INFLUENCE OF SOCIAL TECHNICAL SYSTEM ON THE PERFORMANCE OF WATER PROJECTS IN TANZANIA: A CASE OF SHINYANGA WATER SUPPLY AND SANITATION AUTHORITY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PROJECT MANAGEMENT

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Open University of Tanzania, a dissertation entitled: ***"Influence of Social Technical System on the Performance of Water Projects in Tanzania: A Case of Shinyanga Water Supply and Sanitation Authority"*** in partial fulfilment of Master of Project Management of the Open University of Tanzania.

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DECLARATION AND COPYRIGHT

I, Bundala Igambwa, declare that, the work presented in this dissertation is original. It has never been presented to any other University or Institution. Where other people's works have been used, references have been provided. It is in this regard that I declare this work as originally mine. It is hereby presented in partial fulfilment of the requirement for the Master of Project Management of the Open University of Tanzania.

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Signature

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Date

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DEDICATION

I dedicate my dissertation work to Almighty God for His love and for always protecting me. I also dedicate it to my loving and caring parents, my father Shaban Kapaya and my brother Juma Ali Kapaya, for their excellent guidance that has laid a strong foundation for my life. I am grateful to my beloved wife, Mrs. Ashura Joseph Tanganyika, and our lovely sons, Mwasiti, Amina, and Shabani, for their unwavering support and encouragement during my entire period of study. May Almighty God bless them all.

ABSTRACT

The main purpose of this study was to examine the influence of social technical systems on improving the water project in Shinyanga municipality, Tanzania. Specifically, the study aims to examine the influence of social systems on the performance of water projects, to examine the influence of technical systems on the performance of water projects, to examine the mediating effect of system fit on the relationship between social systems and the performance of water projects, and to examine the mediating effect of system fit on the relationship between technical systems and the performance of water projects in Shinyanga Municipality. The study used a causal research design and a quantitative research approach to gather information from respondents. The population for this study consisted of 78 SHUWASA, of which all of them were included in the study through the census method. Data collection was done using a closed-ended questionnaire consisting of a 5-point Likert scale. Demographic data were analyzed through descriptive statistics, whereas a multiple regression model was used to analyze 5-point Likert scale data that examines the influence of social technical systems on improving the water project in Shinyanga municipality. The study findings found that the social system and technical system have a significant impact on the performance of water projects in Shinyanga Municipality. Also, the study found a mediating effect of system fit on the relationship between the social system and technical system toward the performance of the water project in Shinyanga Municipality. The study concluded that enhancing the alignment between social and technical systems may improve the performance of the water project in Shinyanga Municipality.

Keywords: *Social System, Technical System, System Fit, Performance of water project*

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LIST OF ABBREVIATIONS

ANOVA	ANALYSIS OF VARIANCE
ICT	Information Computer Technology
FITT	Fit between Individuals, Task, and Technology
RUWASA	Rural Water Supply and Sanitation Agency
SHUWASA	Shinyanga Water Supply and Sanitation Authority
SPSS	Statistical Product and Service Solutions
URT	United Republic of Tanzania
VIF	Variance Inflation Factor

CHAPTER ONE

INTRODUCTION

1.1 Chapter overview

The first chapter of the study includes the background information, problem statement, objectives, and research questions. It also defines the scope, significance, and structure of the study.

1.2 Background to the Problem

In recent years, the issue of water scarcity has become a growing concern globally, affecting various regions and communities around the world (Tzanakakis *et al.*, 2020). This problem is particularly acute in developing countries, where access to clean and safe drinking water is limited, leading to a range of health and socio-economic challenges (Shemer et al., 2023).

In response to this issue, governments, non-governmental organizations, and other stakeholders have initiated water projects to improve access to clean water and sanitation for the population (Moreira *et al.*, 2024; Wise, 2023). However, despite the implementation of numerous water projects, there are still significant challenges in achieving sustainable and effective water management systems (Evaristo *et al.*, 2023; Olley *et al.*, 2024). Many of these projects fail to deliver the intended benefits due to various factors such as inadequate infrastructure, lack of resources, inefficient management, and poor community engagement (Tseole *et al.*, 2022). Consequently, there is a pressing need to explore innovative approaches to improve the performance of water projects and ensure the provision of clean and safe water to all (Wehn & Montalvo, 2018).

According to (Heinzel *et al*., 2023), one potential approach that could be utilized to address these water challenges is the social technical systems. This approach emphasizes the importance of considering both the technical aspects of a system (such as infrastructure and technology) and the social aspects (such as behaviours, values, and relationships) in order to achieve optimal performance and sustainability (Oesterreich *et al*., 2022). By integrating social technical systems approach into the design and implementation of water projects, it is possible to address the various challenges and complexities that arise in managing water resources (Suh & Mehmood, 2020).

The influence of social technical systems on water projects has been studied in various counties in the developed countries, but there is still limited research on its application in developing countries. For example, in the United States, a study conducted by Garcia (2021), in Flint, Michigan and Newark, New Jersey, found that a social technical system approach involving local government, community groups, and engineering experts was instrumental in addressing the water crisis and ensuring safe drinking water for residents. Meanwhile, in European countries, the integration of technology and social networks has significantly enhanced water management practices. For example, the Netherlands have implemented state-of-the-art water management systems that rely on real-time data and stakeholder engagement to mitigate flood risks and protect water sources (Molenveld & van Buuren, 2019). The successful management of water resources in these countries has been much attributed by the effective collaboration between technical experts, policymakers, and community.

In Southeast Asia, social technical systems have played a crucial role in ensuring sustainable water supply and sanitation (MacKinnon *et al*., 2007). The adoption of innovative technologies such as water recycling and desalination, coupled with community engagement and public awareness campaigns, have helped to address water scarcity issues and improve water quality (MacKinnon *et al*., 2007).

In African countries, few countries, such as Kenya, South Africa, and Nigeria, has been utilized social technical system to enhance the sustainability and resilience of water projects (Ekesa *et al*., 2021; Ojo, *et al*., 2020; Omojola *et al*., 2020). According to Folorunso and Onu (2021), there are several critical issues that need to be taken into consideration for African countries to successfully implement social technical systems. First, according to Kaur and Singh (2020), a lack of technical expertise should be addressed for successful implementation of social technical systems. Also, cultural and social factors can also play a significant role in the success of social technical systems. Yeboah *et al*. (2021), in their study conducted in Ghana stated that, it is important to understand the local customs, traditions, and social dynamics in order to successfully implement social technical systems in water projects. Additionally, according to Ouedraogo *et al*. (2021), the involvement of community members is crucial for designing and implementing technical systems for water projects. Griffin and Haile (2020), added that, by engaging the community in the process of implementing and monitoring the technology, they feel a sense of ownership and are more likely to utilize the technology effectively.

In Tanzania, like other African countries, the implementation of social technical system in is not clear. Given the fact that, the country has made significant strides in improving access to clean water for its citizens through implementing water projects in almost each part of the country (Marsili *et al.*, 2019), the sustainability and the performance of these projects has often been a concern, with issues such as water quality, water losses, and operational efficiency affecting their long-term sustainability specifically in the rural areas (Mijumbi, 2019; Shengena, 2019). In the rural areas, Rural Water Supply and Sanitation Agency (RUWASA) mandated by the government to supply clean water and provide sanitation services to the local communities in many regions in Tanzania including Shinyanga (URT, 2024). However, the agency faces challenges such as inadequate infrastructure, limited resources, and low community participation which ultimately led to the unsatisfactory clean water supply to the local community.

Despite the potential benefits of social technical system, there is limited research on their effectiveness in ensuring the performance of water supply projects in developing countries including Tanzania. In particular, there is a lack of research on the impact of these systems on water availability, quality, and infrastructure maintenance. Most of studies conducted in Tanzania on the performance of water project have focused on specific aspects of the social technical system, such as community engagement or technical design, without considering the broader implications for project outcomes. For example Kiteme and Wünscher (2020), Manase and Francis (2021), Wilcock (2016), and Yobe *et al*. (2018) in their study were focused on the community participation and good management practice while

Nyaki and Simba (2020), Mrema *et al*. (2020), Mushi (2021), and Mwaipopo and Mbilinyi (2020) were focused on the role of technology on the performance of water projects. Additionally, most previous studies on the influence of social technical systems on water project performance have mainly focused on developed countries, with limited research conducted in low and middle-income countries such as Tanzania. This gap in knowledge highlights the need for further research to explore the applicability of social technical systems approach in improving the performance of water projects in developing countries including Tanzania.

Therefore, this research study seeks to address this gap by investigating the influence of social technical systems on improving the performance of water projects in Tanzania, specifically focusing on the role of Shinyanga Water Supply and Sanitation Authority.

The study was guided by Social Technical Theory and Technology Fit theory. The Social Technical Theory is a holistic approach that combines social and technical factors to examine the relationship between them within an organization. It suggests that effective and efficient functioning of an organization depends on the interactions between people, technology, and the environment in which they operate. On the other hand, Technology Fit theory suggests that the success of implementing new technology in an organization is highly dependent on how well the technology aligns with the organization's existing systems, processes, goals, and culture. In other words, the technology must "fit" with the organization in a way that enhances efficiency, productivity, and overall effectiveness. According to this theory, organizations should carefully assess the compatibility of a new technology with their existing infrastructure and operations before implementing it. This includes considering factors such as the technical capabilities of the new technology, the skills and expertise of employees, and the potential impact on workflows and processes.

1.3 Problem Statement

Although the Rural Water Supply and Sanitation Agency (RUWASA) has made efforts to improve access to clean water in rural Tanzania, including the Shinyanga region, access to clean water remains insufficient in many areas. In Shinyanga municipality, inadequate monitoring of water infrastructure has led to the malfunctioning of some water points, resulting in water scarcity and limited access to safe drinking water for the local population (Magigi & Kazawadi, 2019). According to Kessy and Mbelwa (2019), the failure of various water provision projects for communities is blamed on a number of factors, among them a lack of technology use and community participation in the water projects.

In recent years, there has been a growing recognition of the importance of considering both social and technical factors in the implementation of development projects, including water projects. Social factors such as the involvement of community members is crucial in shaping technical systems for water projects, as it increases their investment in the project and ensures effective use of the technology (De Oliveira & Deshpande, 2020). Also, considering cultural beliefs and practices, the technology can be developed to align with the cultural values and preferences of the local community (Lee & Lee, 2021). Additionally, human capital expertise is important for implementing the technology (Haas & Hansen, 2020). Moreover, local government support is essential for successful implementation of technical systems.

Despite the potential benefits of implementing social technical systems to improve the management of water projects in various countries, there is a lack of research on their effectiveness in ensuring the success of water supply projects in developing nations like Tanzania. Specifically, there is a gap in literature concerning the impact of these systems on water availability, quality, and infrastructure maintenance. Previous research in Tanzania has mainly concentrated on specific elements of the social technical system, like community involvement or technical planning, rather than considering the interaction of both of them toward project performance. Furthermore, most research on the influence of social technical systems on water project performance has been concentrated in developed countries, leaving a dearth of information on its application in low and middle-income countries like Tanzania. This study aims to address this gap by examining the influence of social technical systems on improving the performance of water projects in Tanzania, with a specific emphasis on SHUWASA in the Shinyanga region.

1.4 Objectives of the Study

1.4.1 General Objective

The general objective of the study is to examine the influence of social technical systems on improving water project in Shinyanga municipality, Tanzania.

1.4.2 Research Objectives

i. To examine the influence of social system on the performance of water projects in Shinyanga Municipality.

ii. To examine the influence of technical system on the performance of water projects in Shinyanga Municipality.

iii. To examine the mediating effect of system fit on the relationship between social systems and performance of water projects in Shinyanga Municipality.

iv. To examine the mediating effect of systems fit on the relationship between technical system and performance of water projects in Shinyanga Municipality.

1.5 Research Questions

i. What is the influence of social systems on the performance of water projects in Shinyanga Municipality?

ii. What is the influence of technical systems on the performance of water projects in Shinyanga Municipality?

iii. What is the mediating effect of systems fit on the relationship between social system and performance of water projects in Shinyanga Municipality?

iv. What is the mediating effect of systems fit on the relationship between technical system and performance of water projects in Shinyanga Municipality?

1.6 Significance of the Study

The findings of this study are significant for multiple reasons. Firstly, the study is important for SHUWASA as it provides valuable insights into the factors that affect the performance of water projects in Tanzania. By identifying the influence of social technical systems on project performance, the organization can make informed decisions and implement more effective strategies to improve the delivery of water services to the citizens of Shinyanga. Secondly, the study is significant for the government of Tanzania as it highlights the importance of social technical systems in the successful implementation of water projects. This information can be used to inform policies and regulations aimed at promoting sustainable and efficient water management practices in the country. Additionally, the study is important for policymakers as it offers evidence-based recommendations for enhancing the performance of water projects. By understanding the impact of social technical systems on project outcomes, policymakers can develop targeted interventions to address any gaps or challenges that may be hindering success. Furthermore, the study adds to the existing literature on water project management by focusing on the specific context of Tanzania and the Shinyanga region. This contributes to a deeper understanding of the factors that influence project performance in different settings and can inform future research in this area. Lastly, the study provides a foundation for future research on the influence of social technical systems on water project performance. By identifying gaps in knowledge and areas for further investigation, the study sets the stage for continued exploration and development in this field.

1.7 Scope of the Study

The study took place in Shinyanga Municipality, with a focus on the Shinyanga Water Supply and Sanitation Authority. The authority is one of the authorities that is mandated to provide water and sanitation services to the residents of Shinyanga (URT, 2024). The study was focused on three specific objectives, such as the influence of the influence of social systems on the performance of water projects; the influence of technical systems on the performance of water projects; and to investigate how the interaction between social and technical systems impacts the effectiveness of water projects in Shinyanga Municipality.

1.8 Organization of the Study

In Chapter one, background information on the research problem, the problem statement, the general objective of the study, research objectives, research questions, the significance of the study, and the scope of the study are presented. Chapter two includes definitions of key terms, a theoretical and empirical literature review, discussions on knowledge gaps, and conceptual frameworks. Chapter three outlines the research methodology to be implemented, which includes the research philosophy, area of the study, target population, sample and sampling techniques, data collection methods, data analysis approaches, and ethical considerations. The fourth chapter of the study focused on presenting the results of the data analysis, including both descriptive and inferential statistics. Following this, the fifth chapter presents the summary of the findings, conclusion, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Chapter Overview

The chapter provides a review of different studies which contain information related to the study. The chapter provides definition of key concepts used in the study, the theoretical literature review under which theories related to the study were provided, empirical literature review, research gap and conceptual framework.

2.2 Definition of Key Terms

2.2.1 Social Systems

The social system is a perspective that views society as a complex system of interconnected parts that work together to maintain order and stability (Nelson & Levesque, 2018). Also, Luhmann (2018) defined social systems as networks of relationships between individuals and groups that function together to maintain social order and organization. With respect to the water project, this study used the definition of Burt (2018), who defined social systems as the interconnected network of individuals, organizations, and institutions that are involved in the planning, implementation, management, and governance of water-related initiatives.

2.2.2 Technical Systems

Technical systems refer to a combination of interconnected components, such as machinery, software, and processes, that are designed to perform specific tasks or functions (Auinger & Schneckenreither, 2020). According to Maier (2021), technical systems refer to complex arrangements of components such as industrial machinery, computer networks, or software programs that work together to achieve a specific goal or outcome. With respect to water projects, this study used the definition of Lee and Gertler (2021), who defined technical systems as the integration of advanced devices, sensors, and algorithms that are used to collect and analyze data in real-time, control water usage, quality, and distribution, and allow for better monitoring of water infrastructure for damage or leakage.

2.2.3 Systems Fit

System fit refers to the alignment or compatibility between a technology (system) and its intended environment or users (Serpytis & Arkhipova, 2020). According to Hassan and Savage (2020), system fit refers to the degree to which a system or technology meets the needs, requirements, and expectations of its users and integrates seamlessly into the existing processes and workflows. In the same vein, Venkatesh *et al*. (2003) stated that system fit refers to the degree to which an information system (or software application) aligns with the needs, goals, and processes of its users and organizations. In this study, system fit refers to the degree to which the components of a system—both social and technical—align and work together effectively to achieve the desired goals and outcomes. In the context of smart water projects which is the focus of this study, system fit involves ensuring that the social aspects (such as stakeholders, communities, regulations, budget, training, policies) and technical aspects (such as infrastructure, sensors, data analytics) are integrated and coordinated in a way that optimizes the performance and sustainability of the water system.

2.3 Theoretical Literature Review

The study was guided by the Social Technical Theory and Technology Fit Theory. The study opts to use these theories because of their complementary nature. In this study Technology Fit Theory is used to complementary Social Technical Theory. By considering both the technical and social aspects of a technology, as well as how well it aligns or fits with organizational goals and processes, organizations can increase the likelihood of successful adoption and integration of the technology.

2.3.1 Social Technical Theory

The Social Technical Theory is a management theory that emphasizes the importance of both social and technical aspects of work in organizational settings (Pasmore, 1988). The theory was originally developed by sociotechnical systems theorists Fred Emery and Eric Trist in the 1950s (Emery & Trist, 1960).

