



**UNIVERSITY OF NAIROBI**

**FACULTY OF ARTS AND SOCIAL SCIENCES**

**DEPARTMENT OF JOURNALISM AND MASS COMMUNICATION**

**ROLE OF COMMUNICATION IN THE CONSERVATION AND RESTORATION OF  
WATER RESOURCES IN THE FACE OF A CHANGING CLIMATE: A CASE STUDY  
OF THE NAIROBI RIVER IN NAIROBI CITY COUNTY, KENYA.**

**SUBMITTED BY:**

**REBECCA KATHINI JOSHUA**

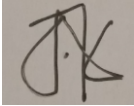
**REG K50/12894/2018**

**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF JOURNALISM  
AND MASS COMMUNICATION IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF ARTS IN  
COMMUNICATION STUDIES**

**NOVEMBER, 2023.**

**DECLARATION**

I declare that this is my original work and has never been submitted for any award in any institution.


Signature..........

Date.....24/11/2023.....

**REBECCA KATHINI JOSHUA**

**K50/12894/2018**

This research project has been submitted for examination with my approval as University Supervisor

  
Signature.....

**22<sup>nd</sup> December 2023**  
Date.....

**PROF. SILAS ORIASO**

**Department of Journalism and Mass Communication**

**University of Nairobi**

## **DEDICATION**

This study is dedicated to my family for immense financial and moral support throughout my academic journey. My guardians Mr. & Mrs. Antony Kiteme, my siblings James Joshua, David Joshua, and my children Elizabeth and Charles. Thank you for your support. A special dedication to my lectures at University of Nairobi for the great work they do to impact society with quality education.

## **ACKNOWLEDGEMENT**

I wish to express my sincere gratitude and appreciation to my lecturer Prof. Silas Oriaso, for his inspiration and tremendous insight, suggestions and encouragement throughout this project.

Thanks to my fellow students who greatly assisted in this research project.

I also thank my God and savior Jesus Christ for giving me life and also the enabling power to accomplish this project.

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## **ABBREVIATIONS AND ACRONYMS**

AFDB	African Development Bank
AWWDA	Athi Water Works Development Agency
ADF	African Development Fund
EIA	Environment Impact Assessment
EMCA	Environment Management and Co-Ordination Act
KNBS	Kenya National Bureau of Statistics
MHEWS	Multi-Hazards Early Warning signs
MWS&I	Ministry of Water Sanitation and Irrigation
NEMA	National Environment and Management Agency
NCWSC	Nairobi City Water and Sewerage Company
NGO	Non-Governmental Organization
NWMP	National Water Master Plan
UN	United Nations
UNDP	United Nations Development Programme
SDG	Sustainable Development Goal
WMO	World Meteorological Organization



## ABSTRACT

Over the years, the water volume and quality at the Nairobi River have deteriorated because of predominantly human interference both from the populace residing along the riverbank and from industrial waste dumped into the river. Sewage and solid waste disposal at the Nairobi River are the major drivers of pollution at the Nairobi River (AWWDA, 2022). This research paper examined the role of communication in the conservation and restoration efforts at the Nairobi River in the face changing climate. Every person has the right to a clean and healthy environment, as stated in Article 42 of the Kenyan Constitution (CoK), 2010, which also includes the right to have the environment protected for the benefit of current and future generations through legislative and other measures, particularly those considered in Article 69. In light of Article 69 of the CoK, 2010, the state is required, among other things, to guarantee the equitable distribution of benefits accruing from the sustainable exploitation, utilization, management, and conservation of the environment and natural resources; promote public involvement in environmental management, protection, and conservation; and eradicate practices and activities that pose a risk to the environment. This study is premised on two-step flow theory by Paul Lazarsfeld which posits that information flows from mass media channels to opinion leaders who interpret the messages before passing them on to the less active members of public. This research project also derives from Everett Rogers' diffusion of innovation theory which serves as a framework for elucidating the gradual process through which a novel idea or products gain momentum and permeates a specific population or social structure. The research design for this study is systematic review. The study applied thematic analysis of national programs, policies and guidelines, stakeholder report and media articles related to the management of water bodies to come up with broad approaches communicators in the niche of conservation and restoration should embrace as topics for messaging. Additionally, strategic documents from various stakeholders were analyzed which revealed various challenges in the implementation of the strategies and therefore proposes solutions to such strategic challenges. The qualitative analysis aspects of the study involved descriptions of the implication of these themes in the management of the Nairobi river and the Nairobi river ecosystem in Kenya. The findings support use of public education more cohesively than in the past to achieve transformation of public attitudes towards sound waste disposal to save the Nairobi River. This was found to require framing communication messages on rules and regulations reflected in the environmental and water governance frameworks to resonate well with the public. Additionally, it was found out that to change public perceptions towards sound waste disposal, incentives – economic, informative and prohibitive – required to be incorporated and operationalized in the agenda setting on water resource protection at institutional and mass media levels. The study's findings projected that there was a need to adopt a multi-stakeholder approach in conservation of Nairobi River.

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.0 Introduction**

This research aimed to understand and communicate on the effectiveness of communication approaches, the key challenges and the opportunity for effective communication as well as propose best practices for communication of the conservation and restoration efforts of the Nairobi River amidst a changing climate.

### **1.1 Background of the Study**

Access to clean and safe water is a pressing global issue, with millions of people worldwide lacking reliable access to clean water sources and sanitation services. Over two billion people do not have access to clean drinking water, and around 4.5 billion do not have access to properly managed sanitation facilities, according to UN estimates. Many health and economic issues are brought on by the pervasive lack of access to sanitary facilities and clean water, especially in developing nations. In Kenya, clean water access is a significant challenge, as many water sources are heavily polluted due to human activities like agriculture, industrialization, and urbanization. Furthermore, the lack of water has been made worse by climate change, especially in the country's semi-arid and dry regions.

The pollution of Nairobi River is a significant environmental issue with far-reaching impacts on Kenya's environment, society, and economy (Milner et al., 2021). Kenya already has many environmental, social, and economic difficulties; the consequences of climate change only make these more difficult (Nyika, 2022). Kenya, with its growing population and diverse economy, relies

heavily on natural resources such as water, land, and biodiversity (Jilo, 2021). Balancing the demands of a growing urban population in Nairobi and a rapidly developing economy adds complexity to the conservation and restoration of Nairobi River.

The study's main goal was to assess the function of communication employed to address these challenges, with a particular focus on the efficacy of strategic communication. The research would therefore encompass several key areas, including an assessment of the current state of conservation and restoration efforts for Nairobi River, an examination of the role of communication in strategies for managing and mitigating climate change impacts, and an exploration of the challenges faced by communities and stakeholders involved in river management.

There is a growing body of literature on the impacts of climate change on water sources in Kenya, including studies on changing precipitation patterns, increased drought frequency and intensity, and variability in water flow (Haile et al., 2020). Similarly, there is an increasing volume of reports that outlined strategies to manage and mitigate climate change impacts, including water conservation and adaptive management (Lal et al., 2011). In order to solve community concerns and guarantee the sustainable use of natural resources in the face of climate change, it is imperative that these results be effectively communicated. In addition to guiding the development of strategies for involving communities and increasing public awareness of the vital importance of safeguarding and managing water sources and ecosystems in the global context of climate change, this research aims to offer insightful information about the obstacles to and prospects for effective climate change communication in Kenya.

River water contamination is a worldwide problem that affects both industrialized and developing nations. Point and non-point sources of pollution are the two types of pollution sources; non-point sources are the most prevalent type. It is important to understand that industrialized nations like the United States, the United Kingdom, Japan, and China all have serious problems with river pollution. River pollution is not just a problem in poor nations. In China, where the Yangtze River, one of the world's longest and most significant rivers, has suffered extensive pollution due to sewage, agricultural waste, and industrial waste. This pollution poses significant environmental and health risks, affecting millions of people who depend on the river for their drinking water.

In Kenya, urbanization, industrialization, and rapid population growth have placed substantial pressure on urban rivers, such as Nairobi, Ngong/Motoine, and Mathare rivers. These rivers are now considered health risks because of the untreated industrial effluent, raw sewage, and solid garbage from human settlements that have been dumped into them throughout their courses. Given the vital role that rivers play in society's well-being, there is a compelling need to conserve and restore them. As a result, the purpose of this study is to evaluate Kenya's urban river corridors and offer viable solutions for their preservation.

## **1.2 Problem Statement**

Despite its potential significance for the environment and society, the Nairobi River and its urban river corridors are today in a badly deteriorated state. These rivers serve as major receptacles for both solid and liquid pollutants, leading to a significant deterioration of their water quality and the overall ecosystem (Henderson & Nakamoto, 2016). Consequently, the water from these rivers is no longer suitable for recreational, domestic, industrial, or agricultural purposes, hindering the

emergence of development opportunities that these rivers could provide. Particularly the Nairobi River, which was essential to the founding and growth of Nairobi City, has endured years of pollution and neglect (Sobowale, 2019).

The pollution of the Nairobi River is attributed to various sources, including polluting industries, developers, individuals, and a lack of effective action by the authorities responsible for its protection. The river was formerly a clean, fresh water supply, but pollution has turned it into a dark liquid that is tainted with dissolved and suspended solids, raw sewage, used oil, and grease. In addition to reducing the river's aesthetic and financial worth, the ongoing rubbish discharge into it has also altered the river's natural flow, which frequently results in floods that harm nearby land uses, claim lives, and pose health problems. The river's natural nature has been altered into an alien landscape devoid of native vegetation and animals due to the encroachment of undesirable land uses such as agriculture, motor vehicle maintenance, and informal settlements. Urgent action is required to address these pressing issues and prevent further destruction of this vital natural heritage.

The growth of Nairobi City has exacerbated pollution, which is a significant driver of climate change and its adverse effects on water sources, communities, livelihoods, and the environment (Sobowale, 2019). This phenomenon is not unique to Nairobi but is likely to be experienced in other developing towns and cities in Kenya as county governments intensify industrialization and population growth. Collaborative efforts among stakeholders are crucial to building understanding, engagement, and action on these issues and to develop effective strategies to manage and mitigate the impacts of climate change (Henderson & Nakamoto, 2016).

