table 4.4: Multiple linear Regression Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  Sub-Variables | Unstandardized coefficients | Standardized coefficients |  T value | P value |
| Economic factors | 0.226 | 0.229 | 3.766 | 0.000 |
| Technical factor  | 0.419 | 0.343 | 4.715 | 0.000 |
| Institutional factors | 0.292 | 0.287 | 2.543 | 0.000 |
| Intercept | 1.4809 | 0.000 | 2.256 | 0.0000 |

**Source:** Researcher (2023)

# 4.4.1 The Influence of Economic Factors in the Sustainability of Water Scheme

Table 4.8 provides valuable insights into the influence of economic factors on the sustainability of the water scheme. The results of the multiple regression's results revealed a positive and significant influence of income levels on the sustainability of the water scheme (β=0.173, p < 0.018). The coefficient (β) of 0.173 signifies the strength and direction of this relationship. In this context, a positive and significant β value suggests that as economic factors increase, the sustainability of the water scheme also tends to increase. The findings signify that households with higher monthly incomes were more likely to promote the sustainability of the water scheme. The significance level of p < 0.018 indicates that this relationship is statistically significant. In other words, this relationship is a result of random chance. Instead, it suggests that the observed association between economic factors and water scheme sustainability was robust. Furthermore, it is notable that for every one-unit increase in the income per month variable, the dependent variable, which is the sustainability of the water scheme, increases by 0.173 units. The findings imply that even small increments in income can lead to substantial improvements in the sustainability of the water scheme, potentially benefiting the community's access to reliable water resources.

The findings align with the expectations that households or individuals with higher monthly incomes were more likely to contribute to water scheme sustainability. The findings align with the results of Gomez et al. (2019), who assessed the connection between socioeconomic factors and access to improved water sources in rural areas of developing countries. Their study indicated that poverty reduction was identified as a significant factor contributing to the community's access to water and the sustainability of the water supply scheme. Therefore, enhancing income generation opportunities within communities significantly improved their ability to afford and access water services and sustain the water scheme (Reddy, 2015). The practical implication of this result was that even small increments in income led to substantial improvements in water scheme sustainability. The findings suggest that income support programs or interventions aimed at increasing household incomes in the community had a positive cascading effect on the long-term viability of water schemes. Access to reliable water resources is crucial for various aspects of daily life, including health and sanitation, and improving income levels ensures the provision of essential services for the community. The implication to the level of society is that the higher income levels in the community led to increased contributions to water scheme sustainability. The findings indicate that households with more significant financial resources were more likely to support water services. Also, improved income levels enhanced the community's ability to pay for water services, ensuring consistent access to clean water resources for all members of society.

# 4.4.2 The Influence of Technical Factor on the Sustainability of Water Schemes

As shown in Table 4.4, the technical factor had a statistically significant impact on the sustainability of water schemes. In the context of regression analysis, statistical significance (denoted by p-value) assessed whether the relationship observed between the variables was likely due to chance or if it is a natural, meaningful relationship. In this case, the p-value (p < 0.000) was extremely low, indicating that the observed influence of the technical factor was doubtful to be a random occurrence. The coefficient (β) associated with the technical factor is 0.419. This value represents the strength and direction of the relationship between the technical factor and water scheme sustainability.  The β coefficient of 0.419 means that, for every one-unit increase in the technical factor, we expected the dependent variable (water scheme sustainability) to increase by 0.419 units. In other words: If the technical factor improved by one unit (e.g., better technology, infrastructure, or maintenance practices), the sustainability of the water scheme was predicted to increase by 0.419 units.

The finding revealed a positive and significant impact of technical factors on the sustainability of water schemes. The positive coefficient indicates that improvements in technical factors, such as technology, infrastructure, and maintenance practices, led to higher sustainability of the water scheme. This discovery aligns with Kumasi et al. (2019), who underscored the significance of the technical factor in the context of water schemes. The technical factor encompassed a wide range of critical components, such as infrastructure quality, maintenance practices, and water treatment processes. These elements collectively contributed to the overall effectiveness and reliability of water schemes.

Kumasi et al. (2019) emphasized that addressing technical challenges led to substantial improvements in sustainability and service delivery, thus affirming the importance of the technical factor in the successful operation of water schemes. Gorjian et al. (2021) observed that a combination of technical advancements and government-led initiatives played a pivotal role in accelerating the expansion and effectiveness of water supply schemes. Their findings resonated with the current study, reinforcing the significance of technical factors in the development and sustainability of such schemes.