The theory was developed as a response to the increasing mechanization and automation of work processes in the post-World War II era. Emery and Trist believed that traditional management theories, which focused solely on technical efficiency and productivity, were overlooking the important social aspects of work (Emery & Trist, 1960). They argued that effective organizations should focus on both the technical aspects of work (such as technology and processes) and the social aspects (such as teamwork, communication, and job satisfaction) in order to achieve optimal performance (Clegg, 2000).

The Social Technical Theory emphasizes the interdependence of social and technical systems within organizations, and the importance of designing work systems that take both factors into account. By recognizing the influence of social dynamics on technical systems, and vice versa, organizations can create more efficient and effective work environments (Orlikowski & Barley, 2001).

According to Sow *et al*. (2018), social and technical systems play a crucial role in ensuring the success of water projects. Considering social systems, Ouedraogo *et al*. (2021) and Yeboah *et al*. (2021) stated that, community participation, culture, norms, and values play a significant role in influencing the performance of water projects. Manase and Francis (2021) claimed that, community participation is a critical factor in the success of water projects as it involves actively involving local communities in the planning, implementation, and monitoring of water projects. Kiteme and Wünscher (2020) added that, by involving community members in the decision-making process, project managers can ensure that the project meets the needs and priorities of the local population, leading to more sustainable and impactful outcomes. Additionally, community participation can help build social capital and foster a sense of ownership among community members, which can lead to increased project sustainability and success (De Oliveira & Deshpande, 2020).

According to Cho *et al*. (2019), understanding the cultural context in which a project is implemented is crucial for ensuring that the project aligns with the values and beliefs of the local population. Ho *et al*. (2019), added that, by taking cultural factors into account, project managers can design interventions that are culturally sensitive and respectful, ultimately leading to greater acceptance and buy-in from the community.

On the other hand, the technical system, which involves the use of technology such as smart water technology in water projects, can also enhance project performance by improving efficiency, reliability, and sustainability (Pan *et al*., 2020). According to Salami (2020), smart water technology uses sensors, data analytics, and automation to monitor and manage water systems more effectively, leading to better resource management, reduced operational costs, and improved service delivery. By integrating smart water technology into water projects, project managers can enhance data collection, monitoring, and decision-making processes, ultimately leading to more efficient and effective project outcomes (Juárez-Centeno *et al*., 2019).

Despite the significance of social technical theory in providing a valuable framework for understanding the complex interaction between people and technology within organizations, the theory has some criticisms. For example, one criticism is that social technical theory may be limited in its ability to adapt to rapidly changing organizational environments, such as the increasing pace of technological innovation, globalization, and shifting workforce demographics (Kämpf *et al*., 2018), which makes it difficult for organizations to effectively address new challenges and opportunities as they arise (Newman *et al*., 2017). Also, the theory lacks empirical evidence to support its claims and recommendations (Zhang & Liu, 2019), which thus leads to a lack of credibility and practical utility in real-world organizational settings, as practitioners may be skeptical of implementing strategies and interventions based on theoretical frameworks that have not been rigorously tested or validated through research (Smith & Johnson, 2021).

Meanwhile, social technical theory can be costly and may not be feasible for all organizations, especially those with limited resources (Ellis & Jones, 2019). As a result, there may be challenges in securing funding for the initial setup and ongoing maintenance of the monitoring systems (Valerie & Surinder, 2017). Another criticism is that social technical theory may result in a dehumanization of the work environment as the focus shifts more towards data and efficiency than the well-being and job satisfaction of employees (Kura & Baguna, 2019). Furthermore, the theory is too abstract and theoretical, lacking clear and actionable guidance for organizations looking to implement technology effectively. This can make it challenging for organizations to translate the theory into practice (Guzman & Kline, 2019).

Despite the presence of these criticisms, the theory has been supported by a number of scholars. For example Lenz (2019), examined the use of social technical theory in the design of digital water technologies. The results showed that using a social technical approach can lead to improved performance and sustainability of clean water supply systems. Also, in the study conducted by Wang *et al*. (2020), they employed the social technical theory to investigate the factors influencing the adoption of digital technologies for clean water supply. They found that successful implementation of digital technologies requires a deep understanding of the social and technical dimensions of the system. Factors such as stakeholder involvement, communication, and infrastructure were identified as critical in improving the performance of clean water supply systems. Similarly, Teixeira and Silva (2018), in their study, applied a social-technical perspective to examine how digital technology can enhance clean water supply performance in developing countries through a social technical lens. The study highlighted the potential of digital tools to streamline water distribution, identify leakages, and enhance communication between stakeholders. Furthermore, Alizadeh and Ritzel (2020) used a socio-technical framework to examine how digital technology can improve the performance of clean water supply systems. They found that incorporating digital tools such as sensors, data analytics, and real-time monitoring can lead to more efficient operations, reduced maintenance costs, and better overall water quality. With this backdrop, the theory is appropriate for this study to examine the impact of technology on the performance of water projects in Shinyanga Municipality.

2.3.2 Technology Fit Theory

Technology Fit Theory, also known as FITT (Fit between Individuals, Task, and Technology) was developed by Goodhue and Thompson in the 1990s (Goodhue & Thompson, 1995). It is a theoretical framework that aims to understand the fit between individuals, tasks, and technology in an organizational context (Farooq *et al*., 2020). The main premise of the theory is that successful technology implementation is contingent upon the alignment of these three elements (Tarafdar *et al*., 2019). The originality of Technology Fit Theory lies in its focus on the interaction between individual user characteristics, task requirements, and the technology being used (Durndell, 2020). Prior to the development of this theory, most research in information systems focused on either individual user characteristics or technological factors, without considering the specific tasks being performed. FITT theory introduced a holistic approach that takes into account all three elements and how they influence each other (Goodhue & Thompson, 1995).

The theory emphasizes the importance of understanding the specific context in which technology is being implemented, as well as the roles and responsibilities of individuals involved in the process. It suggests that technology should be chosen and implemented based on the specific requirements of the task at hand, as well as the abilities and preferences of the individuals who will be using it (Ahmed *et al*., 2021).

When it comes to water projects, the use of smart water technology is a prime example of how technology fit theory can be applied. Smart water technology involves the integration of sensors, monitoring systems, and data analytics to optimize the management and operation of water projects (Arar *et al*., 2021). This technology allows for real-time monitoring of water quality, leak detection, and efficient water distribution, among other benefits (Salami, 2020). However, to fully leverage the potential of smart water technology, it is essential to ensure that it aligns with the specific requirements and objectives of the water project (Karim et al., 2021).

By applying technology fit theory, project managers can evaluate how well smart water technology fits with the existing processes and systems in place. This includes considering factors such as compatibility with existing infrastructure, ease of integration, budget constraints, environmental factors, and training requirements

(Garg & Sharma, 2021). By ensuring that the technology aligns with the organization's goals and needs, the likelihood of successful implementation and performance is significantly increased.

Furthermore, technology fit theory also emphasizes the importance of stakeholder engagement and buy-in (Subramanian & Gopalakrishnan, 2020). In the context of water projects, involving key stakeholders such as government agencies, water authorities, and local communities in the decision-making process can help to identify and address any potential barriers to technology adoption (Capello & Rossi, 2021). In this context, the evaluation process would involve assessing how well smart water technology can address key performance indicators such as water quality, efficiency, reliability, and sustainability. By ensuring that the technology is a good fit for the project, stakeholders can maximize the benefits and outcomes of the investment in smart water technology.

Ultimately, the successful performance of water projects relies on the effective implementation of technology that is well-suited to the project's needs (Ozkul & Yilmaz, 2021). By applying technology fit theory to the selection and deployment of smart water technology, project managers can enhance the efficiency, effectiveness, and sustainability of water systems, leading to improved outcomes and long-term benefits for the environment and communities (Miller *et al.*, 2020).

However, while this theory can be useful in selecting appropriate technologies for water projects, there are several weaknesses that need to be considered when implementing this theory. One weakness of technology fit theory is the complexity and evolving nature of the technology itself (Miguel *et al*., 2020). For example, the use of smart water technology involves a wide range of sensors, networks, and data analytics tools that can be difficult to integrate into existing water infrastructure. This complexity can lead to challenges in determining the exact requirements of a project and finding a technology solution that fits those requirements (Lederer & Sethi, 2020). Another weakness of technology fit theory in the context of smart water technology is the potential for cost limitations (Hendricks *et al*., 2020). Implementing smart water technology can be expensive, requiring investments in hardware, software, and ongoing maintenance. In some cases, the cost of implementing a technology solution may not align with the budget constraints of a water project, leading to challenges in finding a suitable technology fit (Vicente *et al*., 2020). Additionally, the cost of training staff and building the necessary capacity to effectively use smart water technology can further strain project budgets and limit the feasibility of technology fit.

2.4 Empirical Literature Review

The empirical literature review is organized into sections corresponding to the specific objectives outlined in Chapter one.

2.4.1 The Influence of Social Systems on the Performance of Water Projects

Derib and Alemayehu (2024) in their study conducted in Ethiopia highlighted the importance of social systems in the success of water projects. The study found that community participation, local institutions, and social cohesion were key factors that determined the effectiveness and sustainability of water projects. Strong social networks were identified as critical for overcoming challenges and ensuring project outcomes. Also, Shunglu *et al*. (2022) in their study in Turkey, India, and Sri Lanka discovered that effective community participation and engagement were critical for the success of water projects in the region. The study also revealed that clear communication channels, stakeholder cooperation, and local ownership were essential factors influencing project outcomes. Additionally, Arieko and Kisimbii (2020) in their study in rural Kenya found that social factors such as community involvement, local leadership, and traditional practices were identified as key determinants of project performance. Furthermore, Tantoh *et al*. (2021) in their study in three rural districts of Northwest Cameroon showed that social systems have a significant influence on the performance of water projects. They further explained that, factors such as revealed that centralized control, passive involvement of public, private and grassroots community has continued to thwart water supplies within these districts.

2.4.2 The Influence of Technical Systems on the Performance of Water Projects

Olatunde *et al*. (2024) in their review has explored the multifaceted aspects of smart water management systems within Africa and the United States, highlighting their critical role in addressing contemporary water management challenges. Several key findings emerge from the discussion on the theoretical frameworks underpinning these systems to the detailed examination of the technologies, policy frameworks, and their impacts (Olatunde *et al*., 2024). Smart water management technologies, including IoT, AI, and remote sensing, offer transformative potential to enhance water conservation, improve access to clean water, and ensure sustainable water use

(Olatunde *et al*., 2024). These technologies enable real-time monitoring and management of water resources, leading to significant environmental, social, and economic benefits (Olatunde *et al*., 2024).

Also, Gupta *et al*. (2020) in their review found that smart technologies can lead to better water resource management, which can lead to the reduction of water scarcity worldwide. High implementation cost may act as a barrier to the implementation of SWT in developing countries. Additionally, Egbo *et al*. (2022) in their study in Nigeria discovered that the adaptation and application of sump/infiltration smart indigenous water harvesting technology is vital in solving the perennial water crisis in Enugu metropolis. Furthermore, a study conducted by Owen (2023) found that, smart water enables utilities, regulators, and customers to make more timely and informed decisions about how they use and regard their water resources. Owen (2023) further stated that, by utilizing smart water technology helps in reducing network leakage, lowering energy consumption, and avoiding deploying assets that are not actually needed.

2.4.3 The Mediating effect of system fit on the relationship between social-technical systems and performance of projects

Al-Faouri *et al*. (2024), employed quantitative research to investigate the intricate relationships between technology application, smart human resource management (SHRM), and innovation performance within the Jordanian telecom industry. The results illuminate significant positive associations between technology application, smart human resource management, and innovation performance, elucidating the pivotal roles of technology and SHRM strategies in fostering innovation and bolstering organizational success. Also, Gasco-Hernandez *et al.* (2022), in their article, assessed how local governments enhance their organizational capacity to implement digital transformation with a focus on smart city initiatives in three European cities. The findings revealed that organizational capacity matters in the development of smart cities and, therefore, in the achievement of digital transformation through smart decision-making, smart administration, and smart urban collaboration. Kithae (2023) reviewing the existing literature to investigate how organizational culture is driving employee's actions to embrace change through technological innovation, and how this interplay result to organizational competitiveness. The study used qualitative design to collect data, which was manually analysed using the researcher's insight and research skills to bring out the main themes. After analysis, the study found that technology is a key driver of innovation, and innovation is an enabler for organizations' to consistently achieve superior performance. Kithae (2023) further concluded that, technological innovation and culture interact to influence organizational behaviour which drives economic change, productivity and long-term growth.

2.5 Research Gap

While the literature review provides insights from various studies conducted in countries such as Ethiopia, Egypt, Kenya, Senegal, India, Italy, Nigeria, China, Portugal, Ghana, and Singapore, there is a lack of research specifically focusing on the Shinyanga region of Tanzania. The existing literature highlights the importance of social systems, technical systems, and the compatibility of the system in influencing the performance of water projects across various countries, but the importance of implementing these systems all together in Tanzania, particularly in Shinyanga, is not known. Therefore, it is essential to understand how these factors play out in the context of Shinyanga, Tanzania, and how they specifically impact the performance of water projects in this region. This study aims to fill this gap by exploring the influence of the social system, technical system, and system fit on the performance of water projects in Shinyanga municipality.

2.6 Conceptual Framework

In this study, the conceptual framework for examining the performance of water projects involves three main components: independent variables (social system and technical system), dependent variable (performance of water projects), and mediator variables (system fit). The social system includes factors such as community participation, stakeholder engagement, human capital expertise, budget size, and government policies, while the technical system includes technology used, such as smart water technology. The performance of water projects is influenced by how well these independent variables interact and fit together within a specific context. The mediator variable, system fit, plays a crucial role in determining the effectiveness of the social and technical systems on the overall performance of the water project. It evaluates the compatibility and alignment between the different components of the project, ensuring that they work together seamlessly to achieve the desired outcomes. Figure 2.1 below shows a conceptual framework that represents the relationships between variables.

Independent Variables Mediating Variable Dependent Variable

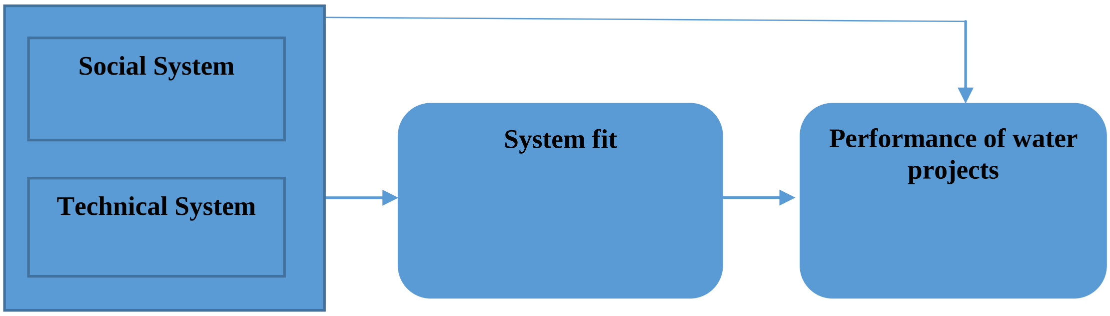


Figure 2. 1: Conceptual Framework
Source: Researcher (2024).

Figure 2.1 shows the various relationships that are tested in this study from the perspective of two independent variables (social system and technical system), one mediating variable (system fit), and one dependent variable (performance of water projects). With respect to the social system as an independent variable, the study first tests its direct impact on the performance of water projects. The second is also testing the impact of the social system on system fit. Third is testing the impact of system fit on the performance of water projects. Finally, the study tests the mediating impact of system fit on the relationship between the social system and the performance of water projects, or, on the other hand, it can simply state the indirect impact of the social system on the performance of water projects via the mediating variable (system fit).

Meanwhile, based on the technical system variable, the study first tests the direct impact of the technical system on the performance of water projects. The second is testing the direct impact of technical systems on system fit. Third is testing the direct impact of system fit on the performance of water projects. Finally, the study tests the mediating impact of system fit on the relationship between the technical system and the performance of water projects, or, on the other hand, it can simply state the indirect impact of the technical system on the performance of water projects via the mediating variable (system fit).

CHAPTER THREE

RESEARCH METHODOLOGY

2.1 Chapter Overview

This chapter detail the methodological perspective employed to address the research objectives, along with the foundational philosophies that underpin this approach. Furthermore, the chapter discuss the study's focus area, target population, sample size, sampling techniques, methods of data collection, instrument reliability, validity, and credibility, data analysis techniques, and ethical considerations.

2.2 Research Philosophy

Research philosophy refers to the sets of beliefs, principles, and assumptions that guide the research process (Baskerville & Myers, 2018). It helps researchers determine research approach, methodology, and the nature of the knowledge they seek to produce (Hair *et al*., 2018). Research philosophy informs the ways in which researchers interpret and make sense of data, as well as the broader implications of their research findings (Saunders & White, 2017). Some common research philosophies include positivism, interpretivism, critical realism, and pragmatism (Morgan, 2018). This study is guided by a positivism-based research philosophy. Regarding this study, positivism considers the use of a quantitative research approach to examine the influence of social and technical systems on the performance of water projects in Shinyanga Municipality. The positivism research philosophy is appropriate for this study because it allows the researcher to collect numerical data for measuring the causal relationship between social technical systems and the performance of water projects in Shinyanga municipality.