To address these challenges, this research aimed to investigate the effectiveness of communication frameworks and approaches between stakeholders involved directly or indirectly in the conservation and restoration of the Nairobi River and its urban river corridors. The study would also seek to identify best practices for communicating climate change and its impacts, as well as key stakeholders critical to the success of these efforts. Therefore, the study is crucial as it provides insights into the current state of river conservation and restoration efforts in Kenya, offer valuable recommendations for improving communication models among stakeholders, and help create practical plans for protecting and managing natural resources in the face of climate change and environmental deterioration.

## **Objectives of the Study**

### **1.3.1 Overall Objective**

The overall objective was to examine the function of communication in the preservation and restoration of the status of the Nairobi River in the face of climate change.

### **1.3.2 Specific Objectives**

- i.**To explore current communication strategies for conservation and restoration efforts of water sources at the Nairobi River.
- ii.**To assess best practices for communicating conservation and restoration efforts of water sources at the Nairobi River.
- iii.**To identify communication challenges hindering effective communication of conservation and restoration in the management of water sources in Kenya.

#### **1.4 Justification of the Study**

The degradation of Nairobi River and its urban river corridors due to pollution from various industrial, commercial, and residential sources is a pressing issue (Sobowale, 2019). This research aimed to prevent further degradation, reclaim recreational spaces, protect biodiversity, and diversify development opportunities. It is crucial to safeguard the health, safety, and environmental quality of city residents and downstream communities. This study directly addressed these urgent environmental concerns and aligned with the need for urban river conservation.

Menge (2013), through a study have recognized the importance of effective communication in environmental conservation. This study sought to build on this knowledge by exploring the role of communication in urban river conservation, especially in a larger and more complex urban context. It aimed to provide insights into the role of communication strategies in preserving urban river corridors, considering a wider study population and more complex environmental challenges. Given the increasing pressure on natural resources due to urbanization and population growth (Sobowale, 2019), this research held significance in addressing the impacts of climate change on water sources. It contributed to developing evidence-based strategies for managing these resources, mitigating climate change effects, and raising awareness among various stakeholders. The study findings will therefore, support the development of effective communication strategies to engage communities in protecting and managing water sources in the face of climate change.

The outcomes of this research have practical implications for policy-making, guiding interventions by governmental agencies, NGOs, academic institutions, and communities. The study was of

interest to and had an impact on a variety of stakeholders as it offered insightful information about the obstacles to and prospects for successful communication about climate change and water source management. This would promote cooperation and well-informed decision-making (Sobowale, 2019). The Kenyan population expected to double and exert greater pressure on natural resources, including water, the findings of this research would be highly relevant for future planning and water resource management (Sobowale, 2019). Engaging various stakeholders, including policymakers, communities, NGOs, and the private sector, is crucial for a more sustainable and resilient future. Thus, the results of the study would be crucial in guiding and formulating plans to deal with the problems brought on by climate change and the preservation of Kenya's water resources.

### **1.5 Scope of the Study**

Nairobi, the capital city of Kenya, depends heavily on the Nairobi River for its water supply. It originates in the Ondiri Swamp, located in Kikuyu, a town in Kiambu County. The swamp serves as a critical water source for the Nairobi River and provides an important habitat for several aquatic species. The swamp was previously a lake which degraded due to deforestation and soil erosion which resulted into plants overrunning the lake. The river then flows downstream, passing through several residential and commercial areas, including Nairobi's central business district. As it flows downstream, the river passes through several communities, including the densely populated informal settlements of Korogocho, Kibera and Mathare. These settlements are known for their poor living conditions and lack of basic services, including clean water and sanitation. Further downstream, the Nairobi River meets the Athi River, which originates from the Aberdare Mountains.



The Athi River is also an important source of water for Nairobi, and its confluence with the Nairobi River forms a critical water source for the city. This study's focus was on how well various parties involved in the preservation and restoration of the Nairobi River communicate with one another. In addition, the study also focused on waste management aiming to reduce pollution in the river trough establishing sound waste disposal systems. This includes the installation of trash traps and the implementation of community-based waste management programs. The third aspect that the study focused on was water conservation; where given the water scarcity in the area, water conservation efforts were being implemented. These include rainwater harvesting and the promotion of efficient irrigation practices. Moreover, public awareness campaigns are being conducted to educate people about the importance of the Nairobi River and the need to protect it. This includes engaging with local communities, schools, and businesses. Sustainable agriculture practices are also being promoted to reduce pollution from agricultural runoff. This includes the use of natural fertilizers and the promotion of crop rotation. Finally, the Nairobi River is impacted by untreated sewage, so efforts are being made to improve sewage treatment infrastructure.

### **1.6 Limitations of the Study**

It is important to acknowledge the many limitations of this study. Firstly, the research will be restricted to Kenya, and it could be necessary to extrapolate the results to other nations or areas. Secondly, the study would be based on secondary data sources and, as such, may need to fully capture the complexity and diversity of the issue. Finally, the study would be limited in terms of the period and may not capture longer-term trends or changes in the measurability of climate change impacts on natural water resources. Climate change effects on the state of natural resources

are slow and gradual and may happen over a couple of decades of years. Despite these limitations, the study provided valuable insights into the communication of climate change and its impacts on the management of water sources in Kenya and contributes to the development of a deeper understanding of this critical issue.

### **1.7 Definition of Terms**

**Climate change:** Long-term modifications to the typical weather patterns that have come to characterize a region's local climate are referred to as climate change (Prakash, 2021). Human activities like burning fossil fuels and deforestation send greenhouse gases into the atmosphere, trapping heat and raising global temperatures, which are the causes of climate change (Rajak, 2021).

**Communication:** Communication refers to the transfer of information and ideas from one person or group to another and can take many forms, including speech, writing, and media (Görke& Scholl, 2006). Effective communication is critical to building understanding and engagement and to support the development of effective strategies to manage and mitigate the impacts of climate change.

**Eutrophication:** As used in this text refers the process through which water becomes contaminated with algae and bacteria toxins from sewage disposal into river water.

**Ecosystem:** An ecosystem refers to a complex network of living and non-living components that interact with one another to create a functional system (Hart, 2019). This can include everything from plants and animals to water, soil, and air and can range in scale from a single pond to a vast ocean.

**Hydrologic Cycle:** There are two stages to the hydrologic cycle (Shiklomanov, 1993). The first phase is the atmospheric phase, which depicts the movement of water in the atmosphere as a gas (water vapor) and a liquid or solid (rain or snow). The second phase explains the water's travel over the land, including infiltration and runoff.

**Management:** Management refers to the process of overseeing, controlling, and directing the use and distribution of resources, such as water sources and ecosystems (Tien, 2019). This can include strategies such as conservation, allocation, and regulation.

**Precipitation:** This includes rain, sleet, hail, fog, and any other form of atmospheric water condensation that falls due to gravity (Shiklomanov, 1993).

**Water sources:** Water sources refer to the sources of water, such as rivers, lakes, groundwater, and reservoirs, that provide water for human consumption, agriculture, and other uses (Looman, Maher, & Santos, 2021).

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Water resources are essential for sustaining life, ecosystems, and socio-economic development. In regions like Nairobi, where rapid urbanization and climate change pose significant challenges to water availability and quality, effective communication strategies play a pivotal role in the conservation and restoration of water resources. The Nairobi River, once a lifeline for the city, now faces degradation due to pollution, encroachment, and unsustainable practices. This literature review explored the critical role of communication in addressing the multifaceted challenges of conserving and restoring the Nairobi River's water resources.

Nairobi's growth has strained the capacity of the Nairobi River Basin to meet the escalating demand for water, sanitation, and industrial needs. Water pollution, driven by urbanization, industrial discharges, and inadequate waste management, has left the river in a state of distress. Climate change exacerbates these issues, leading to irregular rainfall patterns and increasing the risk of droughts and flooding. Consequently, the Nairobi River's health is intricately linked to the well-being of the city and its residents. Conservation and restoration efforts are not only imperative for maintaining the ecosystem's integrity but also for safeguarding human health and ensuring sustainable development.

Effective communication serves as the key player for mobilizing communities, engaging stakeholders, and influencing policy decisions in the conservation and restoration of the Nairobi River. This literature review delved into the existing communication strategies, best practices, and

the challenges that impede the success of these initiatives. It also drew on theories and empirical evidence to offer insights into how communication could bridge the gap between scientific knowledge, community engagement, and policy implementation.

The following sections explore current communication strategies, best practices, and challenges, drawing recommendations for enhancing the role of communication in the conservation and restoration of water resources at the Nairobi River. In a world grappling with water scarcity and environmental degradation, the Nairobi River serves as a microcosm of the broader challenges faced by urban water bodies globally. The lessons learned here can offer valuable insights for other regions grappling with similar issues, making the role of communication in water conservation and restoration an issue of global significance.

## **2.2. Empirical Literature Review**

### **2.2.1 Climate change and variability**

Based on the United Nations Framework Convention on climatic Change (UNFCCC) report of 2007, a number of African regions are subject to some of the most marked seasonal and decadal climatic fluctuations globally. Droughts and floods are happening more often, and they frequently happen in the same places at close intervals. According to reports, a third of Africa's population lives in drought-prone areas, and many more are at danger of drought every year (UNEP, 2010; Lobell et al., 2008). Over the past 10 years, extended droughts brought about by climate change have severely disrupted Kenya, posing a danger to food security and social stability, particularly in sensitive pastoral regions (GoK 2007; UNDP 2007).

In Africa, a number of variables both cause and worsen the effects of the current climatic variability. According to the IPCC (2007), these elements will make it more difficult for the continent to adapt to climate change. According to the UNFCCC (2007), these issues include low educational and healthcare standards, low literacy rates, inadequate skills, weak institutional structures, restricted infrastructure, lack of technology and information, inadequate resource access, limited managerial capacities, and violent conflicts. Given that more than 40% of Africans live in arid, semi-arid, and dry sub-humid regions and that 60% of them live in rural areas and depend on agriculture for a living, water is essential to maintaining livelihoods (UNEP, 2010). Aridity-wise, Africa is ranked second only to Australia. The water resources of the continent are distributed unevenly, with approximately half of the total inland water reserves located in central Africa (UNEP, 2006).

Significant changes in runoff patterns are expected in Africa (IPCC, 2007). Restrictions on hydrological cycles in different places and a decrease in average annual precipitation are predicted by several climate models. Trends over the last ten years have shown that there have been more extended and frequent droughts as well as more floods (UNEP, 2007). By 2050, the average yearly discharge in significant river basins may have decreased by up to 32% (IPCC, 2007). Due to changes in land use, including the expansion of agriculture, urbanization, and population increase, climate change is expected to escalate the current demand on water supplies.