Conversely, deteriorations in technical factors are associated with reduced sustainability. This result underscored the importance of maintaining and upgrading technical aspects of water schemes to ensure their long-term viability. Investments in technology and infrastructure, coupled with effective maintenance practices, significantly contributed to providing consistent and reliable water services to the community. The practical implication is that water scheme managers and authorities should prioritize technical improvements to enhance sustainability. Infrastructure development projects and technological advancements should be prioritized to enhance water scheme sustainability, benefiting society as a whole.

# 4.4.3 The Influence of the Institutional Factors of Community-Based Water Supply Organizations on the Sustainability of Water Scheme

Table 4.4 provides a comprehensive analysis of the impact of the institutional factors measured by the capacity and effectiveness of community-based water supply in the sustainability of the water scheme. Within this context, the study revealed a positive significant influence of the capacity and effectiveness of these organizations on the sustainability of the water scheme, as indicated by a noteworthy coefficient (β=0.419) and an exceptionally low p-value (p < 0.000). The coefficient (β) value of 0.419 is paramount as it illuminates this impact's strength and direction. In this context, a positive β value signified that as the capacity and effectiveness of community-based water supply organizations increased, there was a corresponding positive impact on the sustainability of the water scheme.

The statistical results of the study are highly significant, with an extremely low p-value (p < 0.000). This underscores the robustness of the observed relationship between the capacity and effectiveness of these organizations and the sustainability of the water scheme. It is important to note that this relationship is not a result of random chance, but a substantial and reliable finding within the dataset.

These findings highlight the pivotal role of community-based water supply organizations in the broader context of water resource management. Even modest improvements in their capacity and effectiveness can lead to significant enhancements in the sustainability of the water scheme. This underscores the critical importance of these organizations in ensuring access to reliable and sustainable water resources, and their potential to drive positive change in water management practices.

The findings resonate with the research conducted by Boakye and Akpor (2012), who emphasized the pivotal role of skill development and capacity building in bolstering water scheme management and sustainability. Their study accentuated that equipping individuals involved in water scheme operations with the requisite skills and knowledge is essential for effective decision-making, maintenance, and troubleshooting. Moreover, it emphasized that continuous capacity-building initiatives to empower water scheme managers and stakeholders to adapt to evolving challenges and changes in the water supply landscape, ultimately contributing to such schemes' long-term viability and success.

Henry (2008) contended that community-based natural resource management requires robust local engagement in addressing development challenges. Moreover, the study posited that community organizations could effect substantial transformations within rural societies and communities across the diverse landscape of sub-Saharan African nations. Henry's argument underscored the pivotal role of community as a catalyst for empowering local populations to actively shape their own development trajectories, thereby fostering more resilient and sustainable communities in the region.

Therefore, strengthening the capacity and effectiveness of these organizations should be a priority for policymakers and stakeholders aiming to improve water services in the community. This study highlights the importance of local engagement and leadership in maintaining and managing water schemes effectively. Table 4.5 summarizes the study's hypotheses, results and remarks.

Table 4.5: Hypotheses Testing

|  |  |  |
| --- | --- | --- |
| S/N | Hypothesis | Remarks |
| 1 | H1: Economic factors → Sustainability of water scheme | Supported  |
| 2 | H2: Institutional factors →Sustainability of water scheme | Supported |
| 3 | H6: Technical factor →Sustainability of water scheme | Supported |

# CHAPTER FIVE

# CONCLUSION AND RECOMMENDATIONS

# 5.1 Overview

The study determined the factors influencing the sustainability of a water supply scheme managed by a community-based water supply organization in the Tanganyika district. This chapter includes conclusions and suggestions. The chapter explicitly covers the study's summary, conclusion, implications, and future study direction.