2.3 Research Design

Yin (2014) defines research design as the blueprint for collecting, measuring, and analysing data. Tashakkori and Teddlie (2010) classifies research design into three primary categories: descriptive, exploratory, and causal research. The present study employed a causal research design to assess the impact of social technical systems on the performance of a water project in Shinyanga municipality. According to Bryman (2016), causal research investigates cause-and-effect relationships between variables. This design was chosen for its ability to establish the relationship between social technical systems and the performance of the water project in Shinyanga municipality.

2.4 Area of the Study

The research took place in Shinyanga Municipality, Tanzania, specifically focusing on the operations of the Shinyanga Water Supply and Sanitation Authority (SHUWASA). SHUWASA was chosen as it is responsible for providing clean water supply the residents of Shinyanga (URT, 2024). However, the inadequate monitoring of water infrastructure has led to the malfunctioning of some water points, resulting in water scarcity and limited access to safe drinking water for the local population in the municipality.

2.5 Target Population

The target population refers to the specific group of individuals or subjects that a researcher or study aims to investigate or collect data from (Silverman, 2019). This group is defined based on certain characteristics, such as age, gender, location, or behavior, and is usually chosen to represent a larger population of interest (Neuman, 2019). In this study, the target population involved 78 individuals, including 8 management members (Technical Manager, Operation and Maintenance Manager, Head of ICT and Statistics Unit) and 70 staff (17 engineers, 38 water and sanitation technician, and 15 IT specialists).

2.6 Sample Size and the Sampling Technique

2.6.1 Sample Size

A sample is defined as the group of respondents or observations that are part of a study and serve as a representation of the larger population in which the study's conclusions are applicable (Alvi, 2016). In this study, a sample size of 78 respondents that covers all the available population were selected through the census method to participate in the study. The researcher decided to include all populations in the study because there was a need for a large enough sample size to run the regression model.

2.6.2 Sampling Technique

Sampling techniques refer to the methods used to select a sample from a population for research purposes (Srinivasan & Cheng, 2019). This study used the census method and sampling technique for selecting the study’s respondents. The researcher aims to use census sampling methods because of the small size of the study population. According to He and Liu (2020), census methods cover all the available population to participate in the study.

2.7 Variable and Measurement

This study examined the influence of social technical system on the performance of water projects in the Shinyanga Municipality. The independent variable in the study is social system, technical system, and interaction between social and technical systems, while the dependent variable is the performance of water projects in the Shinyanga Municipality. Variables are measured using questionnaires with four different scales: nominal, ordinal, interval, and ratio (Beatty & Willis, 2019). In this study, a nominal scale was used to label demographic characteristics such as age, gender, and education level of the study respondents. Meanwhile, an ordinal scale with a 5-point Likert scale was used to measure respondents' opinions on the influence of social technical systems on the performance of water projects in the Shinyanga Municipality, with options ranging from "strongly disagree" to "strongly agree."

2.8 Data Collection Instruments

2.8.1 A Likert Scale Questionnaire

In this study, a researcher administered a Likert scale questionnaire to survey chosen respondents about the influence of social technical systems on the performance of water projects in the Shinyanga Municipality. A Likert scale questionnaire is a type of survey instrument used to measure quantitatively respondents' attitudes, opinions, or perceptions on a particular topic (Cho *et al*., 2019). By using a questionnaire in this study, the researcher can efficiently collect data from a large number of respondents in a short period of time. The questionnaire for this study utilized a 5-point Likert scale, asking respondents to indicate their level of agreement, from strongly disagree to strongly agree, regarding the influence of social technical systems on the performance of water projects in the Shinyanga Municipality.

2.9 Validity and reliability of research instruments

Before starting field work for data collection, the instrument tested for validity and reliability. Validity, as defined by Miles *et al*. (2019), refers to how accurately an instrument measures what it is intended to measure. According to Garcia and Nguyen (2021), there are five types of validity, including content validity, construct validity, criterion validity, concurrent validity, and predictive validity. With a focus on content validity, Thomas and Reeve (2021) defined it as the type of validity that assesses whether the instrument covers all relevant aspects of the concept or construct being measured. In this study, to ensure validity, the questionnaires reviewed by supervisors and colleagues for critical feedback, and any suggestions provided by them were incorporated into the final research instrument.

On the other hand, reliability was assessed by administering the instrument to a sample of 7 respondents (10% of the target population) who were not part of the actual study. The respondents completed the questionnaire using a 5-point Likert scale to indicate their level of agreement. The data collected were then analyzed for reliability using Cronbach's alpha coefficient with the assistance of the SPSS computer program, and the result is presented in Table 3.1. Heale and Twycross (2015) consider an instrument to be reliable when the alpha coefficient is greater than 0.7 (alpha > 0.70).

Table 3. 1: Reliability Test

Variable	Cronbach's Alpha	No. of Items
Social System	0.874	5
Technical System	0.871	5
System Fit	0.712	5
Performance of Water Projects	0.909	5
Overall	0.943	20

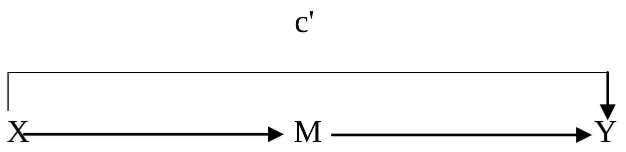
The results from Table 3.1 indicated that the social system, technical system, system fit, and performance of water projects variables had reliability values of 0.874, 0.871, 0.712, and 0.909, respectively. These values surpassed the suggested Cronbach Alpha coefficient of 0.70 (Heale & Twycross, 2015), signifying a high level of reliability for the instruments. As noted by Creswell and Poth (2017), a Cronbach Alpha coefficient of 0.7 or greater is typically deemed adequate for research studies.

2.10 Data Analysis Procedures

2.10.1 Quantitative analysis

Data collected from the field were coded for analysis through assigning numerical codes to the study variables. Then, data cleaning was done to ensure accuracy and consistency. This includes checking for missing values, outliers, and inconsistencies in the dataset. Also, data transformation was conducted to convert ordinal data of the study variable into continuous variables. Once the data had been coded and cleaned, descriptive statistics were used to describe the demographic information of the study respondents. Also, inferential statistics, including Pearson correlation and regression analysis, were used to identify relationships between variables.

This study utilized Pearson's correlation analysis to assess the strength of the relationships between variables as well as multiple regression analysis to measure the impact of independent variables on the dependent variable. The multiple regression coefficient was used to signify the degree to which the dependent variable changed with a one-unit change in the independent and mediating variables while holding all other variables constant (Yoichi, 2016). Baron and Kenny (1986) introduced a four-step approach to testing mediation, which involves conducting multiple regression analyses and examining the significance of coefficients at each step. The authors used the following diagram to outline the procedure.



(note that c' could also be called a direct effect).

Table 3. 2: Baron and Kenny (1986) Direct and Mediating Effects Step Approach

	Analysis	Visual Depiction
Step 1	Conduct a simple regression analysis with X predicting Y to test for path c alone, $Y = \beta_0 + \beta_1 X + \varepsilon$	c X → Y
Step 2	Conduct a simple regression analysis with X predicting M to test for path a, $M = \beta_0 + \beta_1 X + \varepsilon$	a X → M
Step 3	Conduct a simple regression analysis with M predicting Y to test the significance of path b alone, $Y = \beta_0 + \beta_1 M + \varepsilon$	b M → Y
Step 4	Conduct a multiple regression analysis with X and M predicting Y, $Y = \beta_0 + \beta_1 X + \beta_2 M + \varepsilon$	c' X M → Y b

The primary goal of Steps 1-3 is to confirm the presence of direct relationships among the variables. If the results show that these relationships are not statistically significant, researchers typically conclude that mediation is unlikely or not feasible although this is not always true (MacKinnon *et al.*, 2007). Assuming that significant relationships are revealed in Steps 1-3, researchers can then proceed to Step 4. In this stage, evidence of mediation is indicated if the impact of M (path b) remains significant after controlling X. If X loses significance after controlling for M, this suggests full mediation. On the other hand, if both X and M continue to significantly predict Y, then partial mediation is supported.

However, following the utilization of two independent variables (social system and technical system) and one mediating variable (system fit) in this study, the following models were developed from Baron and Kenny (1986) with a guidance of the figures below.

2.10.2 Figure and Statistical Models for Variables Social System (Independent Variable), System Fit (Mediating Variable), and Performance of Water Projects (Dependent Variable)

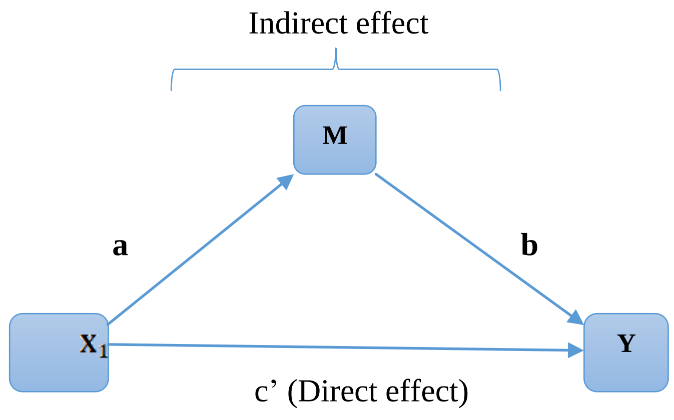


Figure 3. 1: Figure Representing the direct effect of X_1 on Y (via path c') or indirect effect of X_1 on Y via M (path ab)

Where:

Y = Dependent Variable (The performance of water projects)

X_1 = Independent Variable (Social System)

M = Mediator (System Fit)

$\beta_0 =$ Constant term

a = Path from X_1 to M

b = Path from M to Y

c’ = Path from X_1 to Y

Model 1 (Direct effect of X_1 on Y via path c’)

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon$$

Model 2

$$M = \beta_0 + \beta_1 X_1 + \varepsilon$$

Model 3

$$Y = \beta_0 + \beta_1 M + \varepsilon$$

Model 4 (Indirect effect of X_1 on Y via M path ab)

$$Y = \beta_0 + \beta_1 M + \beta_2 X_1 + \varepsilon$$

2.10.3 Figure and Statistical Models for Variables Technical System (Independent Variable), System Fit (Mediating Variable), and Performance of Water Projects (Dependent Variable)

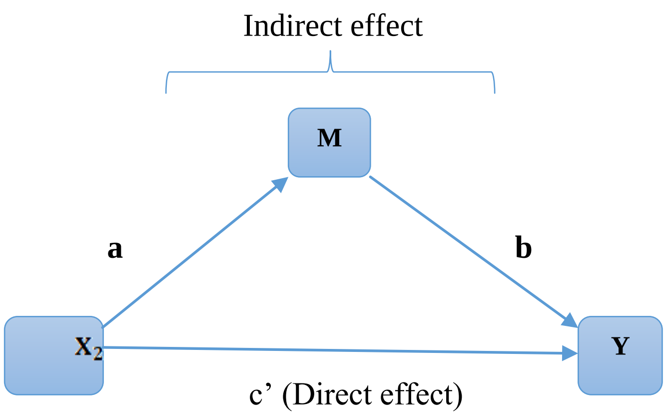


Figure 3. 2: Figure Representing the direct effect of X_2 on Y (via path c') or indirect effect of X_2 on Y via M (path ab)

Where:

Y = Dependent Variable (The performance of water projects)

X_2 = Independent Variable (Technical System)

M = Mediator (System Fit)

$\beta_0 =$ Constant term

a = Path from X_2 to M

b = Path from M to Y

c' = Path from X_2 to

Model 1 (Direct effect of X_2 on Y via path c')

$$Y = \beta_0 + \beta_1 X_2 + \varepsilon$$

Model 2

$$M = \beta_0 + \beta_1 X_2 + \varepsilon$$

Model 3

$$Y = \beta_0 + \beta_1 M + \varepsilon$$

Model 4 (Indirect effect of X_2 on Y via M path ab)

$$Y = \beta_0 + \beta_1 M + \beta_2 X_2 + \varepsilon$$

In the same vein, in order to determine if the model was fitting the data accurately, a model diagnostic was performed to assess if the linear regression assumption was being met. Consequently, a researcher assessed the fundamental assumptions of linear regression, including the distribution's normality, multicollinearity, heteroscedasticity, and linearity, prior to executing the regression model.

2.11 Ethical Considerations

Yip and Han (2016) described ethics as the guidelines that researchers had to follow during a study. To ensure ethical practices, the researcher sought approval from both the Open University of Tanzania and SHUWASA before starting the study. Verbal consent was obtained from respondents before gathering data. Respondents did not have to provide their names on surveys to protect confidentiality and maintain impartiality. The information collected was only used for academic purposes. The researcher treated all respondents with honesty and respect, regardless of any differences they may have had.

CHAPTER FOUR

RESEARCH FINDINGS

4.1 Chapter Overview

The chapter presents the results of data analysis and interpretation, which are divided into descriptive and inferential statistics. Descriptive statistics examined the demographic details of the respondents, whereas inferential statistics examined correlation and regression analyses. The chapter also present response rate of questionnaire.

4.2 Response Rate

Questionnaires were handed out to 78 SHUWASA employees with a timeline of 10 days to complete them. Of the 78 employees who received the questionnaires, 70 were returned, resulting in an impressive response rate of 89.74 percent. According to Mugenda and Mugenda (2003), a response rate of 50 percent is sufficient, 60 percent is good, and 70 percent is very good. The response rate in this study exceeds these benchmarks, indicating that it is excellent for drawing reliable conclusions.

4.3 Descriptive Statistics

4.3.1 Demographic Characteristics of the Respondents

The section aimed to analyze the demographic details of respondents in terms of their gender, age, and educational background. This information is crucial in ensuring that the sample group accurately represents the target population. By capturing demographic information, the researcher was able to verify that data collected was from relevant sources.

4.3.1.1 Gender Distributions of the Respondents

The gender distribution of respondents was analyzed in the study to assess gender balance both within the study and SHUWASA. Gender play a vital role in the performance of water projects. The findings of the study are as shown in Table 4.1.

Table 4. 1: Gender of Respondents (n=70)

Gender	Frequency	Percentage
Male	37	52.9
Female	33	47.1
Total	**70**	**100.0**

Source: Field Data (2024)

The research revealed a slight discrepancy in the number of male and female respondents, with 52.9% being male and 47.1% being female. This demonstrates almost equal representation of both genders, highlighting that both men and women had the same opportunities to participate in the study. Creswell (2017) stresses the significance of maintaining a gender balance in research to incorporate a variety of perspectives, experiences, and insights into the creation of new knowledge and scientific progress. By ensuring an even representation of both genders in the study, researchers can conduct a more comprehensive analysis that addresses issues affecting both men and women equally.

4.3.1.2 Age Group of the Respondents

The study explored the age group of the surveyed respondents, as it plays a crucial role in determining individuals' experiences and responses to various situations. The results are presented in Table 4.2 below.

Table 4. 2: Age of the Respondents

Age	Frequency	Percentage
Below 25 years	1	1.4
26-35 years	22	31.4
36-45 years	36	51.5
Above 45 years	11	15.7
Total	70	100.0

Source: Field Data (2024)

Table 4.2 shows that the survey respondents span across a broad range of ages, beginning from 25 years and older. The majority of respondents, 51.5%, are in the 26-45 age group. Additionally, 31.4% fall within the 46-55 age range. A smaller percentage, 1.4%, are below 25 years old. Finally, 15.7% of the respondents are over the age of 45. Incorporating respondents of varying ages into the research is crucial in influencing their cognitive skills, life experiences, and viewpoints, all of which can influence their reactions to research questions. The results of the study suggest that individuals' age can greatly affect their understanding and responses to research questions.

4.3.1.3 Educational Background of the Respondents

In order to ensure the study's accuracy, it was deemed crucial to have an understanding of the education level of the respondents. It is believed that a certain level of education is necessary to comprehend the questions related to the topic. Hence, respondents were requested to share details about their educational background, as displayed in Table 4.3.

Table 4. 3: Respondents' Level of education (n=70)

Level of Education	Frequency	Percentage
Postgraduate	08	11.4
Bachelor Degree	40	57.1
Tertiary	22	31.4
Total	70	100.0

Source: Field Data (2024)

The research findings indicate that the majority of respondents, 57.1%, have a bachelor's degree, while 31.4% have a tertiary education and only 11.4% have a postgraduate degree. These results suggest a high level of education among SHUWASA employees, highlighting their strong educational background. This indicates that respondents likely have a good understanding of the topic being studied, increasing the likelihood of obtaining reliable data.

4.4 Inferential Statistics

The researcher performed correlation and multiple linear regression analyses to investigate how social technical systems impact the improvement of water projects in Shinyanga municipality, Tanzania.