Changes in temperature and precipitation have already affected runoff and water availability in Kenya for a variety of uses, including home and agricultural needs. Forecast patterns indicate increasing temperatures and less consistent rainfall, increasing the risk of droughts and floods (Few

et al., 2006; WBGU 2007). Thirty percent of Kenya's geographical area is made up of arid and semi-arid areas (ASALs), where droughts are a common occurrence (GoK 2007).

The primary causes of the 25% expected decline in runoff (IPCC, 2007) in many regions of the continent are increased rates of evapotranspiration and less rainfall. According to projections, the frequency of these occurrences will rise, leading to higher total rainfall and more variability in precipitation (Christensen et al., 2007; McSweeney et al., 2008). Drought conditions are predicted to occur in more areas, which will have a substantial impact on a number of industries, including public health, energy production, agriculture, and water supply. In addition, it is anticipated that the need for irrigation would increase throughout the continent (UNEP, 2006). Naanyu (2013) emphasizes that developing nations' primary concern is ensuring food security in the face of climate change. Millions of farmers, fishermen, herders, and foresters depend on their livelihoods from harsh weather, temperature fluctuations, erratic seasonality, and other stresses, therefore it is especially important for them. For them, it is a question of survival.

### **2.2.2. Communication technologies and their role in addressing conservation and restoration of water sources**

Mobile phones are continuously reshaping the landscape of development in ways that were not previously foreseen, even within the conservation and restoration of water sources (Heimbuch, 2009; Houghton, 2009). For instance, there are instances such as the Android application of Field Level Operations Watch (FLOW), which is instrumental in data collection, analysis, and reporting for climate change-related initiatives. However, significant challenges persist in Africa that hinder the widespread adoption of ICT-based solutions for conservation and restoration of water sources.

These difficulties vary between nations and even within them, as seen in the differences between urban and rural locations as well as between various ecosystems (Finlay & Adera, 2012).

Moreover, a new wave of ICT growth has recently emerged on the African continent, characterized by the installation of data centers, value-added services, broadband fiber optic connections, and IT breakthroughs. Prices have decreased as a result of these improvements, which have also raised demand for ICT equipment and boosted spending on ICTs and local content. ICT spending in Africa was expected to reach USD 25 billion in 2011, an increase of 10% (IDC, 2011). Emerging narratives from marginalized groups highlight the increasing use of ICTs (information and communication technologies) such as mobile phones, the internet, and community radio in addressing climate change issues. These incidents also demonstrate the importance of an e-resilience strategy, which sees past surface-level impacts to understand how ICTs can, though occasionally failing, have a deeper and more systemic impact that supports resource management in communities and countries (Ospina and Heeks, 2010a).

Numerous scholarly investigations demonstrated the growing significance of Information and Communication Technologies (ICTs) in the administration of water resources impacted by global warming. Nonetheless, the majority of this literature offered theoretical underpinnings and global viewpoints, with only a few ideas derived from real-world fieldwork. As a result, there was a significant knowledge and application gap, especially when it comes to enhancing the security of water sources in marginal habitats and among vulnerable populations. In addition to examining future standards that may make it easier to successfully implement smart water management efforts, the ITU-T Technology Watch Report (ITU, 2011) provides an overview of how ICTs



might act as a strategic facilitator for the creation of smart water management policy. Key research problems that require further research are identified in the African Global Environmental Change Research Agenda and Science Plan (Odada et al., 2008), particularly when combined with the capabilities of ICTs.

Research on the application of ICTs to climate-related problems in water source management has been done through scoping studies. These studies have looked at prediction, mitigation, monitoring, and increasingly, adaptation, as well as the development of institutional or national strategies (Heeks and Ospina, 2009; Houghton, 2009; Maumbe and Okello, 2010; Schuol et al., 2009; SEI, 2009). Particular emphasis had been placed on the necessity of creatively integrating ICTs into water source management systems' mitigation, monitoring, adaptation, and strategic planning by Ospina and Heeks (2010b) and Kalas and Finlay (2009). Ospina and Heeks's comprehensive approach reveals areas of existing research gaps and upcoming subjects that require more investigation. Given the shifting goals and viewpoints, the interdependence of ICTs, climate change, and the fragility of water systems and populations, these findings are especially relevant for Kenya. The demand for collaboration and knowledge exchange across institutions, governments, and communities is growing as a result of the problems that information and communication technologies (ICTs) provide in the context of climate change and its effects on numerous sectors, including the water sector.

Finlay and Adera (2012) highlighted that the goal of implementing ICT platforms, tools, and protocols is to make it easier for different stakeholders involved in water management to communicate and provide feedback on how best to collect, store, analyze, distribute, and use data.

These ICT instruments might be anything from basic mobile phones to robust and sophisticated field sensors, telemetric data transfer, and satellite-based remote hydrological condition monitoring. The selection of tools is contingent upon several aspects, including the amount of digital data to be transferred and the geographic coverage. With the use of these technologies, water consumers and system administrators may better understand the state of their water systems and anticipate future events.

New technological platforms are crucial for sustainable urban water resource management, as they require smart sensing and efficient data handling for optimization. A good example is the FP7 WISDOM project, Zarli et al., (2014), which aims to optimize water distribution networks and modify consumer behavior through creative demand management and adaptive pricing schemes. This would result in significant improvements in water (and energy) conservation through the integration of innovative Information and Communication Technologies (ICT) frameworks. In order to provide near real-time management of urban water resources, the WISDOM strategy combines sensor monitoring and communication technologies with semantic modeling (using ontologies to construct intelligent links throughout the entire framework) and control capabilities. Initial testing of the WISDOM framework will take place in water facilities in Cardiff, UK, and La Spezia, Italy, as well as in an experimental facility in France. The framework will be modeled and simulated. These pilot programs evaluate the integrated idea and offer insightful information for further implementation.

### **2.2.3. Current communication strategies for conservation and restoration of water sources**

Research carried out in Kenya had demonstrated that efficient communication is essential to managing the Nairobi River and its ecology. For instance, good communication boosted stakeholder involvement, which in turn led to improved water resource management practices, according to a research by Kimathi et al. (2017) on the communication tactics employed in the management of water resources in Kenya. In a similar vein, Wambugu et al.'s (2020) study discovered that encouraging behavioral shift toward sustainable water usage practices among Kenyan households required effective communication. However, the empirical literature also highlighted several challenges in communication in the management of the Nairobi River and the Nairobi River ecosystem in Kenya. These challenges include limited access to information, inadequate resources for communication, language barriers, and inadequate coordination among stakeholders (Odada & Oyieke, 2019; Mugambi *et al.*, 2021). Additionally, the literature highlighted the need for more research on effective communication strategies using sustainable water management practices in the Kenyan context.

Successful water source management hinges on the active participation of various stakeholders, including government bodies, utility companies, businesses, and the general public (Howarth & Butler, 2004). One of the most important components of developing resilience is fostering societal acceptability, which is largely dependent on stakeholder engagement and involvement. Good stakeholder involvement, especially with water users, has the potential to promote positive behavioral changes, enhance investment in and support for sustainability (Gouldson et al., 2008), and aid in the creation of communities that are resilient to water shortages (Weitkamp, McEwen & Ramirez, 2020). In this scenario, communication revolves around stakeholder participation, and

the additional knowledge acquired assists in making informed decisions to achieve communication objectives.

It is crucial to communicate during water-related environmental extremes like droughts and floods, especially for the impacted communities. To improve resilience via efficient two-way communication, it would be critical to include the knowledge and efforts of pertinent stakeholders (Boyd et al., 2013). This method would promote mutual understanding, increasing trust between communicators, and making it easier for people to share their perspectives, information, and practices. Mefalopulos (2005) argued that communication should be carefully designed to allow stakeholders to share their perceptions, knowledge, and practices while taking into account the various perspectives, needs, and knowledge held by different stakeholders. She suggests that the traditional approach to media and message communication design is insufficient.

Water conservation communication campaigns were found more impactful when planned to give stakeholders the opportunity to express their perspectives and expertise, since this will increase the message's credibility. Giving the audience instructions on what to do may seem simple, yet communication efficacy is frequently questioned (Kaplan, 2000). The issue could perhaps stem from the design of the advertising message, which entails the skillful creation of a messaging strategy that forges a bond with the target audience. The field of social marketing has recognized the value of message design and message strategy (Niederdeppe et al., 2008; Black et al., 2002).

Any remark, phrase, or phrasing communicated to an audience—whether spoken or written—is considered an advertising message. The public needs messages that are succinct, provide clear

direction, and provide consistent data. Additionally, the language used in the message should be chosen such that it appeals to a variety of values, supports social norms, arouses feelings, and activates particular biases (Kusmanoff et al., 2020). The message's design should take into account its ability to encourage the intended audience to react to the source, provoke behavioral and attitudinal shifts, and spark conversations in real and virtual spaces—a phenomenon commonly known as "word-of-mouth." Transparency is the cornerstone of utility success and a crucial component of good communication (Smith, 2019). Increased managerial trust is fostered by transparent information (Jones et al., 2010). Water users may, for instance, receive clear information regarding water usage at the household level and public water consumption habits.

It's equally critical to be able to communicate the effects of changing behavior. Effective communication has the power to inspire people to take action by educating them about the importance of making little but meaningful changes in their own lives (Kaplan, 2000). This may be accomplished by educating people about the advantages of doing pro-environmental acts, which in turn creates favorable feelings and deters unsustainable behavior (Nisbet & Gick, 2008). According to Gilbertson et al. (2011), future messaging encouraging water conservation should also emphasize the beneficial effects that behavioral modifications may have on the society as a whole and the social advantages that come with making more adjustments (Rumble et al., 2017).

Especially for those who have a deep connection to nature, representing environmental values is important in encouraging sustainable actions (Schultz et al., 2000; Nisbet et al., 2010). Giving environmental values makes people feel more connected to the environment and encourages them to act in an ecologically beneficial way (Nisbet & Gick, 2008). The desire to solve environmental

challenges increases with one's view of the importance of the environment. Good communication should highlight the negative effects ignorance has on the environment. Leading people through the phases of positive change requires educational and informational communication to help the public see possible trade-offs and make educated decisions (Nisbet & Gick, 2008). According to Kusmanoff et al. (2020), the way environmental concerns are framed can have an impact on public opinion and judgment, which can affect their ability to respond positively. Therefore, in order to establish a connection between environmental concern and empathy, communication should also inform the audience about the negative effects that neglect has on the environment.