# 5.2 Summary of Findings

The following are presented according to specific objectives are follows:

# 5.2.1 The Influence of Economic Factors in the Sustainability of Water Scheme

The findings from multiple regression analysis showed a significant and a positive influence of income levels on the sustainability of water schemes within the studied context. The coefficient (β) of 0.173 (p < 0.000) indicated a positive relationship, suggesting that as economic factors increase, so does the sustainability of the water scheme. This finding underscores the pivotal role of household or individual incomes in supporting the long-term viability of community-managed water initiatives. Notably, for every one-unit increase in monthly income, the sustainability of the water scheme increased by 0.173 units, highlighting the tangible impact even minor economic improvements can have on enhancing access to reliable water resources for the community. The findings from multiple regression analysis showed a significant and a positive influence of income levels on the sustainability of water schemes within the studied context. The coefficient (β) of 0.173 (p < 0.000) indicated a positive relationship, suggesting that as economic factors increase, so does the sustainability of the water scheme. This finding underscores the pivotal role of household or individual incomes in supporting the long-term viability of community-managed water initiatives. Notably, for every one-unit increase in monthly income, the sustainability of the water scheme increased by 0.173 units, highlighting the tangible impact even minor economic improvements can have on enhancing access to reliable water resources for the community.

# 5.2.2 The Influence of Technical Factor on the Sustainability of Water Schemes

The findings from multiple regression analysis showed a significant and a positive influence of income levels on the sustainability of water schemes within the studied context. The coefficient (β) of 0.173 (p < 0.000) indicated a positive relationship, suggesting that as economic factors increase, so does the sustainability of the water scheme. This finding underscores the pivotal role of household or individual incomes in supporting the long-term viability of community-managed water initiatives. Notably, for every one-unit increase in monthly income, the sustainability of the water scheme increased by 0.173 units, highlighting the tangible impact even minor economic improvements can have on enhancing access to reliable water resources for the community.

# 5.2.3 The Influence of Institutional Factor on the Sustainability of Water Schemes

The multiple regression analysis uncovered a significant and positive influence of the

capacity and effectiveness of community-based water supply organizations on the sustainability of water schemes, supported by a notable coefficient (β=0.419) and an exceptionally low p-value (p < 0.000). This coefficient value of 0.419 elucidates the strength and direction of this impact, underscoring the critical role played by organizational capacity and effectiveness in ensuring the long-term viability of water supply initiatives. A positive β value indicated that as these organizations' capacity and effectiveness increased, there was a corresponding positive effect on the sustainability of the water scheme. The institutional factors promote the organizational capabilities of community-based water supply organizations to promote sustainable water resource management, offering valuable insights for policymakers, practitioners, and stakeholders engaged in community development efforts.

# 5.3 Conclusion

The findings bring us to the following conclusion. In terms of income level, the study highlights that higher income levels within a community are associated with greater support for water scheme sustainability. The findings suggest that improving the economic well-being of households can positively impact their willingness and ability to contribute to the maintenance and enhancement of water services.

In terms of affordability of water bills, it is a crucial factor in sustaining water schemes. Communities with members who can comfortably pay for water services are more likely to maintain consistent access to clean water. Ensuring affordable water tariffs and billing structures is essential for the long-term viability of these schemes. It is worth knowing that technical factors are critical. Investments in technical aspects, including infrastructure, technology, and maintenance practices, significantly influence the water scheme's sustainability. Adequate resources should be allocated to improving these technical factors.

Moreover, community-based organizations play a vital role. Strong and effective community-based organizations contribute positively to water scheme sustainability. These organizations serve as key actors in managing and maintaining water schemes and efforts should be made to empower and build their capacity.

Also, community participation and ownership are crucial. Community active participation and a sense of ownership significantly and positively influence water scheme sustainability. Engaging communities in decision-making and management processes can improve water service delivery and overall community well-being. To conclude the study, achieving and maintaining sustainable community-managed water schemes requires a multifaceted approach. It involves addressing income disparities, ensuring affordability, investing in technical aspects, and promoting community participation and ownership. Overall, these findings guide policymakers, water service providers, and communities in making informed decisions to enhance the sustainability of water schemes, ultimately benefiting society by ensuring equitable access to clean and reliable water resources. The regression analysis indicated that the economic, institutional and technical factors positively and significantly influenced the sustainability of community water based organizations in Tanganyika district.

# 5.4 Recommendations

Based on the findings and conclusions of the study regarding the sustainability of community-managed water schemes, the following recommendations can be made to the government and community based water supply organizations.

# 5.4.1 Recommendation to the Government

The study recommends the following to the government.

**Investing in infrastructure and technology**

The governance should think about investing in infrastructure, technology, and resources. The resources should be allocated to improve the technical aspects of water schemes, including infrastructure, water treatment, and maintenance practices. Modernizing and upgrading water systems can enhance reliability and reduce water losses.