4.4.1 Pearson Correlation Analysis

Correlation, as a statistical tool, measures the strength and direction of the association between two variables. Aggarwal and Ranganathan (2016) emphasize that correlation analysis should be used to examine relationships between variables, not to suggest causation. They explain that correlation does not indicate causation, as it merely highlights the presence and direction of a relationship. In this study, Pearson correlation was used to assess the extent and direction of the linear relationships between independent variables (social system and technical system) and dependent variable (performance of water projects) as well as their statistical significance. It is also used to assess the extent and direction of the linear relationships between independent variables (social system and technical system) and mediating variable (system fit). Finally, Pearson correlation was used to assess the degree of relationship that independent variables and mediating variable have with the dependent variable. The results of the correlation analysis are presented in Table 4.4, Table 4.5, and Table 4.6.

Table 4.4: Pearson Correlations between Independent Variables and Dependent Variable

	Social System	Technical System	Performance of Water Projects
Social System	1		
Technical System	.454** (.000)	1	
Performance of Water Projects	.890**(.000)	.938**(.000)	1

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Field Data (2024)

The Pearson correlation analysis presented in Table 4.4 reveals that the social system and technical system exhibit a strong positive correlation with the performance of water projects in Shinyanga Municipality, with correlation coefficients of 0.890 and 0.938 respectively. These results suggest that the social system and technical system serve as reliable predictors for the performance of water projects in Shinyanga Municipality.

Table 4. 5: Pearson Correlations between Independent Variables and Mediating Variable

	Social System	Technical System	System Fit
Social System	1		
Technical System	.454** (.000)	1	
System Fit	.544**(.000)	.558**(.000)	1

**. Correlation is significant at the 0.01 level (2-tailed).

The results displayed in Table 4.5 indicate that there is a notable positive correlation between the social system and technical system with the system fit, evidenced by correlation coefficients of 0.544 and 0.558, respectively. Moreover, the independent variables (social system and technical system) have p-values below 0.05, suggesting a significant association with the system fit. This suggests that the social system and technical system have a significant impact on the system fit, highlighting the importance of considering these factors in assessing and improving system performance.

Table 4. 6: Correlation between Independent Variables and Mediating Variable with the Dependent Variable

	Social System	Technical System	System Fit	Performance of Water Projects
Social System	1			
Technical System	.454** (.000)	1		
System Fit	.544**(.000)	.558**(.000)	1	
Performance of Water Projects	.890**(.000)	.938**(.000)	.577**(.000)	1

**. Correlation is significant at the 0.01 level (2-tailed).
Source: Field Data (2024)

The results shown in Table 4.6 indicate that the social system, technical system, and system fit are strongly positively correlated with the performance of water projects in Shinyanga Municipality, with correlation coefficients of 0.890, 0.938, and 0.577, respectively. Additionally, the independent variables (social system and technical system) and mediator variable (system fit) have p-values below 0.05, signifying a significant relationship with the dependent variable (performance of water projects). These findings suggest that the social system, technical system, and system fit are reliable predictors of water project performance in Shinyanga Municipality.

4.4.2 Multiple Linear Regression Analysis

After establishing a relationship through correlational analysis, a multiple linear regression model was developed to ascertain causality and predict an outcome variable. Prior to conducting the regression analysis, diagnostics were performed to examine the assumptions of linear regression, as detailed in the following sections.

4.4.2.1 Normality Test

In statistics, normality refers to the distribution of data points in a dataset. A dataset is considered to be normally distributed if the data points are symmetrically distributed around the mean, with the majority of data points falling close to the mean and fewer data points further away from the mean (Silvestri & Tutino, 2019). In this study, skewness and kurtosis were used to test the normality of the data. Skewness is a measure of the symmetry of a distribution. A normal distribution is perfectly symmetrical, with a skewness value of zero. Kurtosis is a measure of the shape of the distribution. A normal distribution has a kurtosis value of three, which is known as mesokurtic (Ghosh & Vogt, 2020). According to Ghosh and Vogt (2020), data is considered to be normally distributed when the skewness and kurtosis values approximate zero. The findings of this study show that both skewness and kurtosis tests are approaching zero, indicating that all variables adhere to a normal distribution.

Table 4. 7: Normality Test Result (n=70)

Independent variables	N	Skewness		Kurtosis	
		Statistic	Std. Error	Statistic	Std. Error
Social System	70	-0.814	0.287	0.697	0.566
Technical System	70	-0.961	0.287	0.293	0.566
System Fit	70	-0.425	0.287	-0.130	0.566
Performance of Water Projects	70	-0.139	0.287	0.292	0.566

Source: Field Data (2024)

4.4.2.2 Test of Assumptions of Multi-collinearity

Multicollinearity of data refers to a situation in which two or more independent variables in a regression model are highly correlated with each other, which makes it difficult to separate their effects on the dependent variable (Sengupta & Roy, 2019). In this study, Variance Inflation Factor (VIF) and tolerance were conducted to test for multi-collinearity in the study. Variance Inflation Factor (VIF) is a measure of how much the variance of the estimated coefficients in a regression model is increased due to multicollinearity (Chatterjee & Hadi, 2019). Tolerance, on the other hand, is the reciprocal of the VIF According to Rabinovitch (2019), if any of the VIF values are above 10 or the tolerance values are below 0.1, multicollinearity may be present, and further investigation is needed. Table 4.8 presents the Tolerance and VIF values for the independent variables.

Table 4. 8: Tolerance Value and the Variance Inflation Factor (VIF)

Independent variables	Collinearity Statistics	
	Tolerance	VIF
Constant		
Social System	.269	3.723
Technical System	.231	4.338
System Fit	.685	1.460

Dependent Variable: Performance of Water Projects

Based on the findings in Table 4.8, it can be concluded that no multicollinearity is present among the independent variables. This is evident from the Tolerance values exceeding 0.1 and the VIF values being below 10. Therefore, the study does not exhibit any signs of multicollinearity issues.

4.4.2.3 Heteroscedasticity

Heteroscedasticity of data refers to a situation in which the variability of a variable is not constant across all levels of another variable. In other words, the spread of the data points around the regression line is not consistent (Taufik, 2019). In this study Breusch-Pagan test was used to test the presence of heteroscedasticity in a dataset. The Breusch-Pagan test is a statistical test used to determine whether the variance of errors in a regression model is constant (homoscedasticity) or varies (heteroscedasticity) across observations (Bera *et al.*, 2019). According to Lo and MacKinlay (2019), the null hypothesis of the Breusch-Pagan test is that there is homoscedasticity in the data, meaning that the errors have constant variance. A rejection of the null hypothesis suggests the presence of heteroscedasticity in the data (Lo & MacKinlay, 2019). If the test statistic is greater than the critical value, it suggests that there is heteroscedasticity in the data, meaning that the variance of errors is not constant (Taufik, 2019). In this case, researchers may need to address the issue by transforming the data or using different modeling techniques that account for heteroscedasticity. Table 4.9 present the findings of Breusch-Pagan test.

Table 4. 9: Breusch-Pagan Test for Heteroscedasticity

H_0: Homoscedasticity
H_1: Heteroscedasticity

Model	P-Value
Residual	0.88

Dependent Variable: res_squared
Predictors: (Constant), Social System, Technical System, System Fit

The null hypothesis of constant variance or homoscedasticity was not rejected, as the errors in Table 4.9 had a p-value above 0.05. This indicates that the variance of the errors is stable across observations, confirming that heteroscedasticity is not found in the regression model.

Once the basic prerequisites for linear regression analysis were met, the model was estimated in order to assess the influence of independent variables on the dependent variable.

4.4.2.4 Multiple Linear Regression Model Estimation

The study utilized a linear regression model to examine the mediating roles of the System Fit variable in the effect of the social system and technical system variables on the performance of water projects in Shinyanga Municipality. Detailed findings from the model summary, ANOVA, and regression coefficients are presented in the subsequent sections.

4.4.2.4.1 The Mediating Roles of the System Fit in the effect of the Social System on the Performance of Water Projects in Shinyanga Municipality

Based on the mediation steps listed in Chapter 3, the first relationship to be investigated involves running a linear regression analysis of the performance of the water project against the social system as explained below.

4.4.2.4.1.1 The Influence of Social System on the Performance of Water Projects in Shinyanga Municipality

Table 4. 10: Model Summary of Performance of the Water Project Against the Social System

Mode	R	R Square	Adjusted R Square
1	0.890	0.793	0.790

Predictors: (Constant), Social System

Based on the findings in Table 4.10, it is evident that there is a significant correlation between the independent variable and dependent variable with a strong correlation coefficient (R) of 0.890. The coefficient of determination (R Square) also reinforces this relationship, with a value of 0.793 suggesting that 79.3% of the variations in Water Project Performance can be accounted for by changes in the Social System. The remaining 21.7. % of variability is linked to factors that were not included in the study.

Table 4. 11: ANOVA Statistics for Performance of the Water Project Against the Social System

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	28.271	1	28.271	259.798	.000
Residual	7.400	68	.109		
Total	35.671	69			

Dependent Variable: Water Project Performance
Predictors: (Constant), Social System

ANOVA presented in Table 4.11 examines the null hypothesis stating that there is no linear relationship between the independent variable (social system) and the performance of water projects in Shinyanga Municipality. The alternative hypothesis suggests that there is indeed a linear relationship between these variables. The findings indicate that the F statistic yielded a p-value of 0.000, which is below the significance level of 0.05. Therefore, we reject the null hypothesis and conclude that a significant linear relationship exists between the independent variables and the dependent variable.

Table 4. 12: Regression Coefficients for Performance of the Water Project Against the Social System

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	.546	.234		2.332	.023
Social System	.900	.056	.890	16.118	.000

Dependent Variable: Performance Water Project

The results of the linear regression analysis in Table 4.12 demonstrate that there is a significant relationship between the performance of the water project and the social system. Specifically, a marginal increase in the social system may lead to a 0.900 increase in the performance of the water project in Shinyanga Municipality. Furthermore, social system had p-values of 0.005, indicating significance at the 5 percent level. The t-statistics for the social system was 16.118, exceeding the critical value of 1.96 at the 5 percent significance level. Therefore, it can be concluded that social system has a significant influence on the performance of water projects in Shinyanga Municipality. This suggests that there is an effect that can be mediated (Hsu, Wang, & Hsu, 2012).

4.4.2.4.1.2 The Effect of Social System Variable on System Fit Variable

In accordance with the mediation steps of Baron and Kenny (1986), the second regression involves testing the relationship between the independent variable (social system) and the mediating variable (system fit).

Table 4. 13: Model Summary for the Effect of Social System on System Fit

Mode	R	R Square	Adjusted R Square
1	0.444	0.197	0.186

Predictors: (Constant), Social System

The results presented in Table 4.13 show a moderate correlation between the social system and system fit, with a correlation coefficient (R) of 0.444. The coefficient of determination (R Square) further confirms this relationship, indicating that 19.7% of the system fit can be explained by changes in the Social System.

Table 4. 14: ANOVA Statistics for the Effect of Social System on System Fit

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	6.655	1	6.655	16.733	0.000
Residual	27.047	68	.398		
Total	33.703	69			

Dependent Variable: System Fit
Predictors: (Constant), Social System

The ANOVA Table presented in Table 4.14 tests the null hypothesis that there is no linear relationship between the social system and the system fit, while the alternative hypothesis suggests that a linear relationship does indeed exist. The results reveal that the F statistic produced a p-value of 0.000, which is lower than the predetermined significance level of 0.05. Consequently, we reject the null hypothesis and confirm the presence of a significant linear relationship between the independent variables and the mediating variable.

Table 4. 15: Regression Coefficients for the Effect of Social System on System Fit

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	2.023	.448		4.515	.000
Social System	.437	.107	.444	4.091	.000

Dependent Variable: System Fit

Table 4.15 illustrates that the compatibility of the system (system fit) increased by 0.437 as a result of an improvement in the alignment of the social system, while keeping all other factors constant. The t-statistic linked to this connection indicates that the increase is statistically significant. The research discovered absolute t statistics of 4.091 for the social system, with corresponding p-value being lower than 0.05. According to Baron and Kenny (1986) mediation tests, the second null hypothesis in this study suggested that there is no significant correlation between the independent variable (social system) and the mediating variable (System Fit). Since the absolute values of the t-statistics 4.091 exceeded 1.96 (the critical value of the t-statistic at a 5 percent significance level), the null hypothesis was rejected. Similarly, the p-value of .000 were below the significance level of 0.05, further confirming a significant relationship between the independent variable and the mediating variable. Therefore, it is concluded that there is a significant relationship between the social system and the system fit. This indicates that there is a mediating effect of the social system on system Fit (Hsu, Wang, & Hsu, 2012; Iacobucci, 2012; Baron & Kenny, 1986).

4.4.2.4.1.3 The Influence of System Fit on the Performance of Water Projects in Shinyanga Municipality

In accordance with the mediation steps of Baron and Kenny (1986), the third regression involves testing the relationship between the mediator (system fit) and the dependent variable (Performance of Water Projects). The findings are presented in Table 4.16, Table 4.17, and Table 4.18.

Table 4. 16: Model Summary for Performance of Water Projects against System Fit

Mode	R	R Square	Adjusted R Square
1	.577	.333	.324

Predictors: (Constant), System Fit

The findings in Table 4.16 reveals a moderate correlation between the mediating variable (System Fit) and the dependent variable (performance of water projects in Shinyanga Municipality), as evidenced by a correlation coefficient (R) of 0.577. The coefficient of determination (R Square) solidifies this correlation, showing that 33.3% of the performance of water projects in Shinyanga Municipality can be attributed to variations in the system fit.

Table 4. 17: ANOVA Statistics for Performance of Water Projects against System Fit

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	11.896	1	11.896	34.023	0.000
Residual	23.775	68	.350		
Total	35.671	69			

Dependent Variable: Performance of Water Projects
Predictors: (Constant), System Fit

The results presented in Table 4.17 indicate that the analysis of variance was conducted to test the null hypothesis suggesting no significant linear relationship between the mediating variable (System Fit) and the dependent variable (performance of water projects in Shinyanga Municipality) at a 5% significance level. The observed p-value of 0.000 was found to be less than 0.05, leading to the rejection of the null hypothesis. Therefore, this signifies the existence of a significant linear relationship between System Fit and the performance of water projects in Shinyanga Municipality.

Table 4. 18: Regression Coefficients for Performance of Water Projects against System Fit

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	1.994	.396		5.032	.000
System Fit	.594	.102	.577	5.833	.000

Dependent Variable: Performance of Water Project

Table 4.18 illustrates that the performance of water projects in Shinyanga Municipality increased by 0.594 as a result of a slight improvement in system compatibility (System Fit). The study revealed a t-statistic of 5.833 with a corresponding p-value of 0.000. The observed t-statistic exceeded the critical value of 1.96 at a significance level of 5 percent, and the p-value was less than 0.05, indicating a significant relationship. Therefore, the third null hypothesis, stating that there was no significant correlation between System Fit and the performance of water projects in Shinyanga Municipality, was rejected. This further confirms the presence of significant mediation of System Fit on the relationship between social system and the performances of water projects in Shinyanga Municipality.

4.4.2.4.1.4 The Performance of Water Projects in Shinyanga Municipality against System Fit and the Social System

The fourth mediation condition tested the relationship between Social System and the performance of water projects in Shinyanga Municipality, after controlling for the effect of System Fit. Hsu, Wang, & Hsu (2012) suggest that if the impact of the independent variable (social system) on the dependent variable (performance of water projects) weakens once the System Fit variable is controlled, then a mediation effect may be present. The findings for this analysis are presented in Table 4.19, Table 4.20, and Table 4.21.

Table 4. 19: Model Summary for the Influence of Social System and System Fit on the Performance of Water Projects

Mode	R	R Square	Adjusted R Square
1	.913	.834	.829

Predictors: (Constant), System Fit, Social System

Table 4.19, shows that social system and system fit have a significant linear relationship with the performance of water projects in Shinyanga Municipality. The Pearson's correlation coefficient is recorded at 91.3 percent, with a coefficient of determination (R Square) of 83.4 percent. This indicates that 83.4 percent of the variability in the performance of water projects in Shinyanga Municipality can be attributed to the variations in Social System, after controlling for the impact of System Fit.

Table 4. 20: ANOVA Statistics for the Influence of Social System and System Fit on the Performance of Water Projects

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	29.741	2	14.871	168.026	0.000
Residual	5.930	67	.089		
Total	35.671	69			

Dependent Variable: Performance of Water Projects
Predictors: (Constant), System Fit, Social System

Table 4.20 shows the analysis of variance that was conducted to test the null hypothesis, suggesting no significant linear relationship that the social system and system fit have on the performance of water projects in Shinyanga Municipality at a 5% significance level. The observed p-value of 0.000 was found to be less than 0.05, leading to the rejection of the null hypothesis. Therefore, there is evidence of a significant linear relationship between these factors and the performance of water projects.