One crucial component of communication was found to be the capacity to make the audience picture life without water. Effective communication greatly depends on the effects of the drought being visible (Hannaford et al., 2018). As a result, the message must be able to make the listener imagine the effects of a water shortage (Gilbertson et al., 2011). This explains why water conservation initiatives that are launched after a drought crisis has ended are less successful (March et al., 2015). Before the repercussions of a drought can be acknowledged and shared, the general public frequently needs to see the effects of the drought and the full magnitude of the event if the effects have been minimized or hidden. Zhuang et al. (2018) conducted a study to examine the impact of messaging presented with distinct temporal perspectives, namely present and future, on people's attitudes and actions related to water conservation. The study found that, in contrast to a future-framed communication, a present-framed message produced a more favorable attitude toward water conservation (Zhuang et al., 2018). This emphasized how successful short-term warning about natural hazards is.

Message design has a direct bearing on how successful advertising communications are; it may affect communication's trustworthiness and informativeness. The messaging technique may arouse feelings, depending on message design and presentation. According to Pulizzi (2012), social media technologies have facilitated content marketing and highlighted the significance of narrative, which is now a vital component in drawing in and keeping clients. According to Padgett and Allen (1997), storytelling is a type of narrative that helps people digest information and builds a stronger bond with a business. Effective communication in advertising relies heavily on storytelling (Kang Hong and Hubbard, 2020). Water utilities ought to think about taking on the role of storytellers and explaining the science, engineering, and financial commitments that go into creating sustainable water sources (Smith, 2019). According to Kang Hong and Hubbard (2020), this type of communication successfully elicits an emotional reaction from the audience, mostly through factual or poignant tales (Wearn & Shepherd, 2020).

Because they may connect the story to their own experiences, the audience's view of the material is shaped by these connections. This has to do with the self-reference tactic. It has been proposed that when something seems familiar and related to them, people are more likely to recall it (Bower & Gilligan, 1979). Customers are persuaded by this tactic because it helps them remember the information offered by allowing them to make connections between the marketing content and themselves or their experiences (Meyers-Levy & Peracchio, 1996; Rogers et al., 1977). According to Meyers-Levy and Peracchio's 1996 proposal, viewers may be more receptive to information if it is connected to their own experiences and recollections. Building a relationship with an advertising through recollection and past interactions can positively influence brand sentiments.

#### **2.2.4. Best practices for communicating conservation and restoration of water sources**

Effective communication strategies can significantly enhance the impact of water conservation initiatives. Creating a strategic communication strategy that includes targeted message, takes the target audience into account, and chooses the right channels of communication is crucial to supporting an organized communication effort. In order to help Extension specialists and other practitioners who are active in water conservation communication, this publication provided a thorough review of excellent communication methods in the context of water conservation initiatives.

Research conducted by Richetin et al. (2014), Rumble et al. (2017), and Warner et al. (2015) demonstrated that utilizing normative views and combining both gain-frames and social-value frames could be effective. Studies show that urban dwellers are more likely to embrace water conservation measures when they see them as community-endorsed activities or as social norms (gain-frame and value-frame). Positive messaging that emphasizes the advantages of taking action is often more successful than negative messaging that focuses on the consequences of inaction. The following are some instances of gain and loss frames that conform to societal norms: One of the best practices for conserving and restoring water sources has been determined to be using printed materials and websites as the main routes of communication. Research demonstrated that the intended recipients of these communications are more likely to be interested in finding out more information via print materials (such as brochures or fact sheets), websites, or television (Lamm et al., 2016; Warner et al., 2017). In order to accommodate this choice and be in line with current Extension and educational initiatives, it is imperative that workshop participants be directed to websites for more information, either by spoken instructions or handouts with pertinent



links. Furthermore, wherever feasible, provide workshop materials in alternate media, such as printed materials and websites.

A good communication plan should target certain important audiences with the message. The people who are most likely to be interested in your products and information are your target audiences, as are the people you hope to reach with your outreach. These target audiences may include certain categories, but they are not restricted to them. First, there is the group of people who care about water concerns but have room to grow in their adoption of water-saving measures (also known as the water-considerate majority). Women who are eager to embrace new techniques and participate in additional educational outreach are often included in this audience (Warner et al., 2016).

Another recommended approach for communicating conservation and restoration projects was to center material around actions and subjects that correspond with the particular needs, interests, and openness to learning of your target audiences. Topics like sprinkler system efficiency and timing for irrigation are of great interest to residential audiences when it comes to home landscaping and water saving. These audiences are also interested in topics related to water conservation, such as access to clean water for recreational purposes, the cleanliness of big bodies of water, and local water quality (Warner et al., 2016; Warner et al., 2018). When it comes to large-scale landscape changes, smart irrigation systems, and conserving water quality, residential audiences have shown lower levels of self-efficacy (Warner et al., 2018). This suggests that they are not confident in their capacity to carry out or apply some of these procedures, which reduces their likelihood of doing so. If any of these three themes are included in your communications, it's critical to give your

audience clear directions on how to do these jobs and build their trust in the useful implementation of these management techniques.

#### **2.2.5. Communication challenges hindering effective communication of conservation of water resources**

The quantity and quality of water resources as well as the ecosystems of river basins have been significantly impacted by human activity (UNCHS, 1995). Water, the foundation of life, is used for many things: residential consumption, industrial activities, agriculture, hydropower production, and more. In order to fulfill the demands of industrialized countries, developing metropolitan areas, and expanding populations, the world's water consumption has tripled during the last forty (40) years. Significant advances in science and technology over the 20th century have made it possible to use water resources extensively. Because of this exploitation, massive dams, man-made lakes covering hundreds of square kilometers, and irrigation projects have been built. Protecting aquatic habitats, water resources, and water quality is now a challenge. Problems including declining freshwater supplies, declining water quality, and groundwater and surface pollution affect many parts of the world. A number of significant issues are responsible for the deterioration of river quality, such as improper agricultural practices, shifting cultivation, habitat loss, industrial effluent, and household sewage.

Water-related projects like dams, river diversions, and irrigation plans have a big influence on aquatic ecosystems. Thus, evaluating the effects of water use on the environment, maintaining river basins, maintaining ecosystem health, and ensuring public health should be the main priorities of conservation efforts. The utilization of river resources must align with the principles of

environmental protection, ensuring that it does not harm the natural foundation of rivers (Boon, 1992). One of the primary obstacles to effective communication in water source management in Kenya is the lack of awareness and understanding among various stakeholders, especially in rural areas. Many people do not fully grasp the importance of preserving and restoring water sources (Chepyegon & Kamiya, 2018). This lack of awareness hampers their ability to appreciate the significance of conservation initiatives. Communicating the value of water source management and the consequences of neglect is a crucial but challenging task.

Kenya's linguistic and cultural diversity is a considerable hurdle to effective communication. To reach diverse communities across the country, messages must be communicated in languages and through channels that are culturally relevant (Burgess *et al.*, 1998). Failure to do so can lead to messages being misunderstood or misinterpreted. The country's various ethnic groups have distinct languages, traditions, and customs, making it essential to tailor messages to each community. Without culturally sensitive communication, there is a risk of resistance or a lack of engagement in conservation efforts. Limited access to information and technology, particularly in rural and remote regions, poses a significant challenge (Adeleke, 2019). In areas with inadequate access to the internet, television, and radio, disseminating crucial information about water source conservation becomes difficult. Without reliable communication channels, remote communities may miss out on essential knowledge and updates about conservation and restoration initiatives. Bridging the digital divide to ensure that conservation messages reach all segments of the population, regardless of their location or access to technology, is a pressing issue.

To overcome these challenges, effective communication strategies should prioritize community engagement and education. Tailored approaches should aim to raise awareness about the importance of water source conservation while considering linguistic and cultural diversity (Omondi, 2020). Additionally, leveraging accessible communication channels, such as community meetings, local radio stations, or mobile messaging, can help ensure that even the most remote communities receive the vital information they need to support and participate in water source management efforts. Effective communication would be a key factor in achieving successful conservation and restoration of water sources in Kenya.

### **2.3. Theoretical Literature Review**

Effectively conveying information from the recipient to the intended audience is a multifaceted endeavor that necessitates meticulous preparation to achieve the desired influence. It is essential to present the information in a manner that is persuasive to the target audience, encouraging them to alter their perspectives and interpretations of various matters. The study drew upon multiple theories to elucidate effective strategies, employing an inclusive approach to construct the theoretical framework. Two theories, specifically the Two-Step-Flow Theory and the Diffusion of Innovation Theory, were employed to recognize existing discussions and insights while also gaining an understanding of the advantages and limitations of current knowledge (Higgs *et al.*, 2009).

#### **2.3.1 The Two-Step-Flow Theory**

This theory was introduced by Paul Lazarsfeld and Katz in 1944, posits that information flows from mass media channels to opinion leaders, who interpret the message before passing it on to

the less active members of the public (Lazarsfeld & Katz, 1944). Opinion leaders are respected figures in the community, such as church leaders, teachers, politicians, clan elders, and experts in various fields. They hold the trust of the community, making their word highly influential. In essence, information can travel from policy makers to opinion leaders, who act as intermediaries to ensure that the information reaches the broader audience. This theory aimed to prevent anyone from being excluded when conveying information, considering that different audience members receive, interpret, and act on information selectively.

Glock and Nicosia's studies in 1966 suggested that opinion leaders serve as sources of social pressure to influence a particular choice and provide social support to reinforce that choice (Glock & Nicosia, 1966). Opinion leaders attain their influential positions based on their knowledge of matters beyond their immediate social circles. Social pressure and social support play vital roles in motivating individuals to act in a particular way. Opinion leaders provide the reinforcement needed to create a significant impact. The use of social pressure, not necessarily through force but through consistent and sustained pressure, can lead to successful activities.

The Two-Step-Flow Theory emphasized the significance of personal contact and interaction in communication. It was characterized by non-purposive, casual conversations that are flexible and conducted with trust (Lazarsfeld & Katz, 1944). This approach allows for countering resistance, and it is more effective than print and electronic media in certain cases. Personal contacts carry more weight and trust compared to media, as people can gauge sincerity and honesty through non-verbal cues and body language. These features make personal communication more persuasive and influential.