**Government to subsidize water services for low-income communities**

Governance should consider investing in infrastructure, technology, and resources. The resources should be allocated to improve the technical aspects of water schemes, including infrastructure, water treatment, and maintenance practices. Modernizing and upgrading water systems can enhance reliability and reduce water losses.

**Government Training to Community-Based Organizations**

The government should provide training, capacity-building, and financial support to community-based organizations responsible for managing water schemes. Community-based water organizations are responsible for promoting water services' sustainability in rural communities. Any time, the government should be ready to provide governance, financial management, and technical expertise. The government should provide training, capacity-building, and financial support to community-based organizations responsible for managing water schemes. Community-based water organizations are responsible for promoting water services' sustainability in rural communities. Any time, the government should be ready to provide governance, financial management, and technical expertise.

**Government to promote Community Participation and Ownership**

The government should encourage and facilitate community engagement and participatory decision-making processes in community-based water organizations. Empowering local communities to take ownership of their water resources leads to improved management and sustainability.

**Government should enhance governance and accountability**

The governance should strengthen the governance structures and continue overseeing the community-based water-based organization. Ensuring transparency, accountability, and oversight in the operations of community-based water supply organizations will promote the sustainability of community-based water supply organizations. The clear regulations and accountability mechanisms have the role of maintaining ethical practices and responsibilities.

**Government should invest in income-generating initiatives**

Through implementing income-generating programs and initiatives in low-income communities will improve household income levels. This contributes to greater

financial capacity for paying water tariffs and supports water scheme sustainability.

**Government should encourage cross-sector collaboration**

Through fostering collaboration among government agencies, non-governmental organizations, and community stakeholders should collectively address water sustainability challenges. Collaborative efforts leverage expertise and resources for more comprehensive solutions.

**Community sensitization**

The government should conduct public awareness campaigns to educate communities about the importance of water conservation, hygiene practices, and the value of investing in sustainable water services. Communities are encouraged to participate actively in water scheme management.

# 5.4.2 Recommendation to the Community Based Water Supply Organizations (CBWSOs)

Community-based water supply organizations should strengthen internal control on revenue collection to enhance the sustainability of the water supply scheme. The improved revenue will increase the water distribution and maintenance of the water facilities in Tanganyika district. The increased generated revenue will promote the sustainability of community-managed water schemes, ensuring equitable access to clean and reliable water resources for all citizens.

# 5.5 Contribution of the Study to the Governance Theory

The findings from objective one underscore the crucial role of income level and

affordability in the sustainability of the water supply project. This highlights the importance of good governance within the community, which led to a willingness to pay the water tariff. Additionally, the presence of good governance created a favorable environment for the improvement of community water-based organizations' income levels, thereby enhancing the sustainability of the water supply scheme.

The finding from objective two revealed that governance presented by the institutional factors contributed significantly to the sustainability of the water supply Project. The finding implies that the governance mechanism in CBWSOs was better at ensuring the project's sustainability. The findings meet the requirement of the governance theory, which emphasizes that good governance should be at a level that promotes the growth and sustainability of the services. On the other hand, the capacity and effectiveness of CBWSOs, as well as community participation and ownership, show a significant positive contribution to water supply sustainability due to good governance within the community to be saved by the water supply scheme.

The findings from objective three revealed that technical factors such as technical backstopping from RUWASA significantly impact water supply sustainability due to good governance within government institutions.  The technical influences on the sustainability of RUWASA contribute to good governance by promoting efficiency, accountability, participation, sustainability, and adaptability of the community water organizations. Technical factors are essential in determining the sustainability of community-based organizations by assessing the technical influence of infrastructure, water treatment processes, and the application of appropriate technology. Examining how technical factors influence community water-based organizations contributes to the principles of good governance theory by providing insights into the organization's effectiveness and long-term viability of the community-based water organizations. Furthermore, linking the technical factors and sustainability of the community water organizations with the governance theory provides a comprehensive framework for assessing the organization's overall effectiveness in delivering water and sanitation services to the community.

# 5.6 Suggestions for Future Researches

Future studies should conduct longitudinal studies that track the sustainability of water schemes over an extended period. The studies would provide insights into how changes in factors like income levels, governance structures, and community participation impact sustainability over time.