Table 4. 21: Regression Coefficients for the Influence of Social System and System Fit on the Performance of Water Projects

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	.075	.241		.310	.757
Social System	.798	.056	.790	14.200	.000
System Fit	.233	.057	.227	4.076	.033

Dependent Variable: Performance of Water Project

Table 4.21 illustrates a significant increase in the performance of water projects in Shinyanga Municipality, with a 0.798 increase attributed to a marginal increase in the social system while controlling for the impact of system fit and keeping all other factors constant. Similarly, a marginal increase in system fit resulted in a 0.233 increase in water project performance after controlling for the effect of the social system and holding other factors constant. The study revealed that the social system exhibited a t-statistic of 14.200, surpassing the critical value of 1.96 at a 5 percent alpha level. Additionally, the p-value for the social system was 0.000, indicating significance below the 5 percent level. This suggests a significant relationship between the social system and water project performance in Shinyanga Municipality after controlling for the effect of system fit. Furthermore, the findings showed a diminishing effect of the social system after controlling for system fit. Initially, the social system had a 0.900 effect on water project performance, which decreased to 0.798 after the mediation effect of system fit. This mediation effect implies that the system fit plays a vital role in influencing the relationship between the social system and water project performance in Shinyanga Municipality.

4.4.2.4.2 The Mediating Roles of the System Fit in the effect of the Technical System on the Performance of Water Projects in Shinyanga Municipality

According to the mediation steps outlined in Chapter 3, the initial relationship to be explored entails conducting a linear regression analysis to examine the relationship between the performance of the water project and the technical system, as detailed below.

4.4.2.4.2.1 The Influence of Technical System on the Performance of Water Projects in Shinyanga Municipality

Table 4. 22: Model Summary of Performance of the Water Project Against the Technical System

Mode	R	R Square	Adjusted R Square
1	0.938	0.880	0.878

Predictors: (Constant), Technical System

The results from Table 4.22 show a strong correlation (R=0.938) between the technical system and the performance of water projects in Shinyanga Municipality. The coefficient of determination (R Square=0.880) further supports this relationship, indicating that 88.0% of the variations in Water Project Performance can be attributed to changes in the technical system. The remaining 12.0% of variability is likely influenced by factors outside of the scope of this study.

Table 4. 23: ANOVA Statistics for Performance of the Water Project Against the Technical System

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	31.386	1	31.386	498.066	.000
Residual	4.285	68	.063		
Total	35.671	69			

Dependent Variable: Water Project Performance
Predictors: (Constant), Technical System

Table 4.23 presents an ANOVA analysis examining the null hypothesis that there is no linear relationship between the independent variable (technical system) and the performance of water projects in Shinyanga Municipality. The alternative hypothesis proposes a linear relationship between these variables. The results show that the F statistic generated a p-value of 0.000, indicating statistical significance below the threshold of 0.05. Thus, we reject the null hypothesis and infer that a significant linear relationship exists between the technical system and the performance of water projects in Shinyanga Municipality.

Table 4.24: Regression Coefficients for Performance of the Water Project Against the Technical System

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	.189	.185		1.021	.311
Social System	.979	.044	.938	22.317	.000

Dependent Variable: Performance Water Project

The findings presented in Table 4.24 indicate a strong relationship between the performance of the water project and the technical system. Specifically, a 1% increase in the technical system is associated with a 0.979 increase in the performance of the water project in Shinyanga Municipality. The p-value for the technical system was 0.000, highlighting its significance at the 5 percent level. With a t-statistic of 22.317, surpassing the critical value of 1.96 at the 5 percent significance level, it can be inferred that the technical system significantly impacts the performance of water projects in Shinyanga Municipality. This suggests that there is a relationship that can be intervened upon (Hsu, Wang, & Hsu, 2012).

4.4.2.4.2.2 The Effect of Technical System on System Fit

Following Baron and Kenny's (1986) mediation steps, the second regression for this study is conducted to examine the relationship between the independent variable (technical system) and the mediating variable (system fit).

Table 4. 25: Model Summary for the Effect of Technical System on System Fit

Mode	R	R Square	Adjusted R Square
1	0.558	0.311	0.301

Predictors: (Constant), Technical System

The results displayed in Table 4.25 reveal a moderate correlation between the technical system and system fit, as evidenced by a correlation coefficient (R) of 0.558. Additionally, the coefficient of determination (R Square) supports this finding by suggesting that 31.1% of the variability in system fit can be attributed to variations in the technical system.

Table 4. 26: ANOVA Statistics for the Effect of Technical System on System Fit

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	10.492	1	10.492	30.739	0.000
Residual	23.211	68	.341		
Total	33.703	69			

Dependent Variable: System Fit
Predictors: (Constant), Technical System

The results shown in Table 4.26 support the alternative hypothesis positing a linear relationship between the technical system and system fit, as opposed to the null hypothesis which suggests no such relationship. With an F statistic yielding a p-value of 0.000, indicating statistical significance below the predetermined threshold of 0.05, the null hypothesis is rejected. These findings confirm the presence of a significant linear relationship between the technical system and system fit.

Table 4. 27: Regression Coefficients for the Effect of Technical System on System Fit

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	1.470	.431		3.409	.001
Technical System	.566	.102	.558	5.544	.000

Dependent Variable: System Fit

Table 4.27 demonstrates that a 1% increase in the technical system results in a 0.566 increase in system compatibility (system fit), while holding all other factors constant. The t-statistic associated with this relationship indicates that the increase is statistically significant. The study revealed that the absolute t statistic for the technical system was 5.544, with a corresponding p-value below 0.05. In accordance with Baron and Kenny's (1986) mediation tests, the second null hypothesis posited that there is no significant correlation between the independent variable (technical system) and the mediating variable (system fit). Given that the absolute t statistic of 5.544 exceeded 1.96 (the critical value at a 5% significance level), the null hypothesis was rejected. Moreover, the p-value of .000 was lower than the significance level of 0.05, further supporting a significant relationship between the technical system and the system fit.

On the other hand, the third regression analysis, which assesses the correlation between the mediator (system fit) and the dependent variable (Performance of Water Projects), was omitted in this section as it had already been conducted in the previous section and documented in Tables 4.16, 4.17, and 4.18.

4.4.2.4.2.3 The Performance of Water Projects in Shinyanga Municipality against System Fit and the Technical System

The fourth mediation condition examined the correlation between technical systems and the performance of water projects in Shinyanga Municipality while controlling for the influence of System Fit. According to Hsu, Wang, & Hsu (2012), should the relationship between the technical system (independent variable) and the performance of water projects (dependent variable) diminish after controlling for system fit, it suggests the presence of a mediation effect. The results of this analysis are presented in Tables 4.28, 4.29, and 4.30.

Table 4. 28: Model Summary for the Influence of Technical System and System Fit on the Performance of Water Projects

Mode	R	R Square	Adjusted R Square
1	.940	.884	.881

Predictors: (Constant), Technical System, System Fit

Table 4.28 shows that there is a significant positive correlation between Technical System, System Fit, and the performance of water projects in Shinyanga Municipality. This suggests that 88.4% of the variability in the performance of water projects in Shinyanga Municipality is influenced by variations in Technical System, while controlling for the effects of System Fit.

Table 4. 29: ANOVA Statistics for the Influence of Technical System and System Fit on the Performance of Water Projects

Model	Sum of Squares	df	Mean Square	F	P-Value
Regression	31.537	2	15.769	255.601	0.000
Residual	4.133	67	.062		
Total	35.671	69			

Dependent Variable: Performance of Water Projects
Predictors: (Constant), System Fit, Technical System

The results from Table 4.29 revealed that technical system and system fit have a significant linear relationship with the performance of water projects in Shinyanga Municipality. The analysis of variance conducted at a 5% significance level revealed an observed p-value of 0.000, which is less than 0.05. This led to the rejection of the null hypothesis, providing evidence for the significant impact of these factors on the performance of water projects.

Table 4. 30: Regression Coefficients for the Influence of Technical System and System Fit on the Performance of Water Projects

Model	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	Std. Error	Beta		
(Constant)	.070	.198		.354	.724
Technical System	.933	.052	.894	17.843	.000
System Fit	.081	.052	.079	1.568	.122

Dependent Variable: Performance of Water Project

Table 4.30 demonstrates a notable improvement in the performance of water projects in Shinyanga Municipality. For every 1% increase in the technical system, there was a corresponding 0.933 increase in project performance after controlling for the effect of the system fit and holding other factors constant. Similarly, a 1% increase in system fit led to a 0.081 increase in project performance after controlling for the technical system and other factors. The study revealed that the technical system had a t-statistic of 17.843, exceeding the critical value of 1.96 at a 5% alpha level. Additionally, the p-value for the technical system was 0.000, indicating significance below the 5% level. This suggests a significant correlation between the technical system and project performance in Shinyanga Municipality, even after controlling the impact of system fit. Furthermore, the research showed a diminishing effect of the technical system on the performance of water project when controlling for system fit. Initially, the technical system had a 0.979 effect on water project performance, which decreased to 0.933 after controlling for the effect of the system fit. This mediation effect highlights the importance of system fit in shaping the relationship between the technical system and project performance in Shinyanga Municipality.

Table 4. 31: Summary: Mediation Results for Roles of the System Fit in the effect of the Social System on the Performance of Water Projects in Shinyanga Municipality

	Analysis	P value	Comment
Step 1	The influence of social system on the performance of water projects in Shinyanga Municipality	0.000<0.05	Significant
Step 2	The effect of social system variable on system fit variable	0.000<0.05	Significant
Step 3	The influence of system fit on the performance of water projects in Shinyanga Municipality	0.000<0.05	Significant
Step 4	The performance of water projects in Shinyanga Municipality against system fit and the social system	0.000<0.05	Significant

4.4.2.4.3 Conclusion for the Mediating Roles of the System Fit in the effect of the Social System on the Performance of Water Projects in Shinyanga Municipality

After testing all the four conditions of the mediation test as stipulated in Baron and Kenny (1986) model, it has been concluded that system fit mediate the relationship between Social System and the Performance of Water Projects in Shinyanga Municipality. None of the step was violated in the mediation steps.

Table 4. 32: Summary: Mediation Results for Roles of the System Fit in the effect of the Technical System on the Performance of Water Projects in Shinyanga Municipality

	Analysis	P value	Comment
Step 1	The influence of technical system on the performance of water projects in Shinyanga Municipality	0.000<0.05	Significant
Step 2	The effect of technical system variable on system fit variable	0.000<0.05	Significant
Step 3	The influence of system fit on the performance of water projects in Shinyanga Municipality	0.000<0.05	Significant
Step 4	The performance of water projects in Shinyanga Municipality against system fit and the technical system	0.000<0.05	Significant

4.4.2.4.4 Conclusion for the Mediating Roles of the System Fit in the effect of the Technical System on the Performance of Water Projects in Shinyanga Municipality

Upon conducting tests on all four conditions outlined in the Baron and Kenny (1986) model, it has been determined that system fit serves as a mediator in the connection between technical system and the performance of water projects in Shinyanga Municipality. Furthermore, none of the steps in the mediation process were found to be violated.

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Chapter Overview

The chapter discussed the findings derived from the data analysis, with a focus on the specific objectives established. The discussion was based on the findings obtained from data analysis and then evaluated how they align or differ from earlier studies.

5.1.1 The Influence of Social System on the Performance of Water Projects in Shinyanga Municipality

The study identified that changes in the social system accounted for 79.3% of the variations in water project performance, highlighting the significant influence of social factors on the performance of water projects in Shinyanga Municipality. Further regression analysis showed that a marginal increase in the social system led to a significant improvement in the performance of water projects. These results highlight the importance of effective social systems in ensuring the success of water projects, indicating that factors such as community participation, stakeholder engagement, considering the cultural factors, adherence to local norms, communication, and valuing the perspectives and input of stakeholders play a crucial role in water project outcomes in Shinyanga Municipality. This finding aligns with the study conducted by Wanjue (2023) in Kenya, which found that involving community members in development projects creates trust and community ownership, leading to project sustainability. Also, the study is supported by Atenaka (2019), who recommends that local government should involve community members in the designing of water supply projects, as well as monitoring and evaluation of the water supply project in Tumbi ward in Kibaha Town District Council. Meanwhile, the study concurs with Mutu (2023) findings, which found that collaborating stakeholders' initiatives in planning, identification, monitoring, and evaluation, planning, and implementation significantly contributed to water projects in Kirinyaga County, Kenya.

5.1.2 The Influence of Technical System on the Performance of Water Projects in Shinyanga Municipality

Similarly, the study revealed a strong relationship between the technical system and the performance of water projects in Shinyanga Municipality. Changes in the technical system explained 88.0% of the variations in project performance, underscoring the critical role of technical factors in project success. The regression results showed that improvements in the technical system were positively associated with enhanced project performance. These findings underscore the significance of robust technical systems, such as smart water technology in achieving successful outcomes in water projects in Shinyanga Municipality. This finding is in line with Gupta *et al*. (2020), who found that the utilization of smart technologies can lead to better water resource management, which can lead to the reduction of water scarcity worldwide. Also, same result obtained by Owen (2023) who found smart water has seen an evolution toward monitoring wastewater applications. Furthermore the study conducted by Hernaningsih *et al*. (2023) shared similar result that smart water management support system is indispensable in water system management, leak detection, and water quality monitoring. As such, a smart water grid is used to develop control over water resources, infrastructure, and water discharge with high efficiency and sustainability.

5.1.3 The Mediating Effect of System Fit on the Relationship between Social-Technical Systems and the Performance of Water Projects in Shinyanga Municipality

The results also revealed a mediating effect of system fit on the relationship between the social system and technical system toward the performance of water project in Shinyanga Municiplaity. This suggests that the alignment and compatibility of social and technical systems play a crucial role in influencing project outcomes. System fit acts as a mechanism through which social and technical factors interact and influence project performance. The findings indicate that a well-aligned and compatible system fit can enhance the effectiveness of social and technical interventions, leading to improved project outcomes. This underscores the importance of considering the fit between social and technical systems in order to enhance water project outcomes in Shinyanga Municipality. This involves ensuring that smart water technology aligns with the culture, level of expertise, budget size, and policies of SHUWASA. Additionally, it is crucial for the technology to be user-friendly, enabling community involvement in monitoring water projects. This finding aligns with Bediako *et al.* (2018), who found that compatibility or ease of use of technological innovations is one of the influencing factors for an individual or organization to adopt the technology. The finding is also in line with Brawley-Chesworth (2022) study which found that organizations with a stable knowledge system based in one professional orientation may be more likely to implement some innovations, ones that are compatible with their knowledge system.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Chapter Overview

This chapter provides a summary of the study, outlines key conclusions drawn from the findings, and offers recommendations for future research to explore how social and technical factors can be optimized to enhance the performance of water projects.

6.2 Summary

The main objective of the study was to examine the influence of social technical systems on improving the water project in Shinyanga municipality. The main objective was supported by three specific objectives, including to examine the influence of the social system on the performance of water projects, to examine the influence of the technical system on the performance of water projects, to examine the mediating effect of systems fit on the relationship between the social system and the performance of water projects, and to examine the mediating effect of systems fit on the relationship between the technical system and the performance of water projects in Shinyanga Municipality. In order to meet the objective of the study, a causal research design was adopted. The accessible population to the study was 78, and all of them were included in the study using census methods. A Likert scale questionnaire was used to collect data from the respondents. Data analysis involved descriptive and inferential statistics. Descriptive statistics were used to analyze the respondent's demographic information, while inferential statistics like Pearson correlation and simple linear regression were employed to determine the impact of the social system on the performance of water projects, the impact of the technical system on the performance of water projects, the mediating effect of the technical system on the relationship between the social system and the performance of water projects, as well as the mediating effect of system fit on the relationship between the technical system and the performance of water projects. The study findings from correlation analysis revealed that the social system and technical system exhibit a significant strong positive correlation with the performance of water projects in Shinyanga Municipality, with correlation coefficients of 0.890 and 0.938, respectively. Meanwhile, the study found a notable positive correlation between the social system and system fit, as well as the technical system with the system fit, as evidenced by correlation coefficients of 0.544 and 0.558, respectively.

On the other hand, based on multiple linear regression analysis, the findings revealed that the social system has a significant influence on the performance of water projects in Shinyanga Municipality (β = 0.900, P-value = 0.000). This implies that the social system had a 0.900 (90.0%) influence on the performance of water projects in Shinyanga Municipality. Also, the result found that the system fit plays a vital role in influencing the relationship between the social system and water project performance in Shinyanga Municipality, with a 1% increase in the social system resulting in a 0.798 (79.8%) increase in water project performance after controlling for the effect of the system fit and holding other factors constant.

Additionally, the study found a significant strong relationship between the technical system and the performance of the water project, with a 1% increase in the technical system associated with a 0.979 (97.9%) increase in the performance of the water project in Shinyanga Municipality. In the same vein, the study found that system fit may play a great role in shaping the relationship between the technical system and project performance in Shinyanga Municipality.

6.3 Implications of the Findings

6.3.1 Implications for Practice and Policy

The findings of the study have significant implications for practice and policy in the planning and implementation of water projects in Shinyanga Municipality. By recognizing the mediating roles of system fit in the relationships between social and technical factors towards project performance, policymakers and practitioners can design more effective interventions and strategies to enhance project outcomes.