To enhance the Two-Step-Flow Theory, Menzel in 1963 argues that the abundance of information channels inundates individuals and can be overwhelming (Menzel, 1963). As a result, individuals often turn to peers for help in evaluating the information they receive. This indicates that word-of-mouth communication is among the most effective methods of conveying messages. By reaching opinion leaders through other media channels, such as print and electronic media, word-of-mouth discussions are initiated. Opinion leaders are a crucial component of society for digesting and articulating issues for the common good.

It is worth noting that the Two-Step-Flow Theory doesn't fully address aspects such as the active participation of opinion leaders in adopting and implementing the information they receive as true. The enthusiasm of opinion leaders in embracing new ideas is crucial in influencing the general public to change their attitudes and behaviors for the better. To address this gap and provide a more comprehensive understanding of the impact of communication campaigns, the Diffusion of Innovation Theory is used in conjunction with the Two-Step-Flow Theory. These theories enriched the study and aimed to achieve the desired impact of communication campaigns, particularly in environmental conservation programs. The Two-Step-Flow Theory helps explain the role of opinion leaders in influencing community attitudes and behavior, while the Diffusion of Innovation Theory offers insights into how ideas spread and are adopted in the community.

The Two-Step-Flow Theory proves valuable in understanding why certain media campaigns fail to alter community attitudes and behaviors in environmental conservation programs (Lazarsfeld & Katz, 1944). It aids in predicting the effects of media messages on audience behavior and

underscores the role of opinion leaders in exerting influence to embrace environmental conservation activities. The theory highlights the strong interpersonal relationships within mass communication and the importance of informal personal contacts in influencing sustainable development through environmental conservation activities.

In instances where the Two-Step-Flow Theory alone cannot fully explain how information is received and adopted by the community to effect change, the Diffusion of Innovation Theory complements it (Menzel, 1963). The latter theory addresses the spread of ideas, how they are received, and the changes they bring about among community members. Together, these theories bridge communication gaps and provide insights into aspects that cannot be adequately addressed by the Two-Step-Flow Theory alone.

### **2.3.2 Diffusion of Innovation Theory**

Everett Rogers (1962) is credited with formulating the Diffusion of Innovation theory, which serves as a framework for elucidating the gradual process through which a novel idea or product gains momentum and permeates a specific population or social structure. According to Rogers, individuals within a social context eventually embrace an innovative concept, behavior, or product, signifying a departure from their prior practices. The central premise of this adoption process hinges on individuals perceiving the idea, behavior, or product as an inventive departure from the established norm, thus paving the way for its dissemination.

Rogers goes on to elaborate that the acceptance of a new idea, behavior, or product doesn't happen in an instant; rather, it unfolds progressively, with certain individuals being predisposed to early

acceptance of innovation in contrast to others who adopt innovations at a later stage. These early adopters exhibit distinctive characteristics that distinguish them from those who embrace innovations in subsequent phases. To effectively facilitate adoption, comprehending the characteristics of the target demographic is vital in discerning the factors that may either facilitate or hinder the acceptance of innovation, thereby enabling necessary adjustments to the communication strategy.

Rogers classifies five established adopter segments that illustrate the diverse characteristics of the target audience. When promoting an innovation, tailored strategies are typically employed to resonate with each adopter category. These segments comprise: innovators, early adopters, early majority, late majority and laggards. The adoption of innovation encompasses several stages, including recognizing the necessity for an innovation, deciding to accept or reject it, conducting initial trials to test it, and ultimately continuing its use. Five primary factors influence the adoption of innovation, with their relevance varying across the adopter categories.

Adoption hinges on the perception that the innovation surpasses its predecessor in terms of idea, program, or product. How well an invention fits the requirements, experiences, and values of potential users. The degree of complexity involved in comprehending or using the invention. The degree to which an idea may be tried out or evaluated before being fully adopted. The degree to which the invention produces measurable, observable outcomes. The Diffusion of Innovation hypothesis explores communication's complexities and acknowledges the variety of ways people perceive, accept, and use innovations. It underscores the need for comprehensive strategies customized to address the distinct communication requirements of diverse individuals. This theory

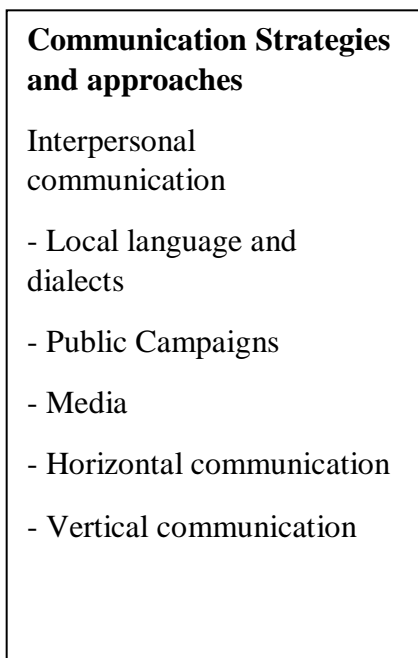


serves as an invaluable instrument for comprehending the acquisition of ideas, their sources, reception by the target audience, and the motivations behind either embracing or resisting these innovations, considering the varied rationales that underlie the actions of the community.

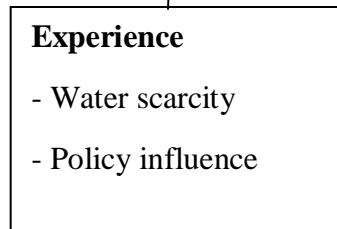
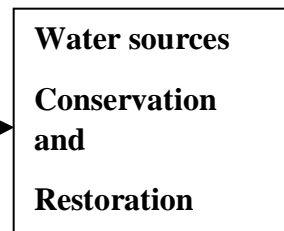
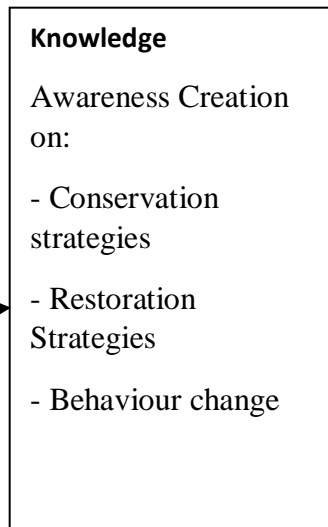
## **2.4 Conceptual Framework**

The success of communication strategies on water sources conservation and restoration relies heavily on its effectiveness in addressing the challenges. Altering the behavior and mindset of the community can be achieved through well-crafted messages that aim to influence them, rather than resorting to coercion to force acceptance of ideas they may not inherently embrace

**Independent Variable**



**Dependent Variable**



**Intervening variable**

**Fig 1: Conceptual Framework**

**Source: Author (2023).**

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1. Introduction**

This chapter describes the study's methodology and research strategy. With an emphasis on how climate change is affecting these resources, the study attempts to explore the function of communication tactics in the management of Kenya's Nairobi River and Nairobi River environment. This river was chosen because it perfectly reflects the issues that face water supplies in the center of established and industrialized cities, which are shared by the majority of emerging cities. An overview of the research design, target population, instruments, sample and sampling strategy, data collecting process, data analysis and presentation, ethical issues, and chapter summary are given in this chapter.

#### **3.2. Research Design**

This study adopted a systematic review design. The primary focus was thematic analysis of policies, national programs, and guidelines related to water resource management. The analysis involved gaining insights into consolidated preventive actions and penalties as outlined in different policy documents. The main objective was to identify comprehensive approaches that stakeholders should embrace and communicate effectively. Additionally, the study examined strategic documents of various stakeholders to identify challenges in implementing their strategies and proposes solutions to address these challenges. The quantitative aspect of the study involved analyzing the frequency of themes across documents, while the qualitative aspect entailed describing the implications of these themes on the management of the Nairobi River and its ecosystem in Kenya.

### **3.3. Target Population**

The target population for this study consisted of documented policies on water management in Kenya, strategic plans of key stakeholders, reports on projects implemented by these stakeholders, and mainstream print media reports related to the thematic study areas.

### **3.4. Sample Frame and Sampling Technique**

#### **3.4.1. Sampling and Sample Size**

The study analyzed and evaluated the content of documents that focus on the study's objectives. The findings provided meaningful insights to examine the efficacy of communication and stakeholder approaches, identify challenges and opportunities in communication for the conservation and restoration of the Nairobi River. The study aimed to develop insights and recommend best practices applicable on a large scale for water body conservation and restoration.

#### **3.4.2. Sample Size**

In qualitative studies, it is common to base data on up to 30 informants (Fridlund & Hildingh, 2000). The inclusion criterion, this research applied the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) elaboration and explanation which is designed primarily for systematic review of documents (Moher et. al 2020). A total of 76 publications were retrieved, of which 48 did not meet the inclusion criteria for the systematic review. Out of the 48 publications that were excluded from the study; twenty-two (22) were found to be related to other themes of agriculture, forestry other than water protection and conservation while some were duplicated reports, twelve (12) were found to be outside the context of environmental protection specifically

rivers but related to wider lakes & marine ecosystem, three (3) were outside duration for the publications of this research which spanned from the year 1999 – 2022 to while eleven (11) did not contain water protection themes in Kenyan context.

The twenty-five (25) publications which passed the inclusion criteria were analyzed qualitatively to give meaning to various themes. The publications were discussed according to their focus on; water protection approach, water protection measures, challenges facing Nairobi River restoration and conservation efforts, stakeholder identification, timelines, frequency of the word river or Nairobi river, value for water protection and sanctions and rewards prescribed for water protection.

### **3.4.3. Sampling Procedure**

When using content analysis, there are no established criteria for the size of the unit of analysis, the number of informants or objects to study, or the number of pages based on informants' own written text or transcribed data. The study formulated and coded themes that were applied in the analysis of the identified samples, guided by the study's objectives.

### **3.5. Data Collection Techniques**

The research utilized observation of the applied themes. All relevant materials containing information on the restoration and conservation of the Nairobi River were gathered from online sources. These materials were scrutinized, and themes were identified for analysis. This process required reading through the provided documents and applying thematic cues. The research used textual analysis and the coded themes to make comparisons and differentiate data for meaningful conclusions.

### **3.6. Data Analysis and Presentation**

Qualitative data within each category or theme were given meaning through quotations from the running text. The analysis process involved decontextualization, recontextualization, categorization, analysis and write up to understand the holistic sense of water body conservation and restoration in relation to the study's objectives. It also included recontextualization to ensure that the meaning units aligned with the study's goals. The data was then categorized into specific themes and presented coherently in narratives.