Future studies should also compare the sustainability of community-managed water supply schemes with those managed by other entities, such as water supply and sanitation authorities or private operators. The studies should investigate the differences in sustainability outcomes and their contributing factors.

Furthermore, future qualitative studies should complement quantitative findings to deeply explore the motivations, challenges, and experiences of community members, water scheme managers, and other stakeholders involved in water supply.

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# APPENDICES

# APPENDIX I:  QUESTIONNAIRE (ENGLISH VERSION)

I am a student at the Open University of Tanzania Faculty of Business Management Pursuing a Masters in Project Management (MPM). I have prepared this questionnaire to collect data concerning my research study titled: “Determinants of Sustainable Water Supply Managed by Community-Based Organizations in Tanzania a Case of Tanganyika District”. Your contribution to making the study successful will be highly valued. Be assured that your personal information will be handled confidentially and in top-most secrecy.

Do you agree to provide the information needed for the study? i. Yes ( ) ii. No ( )

If the response is No, please do not continue filling out the questionnaire.

Date of interview/data collection……………………………..

**A. Personal Particulars**

Sex i. Male ( ) ii Female ( )

Ward……………………………………………………….…………

Mtaa/Village………………………………………………….………

Education level i. Formal ( ) ii primary ( ) secondary ( ), College ( ), university ( )

Occupation i. Farming/ Livestock Faming ( ), ii. Business ( ) iii. Employment ( ) iv. Artisan ( ), v. Hand Craft ( )

vi. Others Please Specify………………………………………………………………….

**B. Income per Month.**

What is your estimated monthly household income per month………………?

1. Below 10,000
2. 10,001-50,000
3. 50,001-100,000
4. 100,001-300,000
5. Over 300,000

**C. Income generating activity**

What is your household’s major source of income? (Tick the appropriate) …...

1. Business (how much per month TZS………………)
2. Farming (how much per month TZS …...………)
3. Wage/employment TZS………………)
4. Livestock keeping (how much per month TZS ….………)
5. Handcraft/artisan (how much per month TZS ………………...)
6. Other (please specify) ……………………… TZS …………………

**D. Affordability of water services**

How much do you spend on water bill per month TZS………………?

**E. Community participation and ownership**

How far are you agreeing with the following community participation and ownership statements?

 Use 1: Strongly disagree; 2: disagree; 3: Neutral; 4: Agree; 5: strongly agree (Please Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statement** | Strongly disagree(1) | disagree(2) | Neutral (3) | agree(4) | Strongly agree (5) |
| 1 | I usually participate in community water activities |   |   |   |   |   |
| 2 | The government has made awareness of water projects to the community |   |   |   |   |   |
| 3 | I regularly participate in the initial stages of project establishment and planning |   |   |   |   |   |
| 4 | RUWASA have enough resources to facilitate participatory planning |   |   |   |   |   |
| 5 | RUWASA has no adequate strategies to create awareness on community water management |   |   |   |   |   |

**F. Governance structure**

How far are you agreeing with the following governance structure statements?

Use 1: Strongly disagree; 2: disagree; 3: Neutral; 4: Agree; 5: strongly agree (Please Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S/N | Statement | Strongly disagree(1) | disagree(2) | Neutral (3) | agree(4) | Strongly agree (5) |
| 1 | I understand the organizational structure and the roles of CBWSO in our village |   |   |   |   |   |
| 2 | The establishment of CBWSO in our village is based on the democratic principle |   |   |   |   |   |
| 3 | Leaders of CBWSO are appointed by the local authorities |   |   |   |   |   |
| 4 | CBWSO in our village discloses water-related financial information at regular intervals |   |   |   |   |   |
| 5 | Water-related rights and interests are protected effectively by the CBWSO |  |  |  |  |  |
| 6 | CBWSO in our village is a trustworthy organization |  |  |  |  |  |
| 7 | There are capacity building /training done to me and community/project leaders to enable them to sustain project interventions |  |  |  |  |  |
| 8 | The community has been empowered enough to carry on the project activities |  |  |  |  |  |
| 9 | Our accountants and technicians are trustfully to promote the sustainability of water schemes |  |  |  |  |  |