6.3.2 Implications for Policymakers

The study underscores the importance of considering social, technical, and system fit factors in project planning and decision-making. By investing in social infrastructure, technical resources, and ensuring alignment between systems, policymakers can promote the success of water projects and improve access to clean water for communities in Shinyanga Municipality.

6.3.3 For Practitioners

The findings highlight the need to adopt a holistic and integrated approach to project management, incorporating social, technical, and system fit considerations into project design and implementation. By addressing these factors systematically, practitioners can optimize project performance, reduce risks, and maximize the impact of water projects on communities in Shinyanga Municipality.

6.4 Conclusion

The study draws conclusions based on the study objectives on the aspects of social technical systems on improving the water project in Shinyanga municipality, Tanzania.

6.4.1 The Influence of Social System on the Performance of Water Projects in Shinyanga Municipality

Based on the findings of the study, it can be concluded that the social system has a significant impact on the performance of water projects in Shinyanga Municipality. Effective social systems, characterized by factors such as community participation, stakeholder engagement, cultural considerations, adherence to local norms, communication, and valuing stakeholder perspectives, are essential for the success of water projects. The study highlights the importance of incorporating social factors into project planning and implementation to improve outcomes and ensure the sustainability of water projects in the region.

6.4.2 The Influence of Technical System on the Performance of Water Projects in Shinyanga Municipality

Based on the findings of this study, it is evident that the technical system plays a crucial role in the success of water projects in Shinyanga Municipality. Investing in and improving technical systems, such as smart water technology, can significantly enhance project performance and ultimately lead to more successful outcomes.

6.4.3 The Mediating Effect of System Fit on the Relationship between Social-Technical Systems on the Performance of Water Projects in Shinyanga Municipality

Based on the findings of this research study, it can be concluded that system fit plays a crucial mediating role in the relationship between social technical systems and the performance of water projects in Shinyanga Municipality. The alignment and compatibility of social and technical systems are essential in influencing project outcomes, as system fit acts as a mechanism through which social and technical factors interact and impact project performance. A well-aligned and compatible system fit can enhance the effectiveness of social and technical interventions, leading to improved project performance. To enhance water project outcomes, it is essential to ensure that smart water technology aligns with the culture, expertise, budget size, and policies of SHUWASA, and that the technology is user-friendly to enable community involvement.

6.5 Recommendations

6.5.1 The Influence of Social System on the Performance of Water Projects in Shinyanga Municipality

The study recommends that SHUWASA in Shinyanga Municipality prioritize the establishment of strong social systems to enhance project performance. This includes actively engaging with the local community, stakeholders, and cultural norms to ensure that projects are effectively planned, implemented, and sustained. Additionally, it is suggested that effective communication strategies be implemented to promote transparency, collaboration, and accountability throughout the project lifecycle. Furthermore, valuing and incorporating the perspectives and input of all stakeholders, including marginalized groups, is crucial for the success of water projects in the area.

6.5.2 The Influence of Technical System on the Performance of Water Projects in Shinyanga Municipality

The study recommends that stakeholders SHUWASA in Shinyanga Municipality prioritize investing in robust technical systems, such as smart water technology, to improve project performance. Furthermore, decision-makers should consider allocating resources towards enhancing the technical aspects of water projects, as changes in the technical system were found to significantly impact project success. Additionally, continuous monitoring and evaluation of technical systems are recommended to ensure that they are functioning optimally and are aligned with project objectives. By focusing on enhancing technical systems, SHUWASA in Shinyanga Municipality can increase their chances of achieving successful outcomes and ultimately contribute to improving water access and management in the region.

6.5.3 The Mediating Effect of System Fit on the Relationship between Social-Technical Systems on the Performance of Water Projects in Shinyanga Municipality

The study recommends that SHUWASA in Shinyanga Municipality prioritize the alignment and compatibility of social and technical systems in order to enhance project performance. This involves ensuring that smart water technology is tailored to fit the culture, expertise level, budget size, and policies of SHUWASA.

Additionally, it is important for the technology to be user-friendly, allowing for community involvement in monitoring and maintaining water projects.

6.6 Limitation of the Study

The researcher faced delays in receiving responses from the respondents because of their busy and strict schedules. To overcome this challenge, the researcher encouraged the targeted respondents to promptly complete and return the questionnaires. Additionally, some respondents were hesitant to fill the questionnaire. Nevertheless, this obstacle was tackled by explaining the importance of the study to the respondents and assuring them of confidentiality. Moreover, the respondents were reassured that the study was solely for academic purposes.

6.7 Areas Recommended for Further Research

As the researcher delved into the intricacies of studying the mediating role of system fit in the relationship between social-technical systems and the performance of water projects in Shinyanga Municipality, he found himself faced with a multitude of potential areas for further exploration. One suggestion for further research is to examine the role of contextual factors, such as political, economic, and environmental conditions, in shaping the relationship between social and technical systems and project performance in Shinyanga Municipality. Understanding how these external factors influence system fit and project outcomes could provide valuable insights for improving the sustainability and effectiveness of water projects in the region.

Another avenue for future research could be to investigate the potential barriers to achieving system fit in water projects in Shinyanga Municipality, which could be a fruitful area for further research. This could involve identifying the key challenges that prevent effective alignment between social and technical systems and developing strategies to overcome these obstacles in order to enhance project performance.

Additionally, longitudinal research could be undertaken to assess the long-term effects of system fit on the performance of water projects in Shinyanga Municipality. By tracking project outcomes over an extended period, researchers can evaluate the sustainability of system fit and its impact on overall project success.

Furthermore, qualitative research methods such as interviews and focus groups could be utilized to gather deeper insights into the perceptions and experiences of stakeholders involved in water projects in Shinyanga Municipality. By incorporating the perspectives of those directly involved in project implementation, researchers can gain a more comprehensive understanding of the dynamics shaping system fit and project performance.

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APPENDICES

APPENDIX I: Questionnaire for SHUWASA staff members

Section I: Demographic Background of the Respondents

Please tick to indicate your opinion on each of the statements

1. What is your Age bracket?
   - i. Below 25 [ ]
   - ii. Between 26 and 35 [ ]
   - iii. Between 36 and 45 [ ]
   - iv. Above 45 [ ]
2. What is your gender?
   - i. Male [ ]
   - ii. Female [ ]
3. What is your highest level of education?
   - i. Tertiary [ ]
   - ii. Undergraduate [ ]
   - iii. Postgraduate [ ]

Section II: The influence of social system on the performance of water projects in Shinyanga Municipality.

Please indicate your agreement level on a scale of 1-5 as follows: 5=Strongly agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly disagree.

Code	**Statements**	**1**	**2**	**3**	**4**	**5**
SS1	To what extent do you agree that stakeholder engagement can positively affects the performance of water projects in Shinyanga Municipality?					
SS2	Do you believe that community participation can has a significant influence on the success of water projects in Shinyanga Municipality?					
SS3	How strongly do you agree that considering the cultural factors in Shinyanga Municipality can influence the performance of water projects?					
SS4	To what extent do you think that adherence to local norms and values can contribute to the success of water projects in Shinyanga Municipality?					
SS5	How much do you agree that valuing the perspectives and input of stakeholders is essential for the success of water projects in Shinyanga Municipality?					

Section III: The influence of technical system on the performance of water projects in Shinyanga Municipality.

Please indicate your agreement level on a scale of 1-5 as follows: 5=Strongly agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly disagree.

Code	**Statements**	**1**	**2**	**3**	**4**	**5**
TS1	Does the availability of technical systems such as smart water technology can enhance the efficiency of water projects in Shinyanga Municipality?					
TS2	To what extent does the integration of technical systems like smart water technology can contribute to the success of water projects in Shinyanga Municipality?					
TS3	Do technical systems such as smart water technology can have a significant role in improving the reliability of water systems in Shinyanga Municipality?					
TS4	How strongly do you believe that the use of technical systems like smart water technology can positively impacts the overall performance of water projects in Shinyanga Municipality?					
TS5	To what extent do technical systems such as smart water technology can influence the sustainability of water projects in Shinyanga Municipality?					

Section IV: Systems fit or compatibility of social and technical systems in imprementing smart water technology in Shinyanga Municipality.

Please indicate your agreement level on a scale of 1-5 as follows: 5=Strongly agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly disagree.

Code	**Statements**	**1**	**2**	**3**	**4**	**5**
SF1	To what extent do you agree that smart water technology aligns or is compatible with the culture of SHUWASA?					
SF2	To what extent do you agree that the smart water technology aligns with the level of human capital expertise at SHUWASA?					
SF3	To what extent do you agree that smart water technology aligns with the SHUWASA's budget size ?					
SF4	To what extent do you agree that the use of smart water technology at SHUWASA can be a user friend for the community to be involved in monitoring the water projects?					
SF5	How strongly do you agree that smart water technology is adherence to the policy of SHUWASA?					

Section V: The performance of water projects in Shinyanga Municipality.

Please indicate your agreement level on a scale of 1-5 as follows: 5=Strongly agree, 4=Agree, 3=Neither Agree nor Disagree, 2=Disagree, and 1=Strongly disagree.

Code	**Statements**	**1**	**2**	**3**	**4**	**5**
PWP1	How strongly do you agree that the performance of water projects in Shinyanga municipality depends on involving community in monitoring smart water technology?					
PWP2	How much do you agree that the performance of water projects in Shinyanga municipality depends on valuing the perspectives and input of stakeholders in designing and implementing the smart water technology?					
PWP3	To what extent do you agree that the performance of water projects in Shinyanga municipality depends on designing and implementing smart water technology based on the culture of the organization and the local population?					
PWP4	How strongly do you agree that the performance of water projects in Shinyanga municipality depends on presence of skilled personnel for implementing smart water technology?					
PWP5	To what extent do you agree that the performance of water depends on designing and implementing smart water technology based on local norms and values?					

APPENDIX II: REGRESION ANALYSIS RESULTS

1. Reliability Test Results

Reliability Statistics for Social System

Cronbach's Alpha	N of Items
.874	5

Reliability Statistics for Technical System

Cronbach's Alpha	N of Items
.871	5

Reliability Statistics for System Fit

Cronbach's Alpha	N of Items
.712	5

Reliability Statistics for Performance of Water Projects

Cronbach's Alpha	N of Items
.909	5

Reliability Statistics for Reliability for all items inclusive

Cronbach's Alpha	N of Items
.943	20

2. Results for Demographic Characteristics of the Respondents

A. Gender Distributions of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	37	52.9	52.9	52.9
	Female	33	47.1	47.1	100.0
	Total	70	100.0	100.0	

B. Age Group of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 25 years	1	1.4	1.4	1.4
	26-35	22	31.4	31.4	32.9
	36-45	36	51.4	51.5	84.3
	Above 45	11	15.7	15.7	100.0
	Total	70	100.0	100.0	

C. Educational Background of the Respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Tertiary	22	31.4	31.4	31.4
	Bachelor Degree	40	57.1	57.1	88.6
	Postgraduate	8	11.4	11.4	100.0
	Total	70	100.0	100.0	

3. Results for Pearson Correlation Analysis

A. Pearson Correlations between Independent Variables and Dependent Variable

		Social System	Performance of Water Projects	Technical System
Social System	Pearson Correlation	1	.890**	.454**
	Sig. (2-tailed)		.000	.000
	N	70	70	70
Performance of Water Projects	Pearson Correlation	.890**	1	.938**
	Sig. (2-tailed)	.000		.000
	N	70	70	70
Technical System	Pearson Correlation	.454**	.938**	1
	Sig. (2-tailed)	.000	.000	
	N	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

B. Pearson Correlations between Independent Variables and Mediating Variable

		Social System	Technical System	System Fit
Social System	Pearson Correlation	1	.454**	.544**
	Sig. (2-tailed)		.000	.000
	N	70	70	70
Technical System	Pearson Correlation	.454**	1	.558**
	Sig. (2-tailed)	.000		.000
	N	70	70	70
System Fit	Pearson Correlation	.544**	.558**	1
	Sig. (2-tailed)	.000	.000	
	N	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

C. Correlation between Independent Variables and Mediating Variable with the Dependent Variable

		Social System	Technical System	System Fit	Performance of Water Projects
Social System	Pearson Correlation	1	.454**	.544**	.890**
	Sig. (2-tailed)		.000	.000	.000
	N	70	70	70	70
Technical System	Pearson Correlation	.454**	1	.558**	.938**
	Sig. (2-tailed)	.000		.000	.000
	N	70	70	70	70
System Fit	Pearson Correlation	.544**	.558**	1	.577**
	Sig. (2-tailed)	.000	.000		.000
	N	70	70	70	70
Performance of Water Projects	Pearson Correlation	.890**	.938**	.577**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	70	70	70	70

**. Correlation is significant at the 0.01 level (2-tailed).

4. Diagnostics for the assumptions of linear regression

A. Skewness and Kurtosis Test for Normality

		Social System	Performance of Water Projects	Technical System	System Fit
N	Valid	70	70	70	70
	Missing	0	0	0	0
Skewness		-.814	-.139	-.961	-.425
Std. Error of Skewness		.287	.287	.287	.287
Kurtosis		.697	.292	.293	-.130
Std. Error of Kurtosis		.566	.566	.566	.566

B. Test of Assumptions of Multi-Collinearity

Model	Standardized Coefficients	t	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
(Constant)		-.643	.523		
Social System	.340	4.922	.000	.269	3.723
Technical System	.595	7.965	.000	.231	4.338
System Fit	.095	2.183	.033	.685	1.460

C. Breusch-Pagan Test for Heteroscedasticity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.067	3	.022	2.276	.088[b]
	Residual	.650	66	.010		
	Total	.717	69			

a. Dependent Variable: res_squared

b. Predictors: (Constant), System Fit, Social System, Technical System

5. Multiple Regression Model Estimation

A. Regression Analysis Results for the Mediating Roles of the System Fit in the effect of the Social System on the Performance of Water Projects in Shinyanga Municipality

i. Results for the Influence of Social System on the Performance of Water Projects in Shinyanga Municipality

Model Summary of Performance of the Water Project Against the Social System

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.890[a]	.793	.790	.32988

a. Predictors: (Constant), Social System

ANOVA Statistics for Performance of the Water Project Against the Social System

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.271	1	28.271	259.798	.000[b]
	Residual	7.400	68	.109		
	Total	35.671	69			

a. Dependent Variable: Water Project Performance

b. Predictors: (Constant), Social System

Regression Coefficients for Performance of the Water Project Against the Social System

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.546	.234		2.332	.023
Social System	.900	.056	.890	16.118	.000

a. Dependent Variable: Performance of Water Project

ii. Results for the Effect of Social System Variable on System Fit Variable

Model Summary for the Effect of Social System on System Fit

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.444[a]	.197	.186	.63068

a. Predictors: (Constant), Social System

ANOVA Statistics for the Effect of Social System on System Fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.655	1	6.655	16.733	.000[b]
	Residual	27.047	68	.398		
	Total	33.703	69			

a. Dependent Variable: System Fit

b. Predictors: (Constant), Social System

Regression Coefficients for the Effect of Social System on System Fit

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.023	.448		4.515	.000
Social System	.437	.107	.444	4.091	.000

a. Dependent Variable: System Fit

iii. Results for the Influence of System Fit on the Performance of Water Projects in Shinyanga Municipality

Model Summary for Performance of Water Projects against System Fit

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.577[a]	.333	.324	.59130

a. Predictors: (Constant), System Fit

ANOVA Statistics for Performance of Water Projects against System Fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.896	1	11.896	34.023	.000[b]
	Residual	23.775	68	.350		
	Total	35.671	69			

a. Dependent Variable: Performance of Water Project

b. Predictors: (Constant), System Fit

Regression Coefficients for Performance of Water Projects against System Fit

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.994	.396		5.032	.000
	System Fit	.594	.102	.577	5.833	.000

a. Dependent Variable: Performance of Water Project

iv. Results for the Performance of Water Projects in Shinyanga Municipality against System Fit and the Social System

Model Summary for the Influence of Social System and System Fit on the Performance of Water Projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.913[a]	.834	.829	.29749

a. Predictors: (Constant), System Fit, Social System

ANOVA Statistics for the Influence of Social System and System Fit on the Performance of Water Projects

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.741	2	14.871	168.026	.000[b]
	Residual	5.930	67	.089		
	Total	35.671	69			

a. Dependent Variable: Performance of Water Projects

b. Predictors: (Constant), System Fit, Social System

Regression Coefficients for the Influence of Social System and System Fit on the Performance of Water Projects

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.075	.241		.310	.757
Social System	.798	.056	.790	14.200	.000
System Fit	.233	.057	.227	4.076	.000

a. Dependent Variable: Performance of Water Project

B. The Mediating Roles of the System Fit in the effect of the Technical System on the Performance of Water Projects in Shinyanga Municipality

i. Results for the Influence of Technical System on the Performance of Water Projects in Shinyanga Municipality

Model Summary of Performance of the Water Project Against the Technical System

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.938[a]	.880	.878	.25103

a. Predictors: (Constant), Technical System

ANOVA Statistics for Performance of the Water Project Against the Technical System

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.386	1	31.386	498.066	.000[b]
	Residual	4.285	68	.063		
	Total	35.671	69			

a. Dependent Variable: Water Project Performance

b. Predictors: (Constant), Technical System

Regression Coefficients for Performance of the Water Project Against the Technical System

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.189	.185		1.021	.311
Technical System	.979	.044	.938	22.317	.000

a. Dependent Variable: Performance of Water Project

ii. Results for the Effect of Technical System on System Fit

Model Summary for the Effect of Technical System on System Fit

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.558[a]	.311	.301	.58424

a. Predictors: (Constant), Technical System

ANOVA Statistics for the Effect of Technical System on System Fit

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.492	1	10.492	30.739	.000[b]
	Residual	23.211	68	.341		
	Total	33.703	69			

a. Dependent Variable: System Fit

b. Predictors: (Constant), Technical System

Regression coefficients for the Effect of Technical System on System Fit

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	1.470	.431		3.409	.001
Technical System	.566	.102	.558	5.544	.000

a. Dependent Variable: System Fit

iii. Results for the Performance of Water Projects in Shinyanga Municipality against System Fit and the Technical System

Model Summary for the Influence of Technical System and System Fit on the Performance of Water Projects

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.940[a]	.884	.881	.24838

a. Predictors: (Constant), Technical System, System Fit

ANOVA Statistics for the Influence of Technical System and System Fit on the Performance of Water Projects

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.537	2	15.769	255.601	.000[b]
	Residual	4.133	67	.062		
	Total	35.671	69			

a. Dependent Variable: Performance of Water Projects

b. Predictors: (Constant), System Fit, Technical System

Regression Coefficients for the Influence of Technical System and System Fit on the Performance of Water Projects

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	.070	.198		.354	.724
Technical System	.933	.052	.894	17.843	.000
System Fit	.081	.052	.079	1.568	.122

a. Dependent Variable: Performance of Water Project

APPENDIX III: RESEARCH CLEARANCE FROM THE OPEN UNIVERSITY OF TANZANIA

The Open University of Tanzania
Shinyanga Regional Centre,
Karena Road,
P.O. Box 1203,
SHINYANGA, TANZANIA.