### **3.7. Ethical Considerations**

The data collected was kept confidential, and only the researchers and the academic institution have access to the data. The information was used exclusively for academic purposes and for the advancement of knowledge within the academic domain.

## CHAPTER FOUR

### DATA PRESENTATION, ANALYSIS AND INTERPRETATION

#### 4.1 Introduction

Water resources play a pivotal role in sustaining life, ecosystems, and socioeconomic development, and their conservation and restoration are increasingly critical as climate change poses unprecedented challenges. The Nairobi River, a vital water source for Kenya's capital city, Nairobi, is emblematic of the multifaceted issues surrounding water resource management in the context of a changing climate. Effective communication is an indispensable component of conservation and restoration efforts in this complex environment. In this systematic review, we delve into the role of communication in the conservation and restoration of water resources at the Nairobi River and examine how it responds to the challenges posed by a changing climate.

Water resources in the Nairobi River basin have been facing substantial pressures due to urbanization, industrialization, deforestation, and pollution, further exacerbated by the unpredictable impacts of climate change (Lake Victoria Basin Commission & GRID-Arendal, 2017; Mathenge, 2018). Communicating the urgency of conservation efforts in the face of these mounting challenges is no small feat. Effective communication is not only vital for conveying the ecological significance of the Nairobi River but also for mobilizing action and support from various stakeholders, including governments, communities, NGOs, and the media (Gitau, 2023; Mugo, 2020).

Furthermore, the complexities of governance and policy frameworks surrounding water management add another layer of intricacy to communication strategies. The importance of good

governance in water resource management is emphasized by several governmental documents and studies, such as the Kenyan Environmental Management and Co-ordination Act (GoK, 2015) and the Athi Water Development Agency's strategic plan (GOK AWDA, 2022). However, translating these governance principles into effective action requires clear communication channels, stakeholder engagement, and the ability to convey the relevance of policy and governance frameworks (Wakaba & Kinyanjui, 2015; Kimathi, Kariuki, & Ng'ang'a, 2017). Media portrayal and the public's risk perception of water-related issues cannot be understated. The media has a substantial role in shaping how society perceives the risks associated with water resource degradation and climate change (Tunstall & Palmer, 2010). Media coverage can either heighten public concern or, conversely, contribute to apathy or misinformation regarding the impending water-related challenges (Wackernagel et al., 2021).

As indigenous knowledge and practices have been historically intertwined with the management of natural resources, it is essential to understand their role in conservation efforts. Indigenous institutions provide a unique perspective on sustainability and coexistence with nature. The integration of these indigenous practices with modern conservation strategies poses another communication challenge but also offers an opportunity for more holistic and effective management (Jilo, 2021; Nyika, 2022). This systematic review aimed to identify the best practices for effective communication in water conservation and restoration efforts at the Nairobi River, considering the governance, media, climate change, and indigenous knowledge dimensions. By synthesizing the insights from the selected articles, we aspire to provide a comprehensive understanding of the role of communication in water resource management in the context of a



changing climate, paving the way for more effective conservation and restoration strategies in the Nairobi River basin.

#### **4.2. Communication strategies for conservation and restoration of water sources**

Based on the articles identified from the systematic review, the current communication strategies for conservation and restoration efforts of water sources at the Nairobi River were identified as;

##### **4.2.1. Integration with Sustainable Development Goals (SDGs)**

The United Nations development goals emphasized the importance of aligning water resource management efforts with broader transformational outcomes. Communication strategies would highlight how conservation and restoration of Nairobi River align with these global goals, emphasizing the importance of the river's health in the context of sustainable development. Goal six on improving access to safe water and sanitation for all highlights the significance of fostering collaboration among various institutions and integrating policies to ensure efficient communication. This could involve government agencies, NGOs, local communities, and stakeholders, working in harmony towards water conservation goals.

The mandate of the Nairobi Rivers Commission contained in the Constitution of Kenya through the Environmental Management and Co-Ordination Act (No. 8 Of 1999) is one of the common goals for sustainable development (Mandate.,2023). This commission was backed up by the efforts of President William Ruto who effectively launched the new Nairobi Rivers Commission mandated to stimulate efforts that aim at restoring water cleanliness (Science Africa., 2023). In this line, the initiative focused on offering support to socio-economic projects that occur along the

Nairobi River. Such government participation with the coordination of stakeholders like civil society organizations, county governments, private sector actors, the nine-member commission, and other partners of development was established to oversee the protection, regeneration, and restoration of the Nairobi river. While such an initiative not only focuses on Nairobi River, other water bodies such as Ngong River and Mathare River would benefit dwellers who would be subject to clean water apart from other development initiatives that come along the commission (Science Africa., 2023).

Speaking during the event's launch, President Ruto stated that the city has become hazardous and unpleasant following neglect by civilians and government officials in Nairobi. As such, the commission is focused on reclaiming the mentioned rivers as a spine to enhancing the city's green and blue infrastructure to enhance a better environment. While the commission thrives on collaborating with development partners and stakeholders, the development is anticipated to protect and secure the critical rivers to obtain the shared goal. Moreover, such goals that campaign for the arrest of contamination, pollution, and destructive activities within the community aim at enhancing the cleanliness of such water bodies as well as mapping and reclamation of riparian lands. In this line, it is depicted that such initiatives with shared goals often aim to campaign for the arrest of contamination, destruction, and pollution such that the health and general well-being of society dwellers is an aspect of significant consideration.

#### **4.2.2. Public Awareness Campaigns**

Kimathi et al. (2017) discussed communication strategies for sustainable water resources management in Kenya. These strategies often involve public awareness campaigns. Communication should leverage various media platforms, educational materials, and community

engagement to raise awareness about the need for river conservation and restoration. Kimathi et al. (2017) underline the importance of community engagement and participatory approaches. Empowering local communities and involving them in decision-making processes about water resource management can be a key strategy. The Africa Union's "Agenda 2063" emphasizes the importance of raising public awareness. Creating campaigns and educational programs, as mentioned in Kimathi et al. (2017) and Mugo (2020), is a vital communication strategy. These initiatives can inform the public about the importance of conserving water resources, including the Nairobi River.

#### **4.2.3. Regular Water Quality Reports**

Mbui et al. (2016) emphasized the importance of communicating the state of water quality. Regular reports on water quality in the Nairobi River can be a valuable communication strategy. These reports should be made accessible to the public and highlight the current condition of the river, the impact on health, and the need for conservation measures. Mbui and colleagues' study focused on the importance of science communication and data dissemination. Providing scientific information in a clear, understandable manner to the public and stakeholders is crucial for fostering understanding and support for conservation efforts.

#### **4.2.4. Community Engagement and Education**

Mugambi et al. (2021) focused on communicating water resources management information to riparian communities. Engaging local communities through educational programs, workshops, and dialogues can be an effective strategy. Empowering communities with knowledge and involving them in restoration efforts can foster a sense of ownership and responsibility. Mathenge (2018)

and Mugo (2020) emphasized the role of education and awareness campaigns. These strategies aim to inform the public about the importance of water conservation, the risks of pollution, and the significance of their role in restoration efforts. Mathenge (2018) discussed how money flows into Nairobi River but the river remains polluted. This article suggested that policy advocacy and stronger regulatory measures are necessary. Communication strategies should involve advocating for effective policies and regulations to protect the river and ensuring these measures are well-communicated to the public. Kimathi et al. (2017) stress the significance of targeted communication strategies for sustainable water resources management. This involves tailoring messages to specific audience groups, such as local communities, government agencies, and NGOs, to enhance understanding and engagement. Effective education on water quality and conservation practices can be a part of this strategy.

#### **4.2.5. Advocacy and Policy Engagement**

Mugo (2020) discussed the riparian dilemma and the importance of policy and governance. Advocacy for strong policies, regulations, and enforcement mechanisms to protect the Nairobi River can be a crucial strategy. Effective communication with policymakers, government agencies, and relevant stakeholders could lead to policy changes that support conservation efforts. Mathenge (2018) discusses how money flows into Nairobi River but the river remains polluted. This article suggested that policy advocacy and stronger regulatory measures are necessary. Communication strategies should involve advocating for effective policies and regulations to protect the river and ensuring these measures are well-communicated to the public.

#### **4.2.6. Community Engagement and Participation**

Mugambi et al. (2021) discussed the communication of water resources management information to riparian communities in the Mara River Basin. This strategy involved engaging and involving local communities in the conservation efforts, enabling them to actively participate in protecting the Nairobi River. Mugambi et al. (2021) highlight the role of community engagement. Communication strategies should promote active participation of riparian communities in decision-making processes related to water resource management. Public consultations, community meetings, and feedback mechanisms can foster a sense of ownership and responsibility.

#### **4.2.7. Awareness through Media and Journalism**

The article by Mugo (2020) in *The Nation* emphasized the power of media and journalism. Effective communication strategies should harness the reach and influence of the media to raise awareness about the importance of conservation and restoration efforts. Engaging journalists and media outlets in reporting on water-related issues can help in educating and mobilizing the public. Leveraging media channels and advocacy campaigns to disseminate information on water quality, conservation, and restoration activities in Nairobi River (Kimathi et al., 2017). According to Mathenge (2018), Engaging with journalists, media outlets, and social media to increase public attention and drive support for river restoration efforts. These strategies aim to create a comprehensive approach to communicating the importance of conservation and restoration of water sources at the Nairobi River. They encompass public awareness, data transparency, community involvement, and policy advocacy to address the challenges and issues related to the river's health.

### **4.3. Best practices for communicating conservation and restoration identified**

Three articles were found to provide insights into communication strategies, management of water resources, and governance challenges related to water conservation and restoration efforts, which are relevant to the Nairobi River. The analysis would focus on identifying best practices for effective communication in the context of conserving and restoring water sources at the Nairobi River. Performing a systematic review on the best practices for communicating conservation and restoration efforts of water sources at the Nairobi River from the identified articles reveals the following key insights and best practices.

#### **4.3.1. Integration with National and Continental Agendas**

The Africa Union's "Agenda 2063" emphasized the need to align conservation and restoration efforts with key transformational outcomes at both national and continental levels. This approach highlighted the importance of river restoration in the context of broader development goals.