**H. Technical**

**How far are you agreeing with the following technical progress statements**

Use 1: Strongly disagree; 2: disagree; 3: Neutral; 4: Agree; 5: strongly agree (Please Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statement** | Strongly disagree(1) | disagree(2) | Neutral (3) | agree(4) | Strongly agree (5) |
| 1 | We use technical experts to increase efficiency |   |   |   |   |   |
| 2 | We have Tools and equipment that we have, help us maintain and repair water Scheme |   |   |   |   |   |
| 3 | Leakages are well attended |   |   |   |   |   |
| 4 | Illegal connections are well managed |  |  |  |  |  |
| 5 | Standard services on the water system are done |  |  |  |  |  |

6. What is your opinion technical progress in general …………………………………………………………………………………………

**I. Sustainability of Water Scheme.**

Please indicate the information about the revenue in each respective year below requested.

|  |  |  |  |
| --- | --- | --- | --- |
| Revenue (In Tshs per year) | 2021 | 2022 | 2023 up to July 2023 |
| Overall revenue from tariffs |  |  |  |
| Overall revenue from grants/government |  |  |  |
| Operating expenditure |  |  |  |
| Balance  |  |  |  |

**THANK YOU VERY MUCH FOR COOPERATION**

# APPENDIX II: QUESTIONNAIRE (SWAHILI VERSION)

***(DODOSO)***

*Mimi ni Mwanafunzi wa Chuo Kikuu Huria cha Tanzania katika kitivo cha Usimamizi wa Biashara nasomea Shahada ya uzamili katika Usimamizi wa Miradi. Dodoso hili ni kwaajili ya kukusanya takwimu kwaajili ya utafiti wangu unaohusu Uendelevu wa Miradi ya maji inayoendeshwa na vyombo vya watoa huduma ya maji ngazi ya jamii*

*Je Unakubali kutoa taarifa zinazohitajika katika utafiti huu ? i Ndio ( ) ii .Hapana ( )*

Kama Hapana , tafadhali usiendelee kujaza dodoso hili

*Tarehe ya Kukusanya Takwimu…………………………...*

**A. *Taarifa Binafsi***

*(Jinsia i Kiume ( ) ii Kike ( )*

*Kata…………………………………………………………………*

Mtaa ………………………………………………….………

*Kijiji……………………………………………………….*

*Kiwango cha Elimu i Sio Rasmi ( ), ii Msingi ( ), Sekondari ( ), Chuo ( ), Chuo Kikuu ( )*

 (*Kazi i Mkulima/ Mfugaji ( ) ii Mfanyabiashara ( ) iii Mwajiriwa ( ) iv Fundi ujenzi ( ) v. Ufundi wa Kuchonga ( ) vi Kazi nyingine ( )*

**B. *Kipato kwa Mwezi***

What is your estimated monthly household income per month………………?

*Kipato cha Kaya Kwa Mwezi ………………………………………………….…?*

1. Below 10,000

*(Chini ya 10,000)*

1. 10,001-50,000
2. 50,001-100,000
3. 100,001-300,000
4. Over 300,000

*(Zaidi ya 300,000)*

**C. *Shughuli ya kuzalisha mapato***

*Ni nini chanzo kikuu cha mapato ya familia yako? (Weka alama inayofaa)*

1. *Biashara (ni kiasi gani kwa mwezi TZS..................*
2. *Kilimo (ni kiasi gani kwa mwezi TZS ...............*
3. *Ajira ya mshahara TZS..........................*
4. *Ufugaji wa mifugo (ni kiasi gani kwa mwezi TZS ............*
5. *Kazi za mikono (ni kiasi gani kwa mwezi TZS .....................*
6. *(Nyingine (tafadhali taja) ..................................... TZS ...................*

**D. Uwezo wa Kulipa Bili za Maji**

*Unatumia kiasi gani cha fedha kwenye bili ya maji kwa mwezi TZS........................?*

**E. Ushiriki wa jamii na umiliki**

Je, unakubaliana na taarifa zifuatazo za ushiriki wa jamii na umiliki?