Chuo KikuuHuria cha Tanzania
Kituo cha MkoawaShinyanga
BarabarayaKarena,
S.L.P 1203,
SHINYANGA, TANZANIA.

12th September, 2024

MANAGING DIRECTOR,
SHINYANGA WATER SUPPLY AND SANITATION AUTHORITY
(SHUWASA),
P. O. BOX 298,
SHINYANGA.

RE: RESEARCH CLEARENCE

Refer the heading above.

The Open University of Tanzania was established by an Act of Parliament no. 17 of 1992, which became operational on 1st March 1993 by Public notice no.55 in the official gazette. The Act was however replaced by OUT charter of 2005 which became operational on 1st January 2007. In line with this letter the Open University of Tanzania mission is to generate, apply knowledge through research and to facilitate, simplify research process.

With this background, the purpose of this letter is to introduce Mr. BUNDALA IGAMBWA who is a bonafide student of the Open University of Tanzania, with registration number PG202087617 pursuing Master of Project Management (MPM). The student carrying this letter seeks a permission to conduct a research titled ***"Influence of Social Technical System on the Performance of Water Projects in Tanzania: A case of Shinyanga Water Supply and Sanitation Authority,"*** from 9th – 19th September, 2024. I am therefore requesting your esteemed office to consider his request.

Kindly accord the student with the necessary assistance he might require.

Thank you in advance for your assumed cooperation and facilitation of this research activity.

In case you need any further information don't hesitate to call 0754574864.

Yours sincerely
THE OPEN UNIVERSITY OF TANZANIA

Dr. AGATHA MGOGO
DIRECTOR
SHINYANGA REGIONAL CENTRE

APPENDIX IV: PERMISSION LETTER FROM SHINYANGA WATER SUPPLY AND SANITATION AUTHORITY (SHUWASA)

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF WATER

SHINYANGA WATER SUPPLY AND SANITATION AUTHORITY (SHUWASA)

In reply Please quote :-
Ref. No. SHY/WS/PF.-317/117

20TH September, 2024

THE DIRECTOR,
OPEN UNIVERSITY OF TANZANIA,
SHINYANGA REGIONAL CENTER,
P.O.BOX 1203,
SHINYANGA.

REF: RESEARCH CLEARANCE FOR MR. BUNDALA IGAMBWA

Kindly refer to the captioned subject above.

2. We declare to receive the letter with the subject above.

3. We have accepted the mentioned student to carry out his research titled **"Influence of Social Technical System on the Performance of Water Projects in Tanzania, a case of Shinyanga Water Supply and Sanitation Authority** from 09th September, 2024 to 19th September, 2024.

4. We assure your office that, the student will get the necessary assistance in his studies.

5. Yours Sincerely,

Eng. Yusuph Katopola
MANAGING DIRECTOR

Official Communication MUST be addressed to the Managing Director
Telephone No. 028-2762073, Email Adress : info@shuwasa.or.tz, Web site .www.shuwasa.or.tz,
01 SHUWASA ROAD, P. O. BOX 298, 37102 SHINYANGA - TANZANIA.

Comments by Supervisors:

Supervisor 1:

Dissertation Report is ready and has been approved for examination

Name of Supervisor: DR. Bukaza Chachage

Signature: Date: 03/10/2024

Supervisor 2:

Dissertation Report has been approved and the candidate can be allowed to proceed with oral presentation.

Name of Supervisor: DR. Dionis Ndolage

Signature: Date: 03/10/2024

INFLUENCE OF SOCIAL TECHNICAL SYSTEM ON THE PERFORMANCE OF WATER PROJECTS IN SHINYANGA MUNICIPALITY

BUNDALA IGAMBWA

ABSTRACT

The primary objective of this research was to investigate the influence of the social technical system on the performance of water projects in Shinyanga Municipality. Specifically, the study sought to analyze the impact of social systems on water project performance, assess the influence of technical systems on water project performance, explore the mediating role of system fit in the relationship between social systems and water project performance, and investigate the mediating effect of system fit on the relationship between technical systems and water project performance in Shinyanga Municipality. This study utilized a causal research design and quantitative research methods to collect data from 78 SHUWASA employees through a census approach. Data was gathered using a closed-ended questionnaire with a 5-point Likert scale. Demographic information was analyzed descriptively, while a multiple regression model was used to assess the impact of social technical systems on project success as well as the mediating effect of system fit on the relationship between social-technical systems and the performance of water projects. The study findings revealed that both social and technical systems significantly affect water project performance in Shinyanga Municipality. Additionally, system fit was identified as a key mediator in the relationship between social and technical systems and project performance. The study concluded that enhancing the alignment between social and technical systems could lead to improved water project performance in Shinyanga Municipality.

Keywords: *Social System, Technical System, System Fit, Performance of water project*

1. Background to the Problem

Water scarcity has emerged as a pressing global issue in recent years, impacting communities worldwide (Tzanakakis *et al.*, 2020). Developing countries, in particular, face challenges in providing clean drinking water and sanitation, leading to health and socio-economic problems (Shemer et al., 2023). Various stakeholders including governments, non-governmental organizations, and other stakeholders have launched water projects to address this issue (Moreira *et al*., 2024; Wise, 2023), but hurdles persist in achieving sustainable water management systems due to factors like inadequate infrastructure and poor community engagement (Evaristo *et al*., 2023; Olley *et al*., 2024; Tseole *et al*., 2022).

To tackle these challenges, the integration of social-technical systems in water projects has been proposed (Heinzel *et al*., 2023). This approach emphasizes the importance of considering both technical and social aspects to optimize performance and sustainability (Oesterreich *et al*., 2022). While this approach has been successful in developed countries, its application in developing nations, such as African countries, remains limited (Ekesa *et al*., 2021; Ojo, *et al*., 2020; Omojola *et al*., 2020). Studies in Southeast Asia, America, and Europe highlight the positive impact of social-technical systems on water management practices (MacKinnon *et al*., 2007; Molenveld & van Buuren, 2019; Garcia, 2021).

In Tanzania, where access to clean water has improved through various projects (Marsili *et al*., 2019), concerns remain regarding project sustainability in rural areas (Mijumbi, 2019; Shengena, 2019). Specifically, in the rural areas of Tanzania, RUWASA, a government-mandated agency, is responsible for supplying clean water and sanitation services to rural communities in various regions of the country, including Shinyanga (URT, 2024). Despite its mandate, RUWASA faces obstacles like insufficient infrastructure, limited resources, and lack of community involvement, resulting in inadequate clean water supply to the local residents. However, despite the potential benefits of social technical system, there is limited research on their effectiveness in ensuring the performance of water supply projects in Tanzania.

Specifically, there is a dearth of research on how the incorporation of these systems together affect water availability, quality, and infrastructure maintenance. Previous studies in Tanzania that examined the performance of water project have mainly focused on specific aspects of the social technical system, such as community engagement or technical design, without considering the broader implications for project outcomes. For example Kiteme and Wünscher (2020), Manase and Francis (2021), Wilcock (2016), and Yobe *et al*. (2018) in their study were focused on the community participation and good management practice while Nyaki and Simba (2020), Mrema *et al*. (2020), Mushi (2021), and Mwaipopo and Mbilinyi (2020) were focused on the role of technology on the performance of water projects. This knowledge gap underscores the need for further research to assess how the social-technical systems approach can enhance the performance of water projects in Tanzania. Guided by Social Technical Theory and Technology Fit theory, this study explores how the interactions between social and technical factors within an organization can enhance water project effectiveness. By considering factors such as organizational culture, technical capabilities, and community engagement, this research aims to shed light on the potential of social technical systems to improve water project performance in Tanzania, ultimately contributing to the sustainable provision of clean and safe water for all.

1.1 Hypotheses

H_1: There is a mediating effect of system fit on the relationship between social systems and performance of water projects in Shinyanga Municipality.

H_2: There is a mediating effect of system fit on the relationship between technical systems and performance of water projects in Shinyanga Municipality.

2. Literature review

2.1 The Concept of System Fit and Social-technical Systems in Relation to Water Projects

The interaction between social systems and technical systems is crucial in the context of water projects. Social systems involve the interconnected network of individuals, organizations, and institutions involved in water-related initiatives (Burt, 2018;

Nelson & Levesque, 2018), while technical systems consist of machinery, software, and processes designed to achieve specific goals related to water management (Auinger & Schneckenreither, 2020; Lee & Gertler, 2021). System fit, therefore, becomes essential in ensuring that these two systems align and work effectively together to achieve desired outcomes in water projects (Serpytis & Arkhipova, 2020). In the context of smart water projects, where advanced technologies such as sensors and data analytics are utilized to improve water management, system fit becomes even more critical. It is essential to ensure that the technological components are compatible with the social aspects of the project, such as stakeholder needs, regulatory requirements, and community engagement. Without adequate system fit, the effectiveness and sustainability of water projects may be compromised.

2.2 Theoretical Literature Review

The research was influenced by the Social Technical Theory and Technology Fit Theory. These theories were chosen for their synergistic relationship. The study utilizes Technology Fit Theory in conjunction with Social Technical Theory. By evaluating both the technical and social components of a technology, as well as its alignment with organizational objectives and procedures, organizations can enhance the chances of effectively incorporating and utilizing the technology.

2.2.1 Social Technical Theory

The Social Technical Theory, developed by sociotechnical systems theorists Fred Emery and Eric Trist in the 1950s (Emery & Trist, 1960), emphasizes the importance of considering both social and technical aspects of work in organizational settings (Pasmore, 1988). This theory was a response to the increasing mechanization and automation of work processes after World War II, as Emery and Trist believed that traditional management theories focusing solely on technical efficiency overlooked crucial social dynamics (Emery & Trist, 1960). They argued that effective organizations should address both technical (technology and processes) and social (teamwork, communication, job satisfaction) aspects to achieve optimal performance (Clegg, 2000).

Social and technical systems are seen as interdependent within organizations, and designing work systems that consider both factors can create more efficient and effective environments (Orlikowski & Barley, 2001). In projects like water supply systems, social systems (community participation, culture, norms, values) and technical systems (smart water technology) play key roles in success (Sow *et al*., 2018). Community involvement in planning, implementation, and monitoring, as well as cultural sensitivity, can enhance project outcomes and sustainability. Smart water technology, utilizing sensors, data analytics, and automation, improves resource management and service delivery (Ouedraogo *et al*., 2021; Yeboah *et al*., 2021).

While social technical theory offers a valuable framework for organizations, it faces criticism for struggles in adapting to rapidly changing environments, a lack of empirical evidence, costliness, potential dehumanization of work environments, and a lack of practical guidance for implementation (Ellis & Jones, 2019; Kämpf *et al*., 2018; Newman *et al*., 2017; Zhang & Liu, 2019). Nevertheless, studies have shown that applying a social technical approach can lead to improved performance and sustainability in projects like clean water supply systems (Lenz, 2019; Teixeira & Silva, 2018; Wang *et al*., 2020). By considering both social and technical dimensions, organizations can enhance communication, stakeholder involvement, and infrastructure to improve project outcomes. This theory is considered appropriate for examining the impact of technology on water projects in Shinyanga Municipality.

2.2.2 Technology Fit Theory

The Technology Fit Theory, also known as FITT (Fit between Individuals, Task, and Technology), was conceptualized by Goodhue and Thompson in the 1990s to explore the alignment of individuals, tasks, and technology within organizational settings (Goodhue & Thompson, 1995). This framework posits that successful technology implementation hinges on the harmonious integration of these three components (Farooq *et al*., 2020). Notably, Technology Fit Theory breaks new ground by considering the interplay between individual user traits, task demands, and the technology involved, a departure from previous research that centered on either user characteristics or technological factors in isolation (Tarafdar *et al*., 2019)..

Central to the theory is the recognition of the context in which technology is deployed, underscoring the significance of matching technology choices to task requirements and user capabilities (Durndell, 2020). By taking a holistic approach that accounts for all three elements and their interconnectedness, Technology Fit Theory provides a comprehensive lens for assessing and optimizing technological implementations (Goodhue & Thompson, 1995).

In the domain of water projects, the application of Technology Fit Theory is exemplified in the integration of smart water technology, which encompasses sensor systems, monitoring tools, and data analytics to enhance water project management (Arar *et al*., 2021). This advanced technology facilitates real-time monitoring, leak detection, and efficient water distribution, among other advantages (Salami, 2020). However, maximizing the potential of smart water technology necessitates alignment with the specific goals and needs of the water project (Karim et al., 2021).

To assess the suitability of smart water technology, project managers can leverage Technology Fit Theory to evaluate compatibility with existing systems, ease of integration, budget constraints, environmental considerations, and training requirements. By aligning technology choices with organizational objectives and stakeholder needs, the likelihood of successful implementation and performance improvement is heightened (Garg & Sharma, 2021).

Moreover, stakeholder engagement and buy-in play a pivotal role in technology adoption, particularly in complex projects like water management (Subramanian & Gopalakrishnan, 2020). Involving key stakeholders in decision-making processes can help identify and address barriers to technology adoption, ensuring that smart water technology effectively addresses performance indicators like water quality, efficiency, reliability, and sustainability (Capello & Rossi, 2021).

While Technology Fit Theory offers valuable guidance in selecting appropriate technologies for water projects, it is not without its limitations. The evolving and intricate nature of technological advancements, such as those in smart water technology, can pose challenges in determining project requirements and finding suitable technology solutions (Miguel *et al*., 2020). Moreover, cost considerations, including expenses associated with hardware, software, maintenance, and capacity-building, may present obstacles in aligning technology choices with project budgets (Lederer & Sethi, 2020).

Despite these challenges, applying Technology Fit Theory to smart water technology selection and deployment holds promise for enhancing water system efficiency, effectiveness, and sustainability. By navigating the complexities and constraints associated with technological implementations, project managers can drive positive outcomes and long-term benefits for both the environment and communities.

2.3 Empirical Literature Review

2.3.1 The Influence of Social Systems on the Performance of Water Projects

In a series of studies conducted across various countries, researchers have consistently emphasized the critical role of social systems in the success of water projects. Derib and Alemayehu (2024) highlighted the importance of community participation, local institutions, and social cohesion in determining the effectiveness and sustainability of water projects in Ethiopia. They found that strong social networks were essential for overcoming challenges and ensuring project success. Similarly, Shunglu *et al*. (2022) identified the importance of effective community participation and engagement in the success of water projects in Turkey, India, and Sri Lanka. Their study emphasized the significance of clear communication channels, stakeholder cooperation, and local ownership in influencing project outcomes. Additionally, Arieko and Kisimbii (2020) conducted a study in rural Kenya and found that social factors like community involvement, local leadership, and traditional practices played a critical role in determining project performance. Moreover, Tantoh *et al*. (2021) examined the influence of social systems on water projects in three rural districts of Northwest Cameroon and found that factors such as centralized control and passive involvement of public, private, and grassroots communities have hindered water supplies in these districts.