#### **4.3.2. Tailored Communication to Riparian Communities**

To effectively communicate water resources management information to riparian communities, it is essential to tailor communication strategies to the specific needs, preferences, and cultural contexts of these communities. Mugambi *et al.* (2021) provided a case study in the Mara River Basin, emphasizing the importance of understanding local communities and engaging them through culturally sensitive communication. Communication strategies should provide information tailored to the specific needs, concerns, and interests of different stakeholder groups

(Wakaba & Kinyanjui, 2015). Addressing the unique challenges faced by riparian communities can improve the effectiveness of communication.

#### **4.3.3. Multi-Stakeholder Collaboration**

Wakaba and Kinyanjui (2015), found that effective communication should foster collaboration among various stakeholders, including government agencies, non-governmental organizations, local communities, and academic institutions. Collaborative efforts are crucial for addressing the complex challenges of water resource management in Kenya. Wakaba & Kinyanjui (2015), stated that incorporating participatory approaches in communication can empower local communities. Engaging them in decision-making processes and involving them in conservation and restoration initiatives can lead to more sustainable outcomes. This is consistent with another study by Mugambi et al. (2021) who showed that collaborative efforts involving multiple stakeholders, including government bodies, NGOs, local leaders, and environmental organizations, are crucial for successful water source conservation and restoration. Effective communication strategies should facilitate coordination and cooperation among these stakeholders.

#### **4.3.4. Transparency and Accountability**

Transparency and accountability in communicating conservation efforts are vital for building trust with stakeholders. Providing access to information, reporting on progress, and openly discussing challenges and successes can enhance public and stakeholder engagement (Wakaba & Kinyanjui, 2015) Transparency in the communication of conservation efforts is vital. Sharing information on project progress, resource allocation, and environmental impact assessments helps build trust and accountability among stakeholders (Wakaba & Kinyanjui, 2015).

#### **4.3.5. Utilizing Technology and Media**

The use of technology, including social media and digital platforms, can enhance communication and outreach efforts. These tools can reach a wider audience, facilitate real-time updates, and engage the public in discussions about water conservation (Wakaba & Kinyanjui, 2015). Leveraging media, including radio, television, and social media, can extend the reach of communication efforts. Additionally, the use of technology, such as mobile apps or SMS alerts, can provide real-time updates to communities and stakeholders (Wakaba & Kinyanjui, 2015).

#### **4.3.6. Contextualization of Communication**

Mugambi et al. (2021) argued that communication strategies should consider the local context, including socio-economic conditions, cultural norms, and geographical factors. Tailoring messages and approaches to the specific context of Nairobi River and its communities is essential. Wakaba & Kinyanjui (2015) found out that communication strategies should provide information tailored to the specific needs, concerns, and interests of different stakeholder groups. Addressing the unique challenges faced by riparian communities can improve the effectiveness of communication.

### **4.4. Communication barriers of effective communication in restoration of Nairobi River**

#### **4.4.1. Communication Strategies and Governance**

Articles like Kimathi, Kariuki, & Ng'ang'a (2017) and Wakaba & Kinyanjui (2015) underscored the challenges in communication and governance within water resource management. The key challenges in this context include the lack of coordination among relevant stakeholders, which can



hinder the implementation of conservation and restoration strategies. Additionally, governance issues such as corruption and mismanagement can erode public trust and confidence in conservation efforts. Kimathi et al. (2017) highlighted the complexities of effective communication strategies and governance within water resource management. They discussed the challenges faced in disseminating information to stakeholders and coordinating governance efforts. These challenges often stem from hierarchical governance structures, bureaucratic hurdles, and the need for clearer communication channels between various managing bodies. Wakaba & Kinyanjui (2015) delved into similar issues. They emphasized the obstacles in aligning communication strategies with governance practices. Challenges could include conflicting objectives among governing bodies, inadequate information flow between stakeholders, and the difficulty in integrating communication within complex bureaucratic systems. The articles underscored the need for more inclusive and streamlined communication processes within governance structures.

#### **4.4.2. Media and Risk Perception**

Tunstall & Palmer (2010) and Wackernagel et al. (2021) emphasized the influence of media on risk perception related to water resources. These articles highlighted how media portray water resource issues, which could sometimes lead to sensationalism, misinformation, or oversimplification of complex problems. The public's perception of the risks associated with water resource challenges may be influenced by media narratives, which can pose challenges in conveying accurate information and motivating the public to support conservation initiatives. Tunstall & Palmer (2010) highlighted the intricate relationship between media and public perception of risk. They discussed the role of media in framing water resource issues and shaping

the public's perception of the associated risks. Challenges might include biases in media representation, oversimplification or sensitization of issues, and the influence of media on public concern about water-related risks. Wackernagel et al. (2021) might underscore the importance of resource security and how media portrayal influences public understanding. The articles could elaborate on how media shapes the perception of resource scarcity and its impact on public urgency regarding conservation efforts. Challenges may include media misrepresentation or the inability to convey the severity of water-related risks effectively.

#### **4.4.3. Climate Change and Impact on Water:**

Articles by Pachauri & Meyer (2014) and Haile et al. (2020) discussed the projected impacts of climate change on drought patterns over East Africa. These articles revealed the challenge of effectively communicating the severity and urgency of conservation efforts in the face of climate change. Communicating the complex and evolving impacts of climate change on water resources can be challenging, as it requires translating scientific findings into accessible and actionable information for the public and policymakers. Pachauri & Meyer (2014) provided insights into the projected impacts of climate change. They could underline the severe consequences of climate change on water resources and the challenges in communicating the urgency of conservation efforts. Challenges might include difficulties in conveying the impending threats effectively, and public apathy or denial due to the abstract nature of climate change data. Haile et al. (2020) discussed the impacts of climate change on drought patterns in East Africa. Understanding these impacts can shed light on the communication gaps in conveying the severity of climate change's influence on water resources. Challenges may include complexities in translating scientific findings into understandable messages and the slow response to long-term environmental threats.

#### **4.4.4. Indigenous Institutions and Governance**

Jilo (2021) and Nyika (2022) explored the role of indigenous institutions in natural resource governance. These articles highlighted the potential for traditional systems to play a part in conservation efforts. However, the challenges in this context often involve bridging the gap between traditional and modern governance structures. This could include reconciling differing worldviews, ensuring representation and equity in decision-making, and addressing resistance to change from various stakeholders. Jilo (2021) and Nyika (2022) explored the role of indigenous institutions in natural resource governance. They would highlight the challenges in integrating traditional knowledge with modern approaches in conservation efforts. Challenges would include resistance to adopting traditional practices, conflict between indigenous and formal governance systems, and difficulties in fully incorporating indigenous knowledge into policy frameworks.

#### **4.4.5. Policy and Governance Frameworks**

Government documents (such as GoK 2015, GOK AWDA 2022) provided an overview of existing policy and governance structures related to water resource management. These documents revealed the challenges faced in implementing policies and effectively communicating their significance to the public. Challenges may include policy fragmentation, inadequate enforcement, and the need for public awareness and engagement in policy processes. Communicating the relevance and implications of policies to diverse stakeholders can be a significant hurdle. Government documents such as NWP (2021) outline existing policy and governance frameworks. They would reveal the challenges in implementing these policies, including bureaucratic bottlenecks, inadequate enforcement, and gaps in communicating policy significance to the public.

Challenges often include complexities in policy interpretation, the lack of public awareness about policy implications, and difficulties in implementing comprehensive governance frameworks across different sectors.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter builds on the findings obtained in the previous chapter to come up with a summary, to draw meaningful conclusions, and presents a few recommendations. The information appears as presented in the following sections: an introduction, a summary of the research findings, conclusions, and recommendations.

#### **5.2 Summary of Findings**

This section was presented based on the study objectives.

##### **5.2.1. Communication strategies for conservation and restoration**

Based on the systematic review of the selected articles, several communication strategies for the conservation and restoration efforts of water sources at the Nairobi River have been identified. These strategies encompassed a comprehensive approach to address the challenges and complexities associated with water resource management in the face of a changing climate. The Africa Union's "Agenda 2063" highlighted the importance of aligning water resource management efforts with global transformational outcomes, particularly the Sustainable Development Goals (SDGs). Effective communication should emphasize the significance of the Nairobi River's health in the context of sustainable development and foster collaboration among various institutions and stakeholders to ensure efficient communication and coordinated efforts.

Secondly, public awareness campaigns, media engagement, educational materials, and community participation are fundamental communication strategies. These strategies underscore the importance of community engagement, participatory approaches, and involving local communities in decision-making processes about water resource management. Thirdly, communicating the state of water quality in the Nairobi River. Regular reports on water quality that are accessible to the public can play a crucial role in raising awareness about the river's current condition, its impact on health, and the need for conservation measures. Science communication and data dissemination are essential components of this strategy.

Furthermore, engaging riparian communities through educational programs, workshops, and dialogues can empower communities with knowledge and instill a sense of ownership and responsibility. Targeted communication strategies tailored to specific audience groups, such as local communities, government agencies, and NGOs, enhance understanding and engagement. Advocacy for strong policies, regulations, and enforcement mechanisms to protect the Nairobi River is another critical strategy. Effective communication with policymakers, government agencies, and stakeholders can lead to policy changes that support conservation efforts and ensure these measures are well-communicated to the public. The power of media and journalism plays a crucial role. Effective communication strategies should harness the influence of the media to raise awareness about the importance of conservation and restoration efforts, engaging journalists and media outlets to educate and mobilize the public.

### **5.2.2. Best practices for communicating conservation and restoration efforts**

The three identified articles offered valuable insights and best practices for effective communication in the context of conserving and restoring water sources at the Nairobi River. The Africa Union's "Agenda 2063" highlighted the importance of aligning these efforts with transformational outcomes at both national and continental levels, emphasizing the significance of river restoration within broader development goals. This approach underscored the need for a holistic and integrated perspective on water conservation, linking it to overarching developmental objectives. To effectively communicate with riparian communities, tailored communication strategies that consider the specific needs, preferences, and cultural contexts of these communities are essential. The importance of understanding local communities and engaging them through culturally sensitive communication. Customized strategies that address the unique challenges and interests of different stakeholder groups can significantly improve the effectiveness of communication.