 Tumia 1: Kutokubaliana kwa nguvu; 2: kutokubaliana; 3: Neutral; 4: Kukubaliana; 5: kwa nguvu kukubaliana (Tafadhali Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statement*****(Taarifa)*** |  k*utokukubaliana kwa nguvu* | Kutokukubaliana | Sikubali wala Sikatai | Kukubaliana | kukubaliana kwa nguvu |
| 1 | *(Kwa kawaida mimi hushiriki katika shughuli za mambo ya maji ya jamii* |   |   |   |   |   |
| 2 | *Serikali yatoa elimu kuhusu miradi ya maji kwa jamii* |   |   |   |   |   |
| 3 | *Mimi mara kwa mara kushiriki katika hatua za awali za uanzishwaji na mipango ya mradi ya maji*  |   |   |   |   |   |
| 4 | *RUWASA wana rasilimali za kutosha kuwezesha mipango shirikishi ya Miradi ya Maji* |   |   |   |   |   |
| 5 | *RUWASA haina mikakati ya kutosha ya kujenga uelewa juu ya usimamizi wa maji kwa jamii* |   |   |   |   |   |

**F.** ***Muundo wa Utawala***

(Je, unakubaliana na taarifa za muundo wa utawala zifuatazo?

Tumia 1: Kutokubaliana kwa nguvu; 2: kutokubaliana; 3: Neutral; 4: Kukubaliana; 5: kwa nguvu kukubaliana (Tafadhali Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| S/N | ***(Taarifa)*** |  (*Kutokukubaliana kwa nguvu)* | Kutokukubaliana | Sikubali wala Sikatai | Kukubaliana | kukubaliana kwa nguvu |
| 1 | *Ninaelewa muundo na majukumu ya Chombo cha Watoa Huduma ya maji ngazi ya Jamii (CBWSO) katika kijiji chetu)* |   |   |   |   |   |
| 2 | *Kuanzishwa kwa CBWSO katika kijiji chetu kunatokana na kanuni ya kidemokrasia* |   |   |   |   |   |
| 3 | *Viongozi wa CBWSO wateuliwa na wananchi* |   |   |   |   |   |
| 4 | *CBWSO katika kijiji chetu inasoma taarifa za mapato na Matumizi kwa Kila Robo mwaka* |   |   |   |   |   |
| 6 | *Haki na maslahi yanayohusiana na maji yanalindwa kwa ufanisi na CBWSO* |  |  |  |  |  |
| 7 | Kuna *mafunzo yaliyofanywa kwangu na viongozi wa jamii ili kuendeleza Mrad wa Maji* |  |  |  |  |  |
| 8 | *Serikali imewezeshwa vya kutosha kutekeleza majukumu ya uendelevu wa Mradi* |  |  |  |  |  |
| 9 | *Wahasibu na mafundi wetu ni waaminifu kukuza uendelevu wa miradi ya maji* |  |  |  |  |  |

**H. *Kiufundi***

Je, unakubaliana na taarifa za muundo wa utawala zifuatazo?

Tumia 1: Kutokubaliana kwa nguvu; 2: kutokubaliana; 3: Neutral; 4: Kukubaliana; 5: kwa nguvu kukubaliana (Tafadhali Tick (V)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S/N** | **Statement*****(Taarifa)*** |  (*Kutokukubaliana kwa nguvu)* | Kutokukubaliana | Sikubali wala Sikatai | Kukubaliana | kukubaliana kwa nguvu |
| 1 | *Tunatumia wataalamu wa kiufundi kuongeza ufanisi* |   |   |   |   |   |
| 2 | *Tuna Zana na vifaa ambavyo vina tusaidia Matengenezo na Ukarabati wa Mradi wa Maji* |   |   |   |   |   |
| 3 |  Mivujo ya Maji inazibwa vizuri na kwa wakati |   |   |   |   |   |
| 4 | *Maunganisho Haramu ya Maji yanadhibitiwa vizuri* |  |  |  |  |  |
| 5 |  *Huduma za kawaida kwenye mfumo wa maji zinafanywa* |  |  |  |  |  |

**I. Sustainability of Water Scheme.**

Tuwekee taarifa zifuatazo

|  |  |  |  |
| --- | --- | --- | --- |
| Mapato kwa mwaka | 2021 | 2022 | 2023 up to July 2023 |
| Maapato kutokana na bili za mwezi kwa mwaka |  |  |  |
| Msaada toka serikalini kwa mwaka |  |  |  |
| Matumizi |  |  |  |
| kilichobakia |  |  |  |

**THANK YOU VERY MUCH FOR COOPERATION**

# APPENDIX III: CLEARANCE LETTERS

**THE OPEN UNIVERSITY CLEARANCE LETTER**



**RUWASA MPANDA CLEARANCE LETTER**