2.3.2 The Influence of Technical Systems on the Performance of Water Projects

In their review, Olatunde *et al*. (2024) have delved into the various aspects of smart water management systems in Africa and the United States, underscoring their crucial role in addressing present-day water management challenges. The discussion spans from the theoretical foundations of these systems to a detailed analysis of the technologies, policy frameworks, and their effects. The authors highlight the potential of smart water management technologies such as IoT, AI, and remote sensing in revolutionizing water conservation, clean water accessibility, and sustainable water usage (Olatunde *et al*., 2024). These technologies enable real-time monitoring and management of water resources, leading to significant benefits across environmental, social, and economic domains. Similarly, Gupta *et al*. (2020) found in their review that the adoption of smart technologies can improve water resource management, ultimately contributing to global water scarcity alleviation. However, the high implementation costs may pose obstacles to the adoption of Smart Water Technologies (SWT) in developing countries. On the other hand, Egbo *et al*. (2022) discovered in their study in Nigeria the importance of utilizing indigenous smart water harvesting technology, specifically sump/infiltration systems, to address the persistent water crisis in Enugu metropolis. Furthermore, Owen (2023) conducted a study that emphasizes how smart water technologies empower utilities, regulators, and customers to make well-informed decisions regarding their water resources, leading to more efficient water usage. The author notes that leveraging smart water technology can help in reducing network leakage, lowering energy consumption, and preventing unnecessary asset deployments.

2.3.3 The Mediating Effect of Systems Fit on the Relationship between Social-technical Systems and Performance of Water Projects

Al-Faouri *et al*. (2024) conducted a quantitative research study in the Jordanian telecom industry to explore the relationships between technology application, smart human resource management (SHRM), and innovation performance. The results revealed positive connections between technology application, SHRM, and innovation performance, emphasizing the importance of technology and SHRM strategies in promoting innovation and organizational success. Gasco-Hernandez *et al*. (2022) investigated how local governments in three European cities enhance their organizational capacity for digital transformation, specifically focusing on smart city initiatives. The study emphasized the significance of organizational capacity in smart city development and digital transformation through smart decision-making, administration, and urban collaboration. Additionally, Kithae (2023) conducted a review of existing literature to examine how organizational culture influences employee behavior towards embracing technological innovation and its impact on organizational competitiveness. The study, using a qualitative approach, highlighted that technology drives innovation and enables organizations to achieve superior performance. Kithae (2023) concluded that technological innovation and organizational culture interact to shape organizational behavior, driving economic change, productivity, and long-term growth.

2.4 Conceptual Framework

This study introduces a conceptual framework for evaluating the effectiveness of water projects, which comprises three key components: independent variables (social and technical systems), dependent variable (water project performance), and mediator variable (system fit). The social system encompasses elements like community involvement, stakeholder engagement, expertise, funding, and governmental policies, while the technical system includes the technology utilized, such as smart water technology. The success of water projects hinges on how well these independent variables interact and align within a specific context. The mediator variable, system fit, is critical in assessing how effectively the social and technical systems impact the overall performance of the project. It evaluates the compatibility and congruence between different project components, ensuring their seamless integration to achieve desired objectives. The conceptual framework presented in Figure 1 illustrates the connections between these variables.

Independent Variables **Mediating Variable** **Dependent Variable**

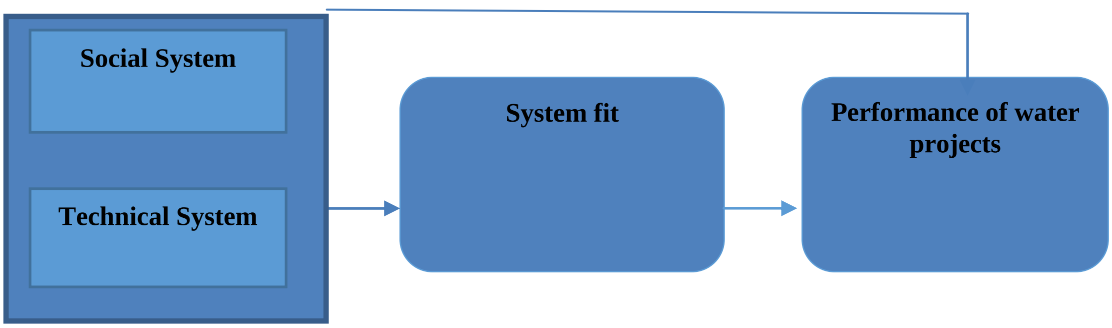


Figure 2: **Conceptual Framework**

Source: Researcher (2024).

In Figure 1 of this study, the relationships between the social system, technical system, system fit, and performance of water projects are depicted. The social system and technical system are considered as independent variables, while system fit serves as a mediating variable and the performance of water projects as the dependent variable.

The study firstly examines the direct impact of the social system on the performance of water projects. It then investigates the influence of the social system on system fit, followed by testing the impact of system fit on the performance of water projects. Finally, the study explores the mediating role of system fit in the relationship between the social system and the performance of water projects, demonstrating the indirect impact of the social system on project performance through system fit.

Similarly, the study also evaluates the direct impact of the technical system on the performance of water projects. It further examines the direct impact of technical systems on system fit and the influence of system fit on project performance. The study concludes by assessing the mediating effect of system fit on the relationship between the technical system and the performance of water projects, illustrating the indirect impact of the technical system on project performance through system fit.

3. Methodology

3.1 Research Philosophy

Research philosophy guides the research process by determining the approach, methodology, and knowledge sought (Baskerville & Myers, 2018).The study is grounded in a positivism-based philosophy, allowing for a quantitative examination of social technical systems' effects on water project performance in Shinyanga Municipality.

3.2 Research Design

According to Yin (2014) research design is the plan for collecting, measuring, and analyzing data. Tashakkori and Teddlie (2010) categorize research design into three main types: descriptive, exploratory, and causal research. In this study, a causal research design was used to examine how social technical systems impact the performance of a water project in Shinyanga municipality. Bryman (2016) explains that causal research investigates cause-and-effect relationships between variables, making it a suitable choice for establishing the connection between social technical systems and the water project's performance in Shinyanga municipality.

3.3 Area of the Study

The study was conducted in Shinyanga Municipality, Tanzania, with a specific focus on the operations of SHUWASA. SHUWASA was selected due to its role in providing clean water to the people of Shinyanga. Unfortunately, due to insufficient monitoring of water infrastructure, some water points are not functioning properly, leading to water shortages and restricted access to safe drinking water for the community (URT, 2024).

3.4 Target Population

The target population comprised 78 individuals, including management members and staff (Silverman, 2019).

3.5 Sample Size and the Sampling Technique

The study utilized a sample size of 78 respondents selected through the census method to ensure the inclusion of all available populations in the study. The researcher opted for this approach as a large enough sample size was needed for running the regression model (Alvi, 2016).

3.6 Variable and Measurement

The variables measured were social and technical systems and their impact on water project performance, utilizing questionnaires with nominal and ordinal scales (Beatty & Willis, 2019).

3.7 Data Collection Instruments

In this study, a researcher utilized a Likert scale questionnaire to assess the impact of social technical systems on the effectiveness of water projects. By employing this survey instrument, the researcher was able to efficiently gather data from a wide range of respondents in a short amount of time. The questionnaire employed a 5-point Likert scale, prompting participants to indicate their agreement levels, ranging from strongly disagree to strongly agree, in relation to the influence of social technical systems on water project performance in the Shinyanga Municipality.

3.8 Validity and Reliability of Research Instruments

Prior to commencing field work for data collection, the instrument was evaluated for validity and reliability. In this study, to ensure validity, questionnaires were reviewed by supervisors and colleagues, and their feedback was incorporated into the final research instrument. In terms of reliability, a 5-point Likert scale questionnaire was administered to a sample of 7 individuals who were not part of the study. The data collected was analyzed for reliability using Cronbach's alpha coefficient with SPSS software, aiming for a coefficient above 0.7 for reliability, as defined by Heale and Twycross (2015). The result for reliability is presented in Table 1.

Table 3: Reliability Test Results

Variable	Cronbach's Alpha	No. of Items
Social System	0.874	5
Technical System	0.871	5
System Fit	0.712	5
Performance of Water Projects	0.909	5
Overall	0.943	20

The results from Table 1 showed that the social system, technical system, system fit, and performance of water projects variables had high reliability values of 0.874, 0.871, 0.712, and 0.909, respectively, which were above the recommended Cronbach Alpha coefficient of 0.70 (Heale & Twycross, 2015). This indicates a strong level of reliability for the instruments used in the study, as a Cronbach Alpha coefficient of 0.7 or higher is considered acceptable for research purposes (Creswell & Poth, 2017).

3.9 Data Analysis Procedures

Data collected from the field were coded and cleaned to ensure accuracy and consistency in the dataset. Data analysis involved quantitative methods such as Multiple linear regression analysis which in this study was used to assess the impact of independent variables on the dependent variable (Yoichi, 2016). The study followed a four-step mediation testing approach outlined by Baron and Kenny (1986) to analyze the relationships between variables. In this study, Baron and Kenny's (1986) models were utilized to develop a framework incorporating two independent variables (social system and technical system) and one mediating variable (system fit).

4. Analysis and Results

4.4.1 Testing of H_1: There is a mediating effect of system fit on the relationship between social systems and performance of water projects in Shinyanga Municipality

Regression analysis was used to explore the mediating role of system fit in the relationship between social systems and the performance of water projects in Shinyanga Municipality. The results from Table 2 and Figure 2 indicate a significant direct effect between social system and system fit (SS → SF) (β = 0.437, t = 4.091, p < 0.000). Additionally, a positive and significant relationship was observed between social system and performance of water projects (SS→PoWP) (β = 0.900, t = 16.118, p < 0.000). Furthermore, a significant relationship between system fit and performance of water projects was also uncovered (SF → PoWP) (β = 0.594, t = 5.833, p < 0.000). These significant direct relationships between the variables indicate partial mediation. The indirect effect also demonstrated a significant relationship (β = 0.798, t = 14.200, p < 0.000) with a total effect (a*b+ c') (β = 1.159, p < 0.000) between social system and performance of water projects (SS → PoWP). Therefore, the analysis concludes that system fit acts as a partial mediator in the connection between social systems and the effectiveness of water projects in Shinyanga Municipality.

Figure 2: Mediating effect of system fit on the relationship between social system and performance of water projects

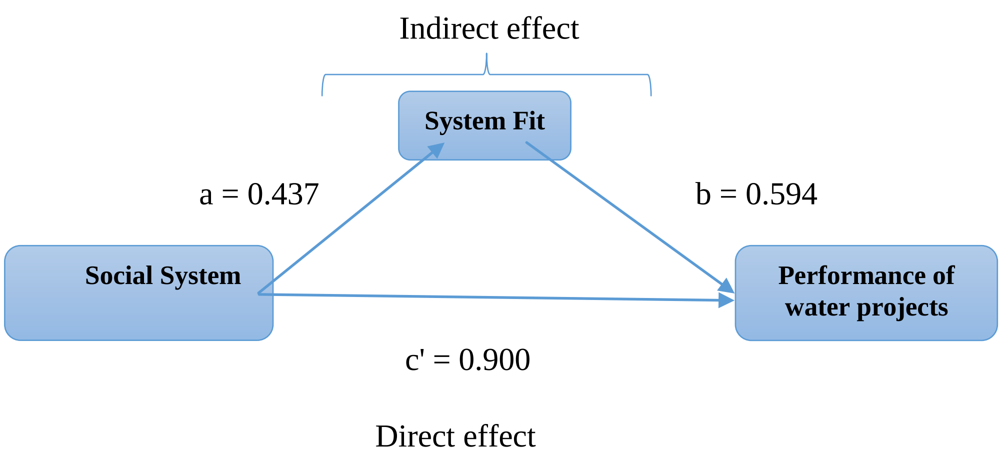


Table 2: Mediating effect of system fit on the relationship between social system and performance of water projects

Predicted relationship	Standardised path loading (β)	t-value	p-value	Indirect effect	Total effect
SS → SF	0.437	4.091	***		0.437

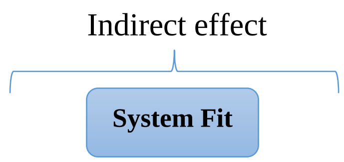
SS→PoWP	0.900	16.118	***	0.798***	1.159
SF → PoWP	0.594	5.833	***		0.594

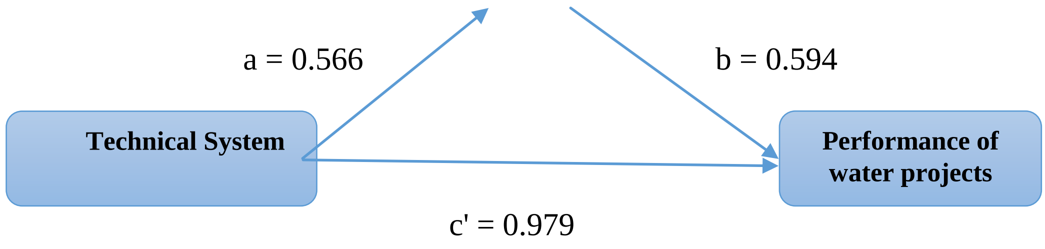
Note(s): SS = Social System; SF = System Fit; PoWP = Performance of Water Project

4.4.2 Testing of H_2: There is a mediating effect of system fit on the relationship between technical systems and performance of water projects in Shinyanga Municipality

Regression analysis was used to investigate the impact of system fit on the performance of water projects in Shinyanga Municipality. The results from Table 3 and Figure 3 revealed a significant direct effect between technical system and system fit (TS → SF) with a coefficient of 0.566, t-value of 5.544, and p-value less than 0.000. Similarly, there was a direct positive relationship between technical system and the performance of water projects (TS → PoWP) with a coefficient of 0.979, t-value of 22.317, and p-value less than 0.000. System fit also showed a direct positive relationship with the performance of water projects (SF → PoWP) with a coefficient of 0.594, t-value of 5.833, and p-value less than 0.000. The findings suggest a partial mediation effect of system fit between technical systems and the performance of water projects. Additionally, an indirect effect was found to be significant with a coefficient of 0.933 and p-value less than 0.000, contributing to the total effect between technical system and performance of water projects (TS → PoWP) (total effect: a*b+ c' = 1.315, $p < 0.000$). Therefore, it can be concluded that system fit serves as a partial mediator between technical system and the performance of water projects.

Figure 3: Mediating effect of system fit in the relationship between technical system and performance of water projects





Direct effect

Table 3: Mediating effect of system fit on the relationship between technical system and performance of water projects

Predicted relationship	Standardised path loading (β)	t-value	p-value	Indirect effect	Total effect
TS → SF	0.566	5.544	***		0.566
TS → PoWP	0.979	22.317	***	0.933 ***	1.315
SF → PoWP	0.594	5.833	***		0.594

Note(s): TS = Technical System; SF = System Fit; PoWP = Performance of Water Project

5. Discussion of Findings

The result of the first hypothesis test indicated that system fit is found to be significant and partially mediated between the social system and the performance of the water project in Shinyanga Municipality, and thus, the hypothesis is accepted. Also, the outcome of the second hypothesis test revealed that system fit is found to be significant and partially mediated between technical systems and the performance of water projects, and thus, the hypothesis is accepted. Hence, it can be said that the presence of system fit can enhance the effectiveness of social and technical interventions, leading to improved project performance in Shinyanga Municipality. Specifically, system fit was identified as a mechanism through which social and technical factors interact to enhance project performance. Ensuring alignment and compatibility between social and technical systems was found to be crucial for achieving successful project outcomes. This finding is consistent with previous research by Bediako et al. (2018) and Brawley-Chesworth (2022), which emphasized the importance of compatibility and ease of use of technological innovations for successful implementation. As a result of the compatibility of the system, it was found that a unit change in the social system can account for 59.4% increase in the performance of a water project, emphasizing the importance of factors such as community participation, stakeholder engagement, cultural considerations, and effective communication in ensuring project success. This finding is supported by previous research conducted in Kenya by Wanjue (2023) and Atenaka (2019), which emphasized the importance of involving community members in development projects for sustainable outcomes. Similarly, the study found a unit implementation of technical systems such as smart water technology can lead to a 97.9% increase in the performance of water projects. This aligns with research by Gupta et al. (2020), Owen (2023), and Hernaningsih et al. (2023), which highlighted the benefits of utilizing smart technologies in water resource management, monitoring wastewater applications, and managing water quality.

6. Contribution of the Findings

The study emphasizes the importance of considering social, technical, and system fit factors in the planning and implementation of water projects in Shinyanga Municipality. By recognizing the mediating roles of system fit in project performance, policymakers and practitioners can design more effective interventions and strategies to enhance project outcomes. Policymakers are encouraged to invest in social infrastructure, technical resources, and ensure alignment between systems to promote the success of water projects. Practitioners are advised to adopt a holistic and integrated approach to project management, addressing social, technical, and system fit considerations to optimize project performance, reduce risks, and maximize the impact on communities in Shinyanga Municipality.

7. Conclusion

This study concluded that system fit plays a significant and partially mediating role between the social-technical systems and the performance of water projects in Shinyanga Municipality. The findings support the importance of aligning and integrating social and technical factors to enhance project effectiveness. Specifically, the presence of system fit was identified as a key mechanism for improving project outcomes, with compatibility between social and technical systems being crucial for success.

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