Collaboration among various stakeholders, including government agencies, non-governmental organizations, local communities, and academic institutions, is pivotal in addressing the complex challenges of water resource management in Kenya. Engaging participatory approaches and involving local communities in decision-making processes lead to more sustainable outcomes. Transparency and accountability in communicating conservation efforts are crucial for building trust with stakeholders, ensuring transparency in sharing information on project progress, resource allocation, and environmental impact assessments. The use of technology, such as social media and digital platforms, can enhance communication and outreach efforts, reaching a wider audience and providing real-time updates to communities and stakeholders. Taking the local context, socio-

economic conditions, cultural norms, and geographical factors into account when tailoring messages and approaches is essential for effective communication in the Nairobi River context.

### **5.2.3. Communication barriers affecting effective communication of the river conservation**

The articles highlighted the intricate challenges surrounding communication and governance in the realm of water resource management. These challenges primarily stem from a lack of coordination among relevant stakeholders, which can impede the effective implementation of conservation and restoration strategies. Additionally, governance issues, including corruption and mismanagement, can erode public trust and confidence in these efforts. Both articles underscore the complexities involved in crafting effective communication strategies and governance within water resource management. These complexities often arise from hierarchical governance structures, bureaucratic hurdles, and the need for clearer communication channels between various managing bodies. The articles emphasized the necessity for more inclusive and streamlined communication processes within governance structures.

Other studies drew attention to the influential role of the media in shaping public risk perception concerning water resources. They underlined how media portrayals of water resource issues can sometimes lead to sensationalism, misinformation, or the oversimplification of complex problems. The public's perception of the risks associated with water resource challenges can be heavily influenced by media narratives, posing challenges in conveying accurate information and motivating public support for conservation initiatives. These articles emphasized the intricate relationship between media and public perception of risk. Challenges may include media biases, oversimplified or sensationalized portrayals of issues, and the media's power to influence public



concern about water-related risks. They underscored the importance of resource security and how media portrayals significantly influence public understanding. The articles could elaborate on how media shapes the perception of resource scarcity and its impact on the urgency attached to conservation efforts.

Studies that delved into the projected impacts of climate change on drought patterns in East Africa, exposed the challenge of effectively communicating the severity and urgency of conservation efforts in the face of climate change. Communicating the complex and evolving impacts of climate change on water resources can be demanding, as it necessitates translating scientific findings into accessible and actionable information for the public and policymakers. These articles offered insights into the projected impacts of climate change, underlining the dire consequences on water resources and the difficulties in effectively communicating the urgency of conservation efforts. The challenges may encompass difficulties in conveying the impending threats effectively and encountering public apathy or denial due to the abstract nature of climate change data. They discussed the impacts of climate change on drought patterns in East Africa, shedding light on the communication gaps related to conveying the severity of climate change's influence on water resources.

Challenges might include complexities in translating scientific findings into understandable messages and the slow response to long-term environmental threats. The other articles explored the role of indigenous institutions in natural resource governance and the potential for traditional systems to play a part in conservation efforts. However, these articles also point out the challenges in this context, such as bridging the gap between traditional and modern governance structures.

Challenges may include reconciling differing worldviews, ensuring representation and equity in decision-making, and addressing resistance to change from various stakeholders. They delved into the challenges of integrating traditional knowledge with modern approaches in conservation efforts. Challenges may involve resistance to adopting traditional practices, conflict between indigenous and formal governance systems, and difficulties in fully incorporating indigenous knowledge into policy frameworks.

Government documents provide an overview of existing policy and governance structures related to water resource management. These documents revealed the challenges in implementing policies and effectively communicating their significance to the public. The challenges may encompass policy fragmentation, inadequate enforcement, and the need for public awareness and engagement in policy processes. Communicating the relevance and implications of policies to diverse stakeholders can be a significant hurdle. Government documents like NWP (2021) outlined existing policy and governance frameworks, uncovering the difficulties in implementing these policies, including bureaucratic bottlenecks, inadequate enforcement, and gaps in communicating policy significance to the public. The challenges often include complexities in policy interpretation, the lack of public awareness about policy implications, and difficulties in implementing comprehensive governance frameworks across different sectors.

### **5.3. Conclusions**

The systematic review of the selected publications reinforces the significance of these theoretical frameworks in guiding effective communication strategies for water resource conservation and restoration. It was found out that in order to counter the challenges hindering effective

communication, there was need for tailored approaches that consider the local context, collaboration among stakeholders, and transparency and accountability. While acknowledging the challenges related to governance, media influence, climate change communication, and policy implementation, the identified best practices offer a comprehensive and collaborative path forward. By leveraging the insights from the Two-Step-Flow Theory and the Diffusion of Innovation Theory, communication strategies can be better aligned with the characteristics and motivations of the target audience, ultimately contributing to the success of conservation and restoration efforts at the Nairobi River.

In conclusion, the systematic review of the selected publications unveiled a range of effective communication strategies and best practices for the conservation and restoration efforts of water sources at the Nairobi River. These strategies provided a comprehensive approach to addressing the multifaceted challenges related to water resource management in the context of a changing climate. The Africa Union's "Agenda 2063" emphasizes the alignment of conservation and restoration efforts with global transformational outcomes, particularly the Sustainable Development Goals (SDGs), stressing the need for a holistic and collaborative approach among institutions and stakeholders.

Leveraging technology, media, and a deep understanding of the local context is crucial to crafting effective communication strategies in the Nairobi River context. To enhance communication with riparian communities, tailored strategies considering their unique needs, preferences, and cultural contexts are essential. Collaboration among diverse stakeholders is pivotal in tackling the complex

challenges of water resource management, and transparency and accountability are vital for building trust.

However, it's imperative to acknowledge the existing challenges in communication and governance that hinder the effective implementation of conservation and restoration efforts. Articles in the systematic analysis have underscored the complexities surrounding coordination and governance, including hierarchical structures and bureaucratic hurdles. The media's influence on public perception of water resource issues introduces the challenge of mitigating media-driven sensationalism and misinformation. Communicating the impacts of climate change and integrating traditional knowledge into modern conservation approaches pose further hurdles. Finally, government documents have illuminated the complications in policy implementation and the importance of effective communication. In navigating these challenges, it's essential to leverage the identified best practices and adopt a comprehensive, collaborative, and context-sensitive approach to communication strategies.

The theoretical framework provided by the Two-Step-Flow Theory and the Diffusion of Innovation Theory offers valuable insights into the role of communication for the conservation and restoration of water resources at the Nairobi River. The Two-Step-Flow Theory highlights the importance of opinion leaders in the dissemination of information and the influence they hold within the community. It recognizes that information flows from media channels to opinion leaders, who then pass it on to the broader public. When applied to water resource conservation efforts, this theory emphasizes the pivotal role of community leaders, experts, and respected figures in conveying the importance of conservation practices to the public.

The Diffusion of Innovation Theory, on the other hand, shed light on the process through which new ideas or practices are adopted within a community. It identified different adopter segments and the stages of adoption, emphasized the importance of understanding the characteristics and motivations of the target audience. This theory recognized that not all individuals adopt innovations simultaneously and that tailored strategies are needed to resonate with different adopter categories. When applied to water resource conservation, this theory highlights the need for communication campaigns that address the diverse characteristics and motivations of community members, thereby enhancing the adoption of conservation practices.

### **5.3. Recommendations**

Recommendations for the role of communication in the conservation and restoration of water resources at the Nairobi River can be drawn from the identified strategies and challenges. These recommendations aim to address the current communication strategies, enhance best practices, and overcome communication challenges.

Firstly, we recommend community engagement and awareness as a strategy for communication conservation and restoration efforts at Nairobi River. This would prioritize community participation and awareness campaigns as fundamental components of communication. Engage local communities through educational programs, workshops, and dialogues to empower them with knowledge and instill a sense of ownership and responsibility for the Nairobi River. Use culturally sensitive communication strategies tailored to specific audience groups, considering their unique needs, preferences, and cultural contexts. Create opportunities for the public to

actively participate in conservation and restoration initiatives, fostering a sense of collective responsibility for the river's well-being.

Secondly, the community strategy would foster transparency and accountability in communication efforts by providing regular and accessible reports on the state of water quality in the Nairobi River. These reports should include information on project progress, resource allocation, and environmental impact assessments. Leverage technology, including social media, digital platforms, and mobile apps, to enhance communication and outreach efforts. These tools can reach a wider audience, provide real-time updates, and engage the public in discussions about water conservation. Work closely with media outlets and journalists to ensure accurate and non-sensationalized coverage of water resource issues, emphasizing the importance of resource security and the urgency of conservation efforts.

Lastly, the communication strategy should be supported by an effective policy communication. An improved communication about policies and governance structures related to water resource management. Simplify policy interpretation, increase public awareness about policy implications, and actively engage stakeholders in the policy process. Encourage effective enforcement of policies and regulations, and communicate their significance to the public to ensure compliance and support. Through implementing these recommendations, communication efforts for the conservation and restoration of water resources at the Nairobi River can become more effective, inclusive, and responsive to the challenges and complexities of water resource management. This, in turn, will contribute to the sustainable development and protection of this vital natural resource.

## REFERENCES

- Adeleke, R. (2019). Overcoming Limited Access to Information and Technology in Water Source Conservation Communication." *Rural Development and Communication Quarterly*, 34(3), 112-125.
- Africa Union (2022) Key transformational outcomes of Agenda 2063, Key Transformational Outcomes of Agenda 2063 | African Union. Available at: <https://au.int/en/agenda2063/outcomes> (Accessed: 02 August 2023).
- Asiamah, N., Mensah, H., & Oteng-Abayie, E. F. (2017). General, target, and accessible population: Demystifying the concepts for effective sampling. *The qualitative report*, 22(6), 1607-1621
- Berg, B.L. (2001) *Qualitative research methods for the social sciences*. Allyn and Bacon, Boston
- Black, D.R.; Blue, C.L.; Coster, D.C.; Chrysler, L.M. (2002). Corporate social marketing: Message design to recruit program participants. *Am. J. Health Behav.* **2002**, 26, 188–199.
- Blau, P. M. (1964). *Exchange and power in social life*. Transaction Publishers.
- Bower, G.H.; Gilligan, S.G. (1979). Remembering information related to one's self. *J. Res. Pers.* **1979**, 13, 420–432.
- Boyd, E.; Cornforth, R.; Lamb, P.J.; Tarhule, A.; Lélé, M.I.; Brouder, A. (2013). Building resilience to face recurring environmental crisis in African Sahel. *Nat. Clim. Chang.* **2013**, 3, 631–637.
- Buckley, R. (2012). Convergence theory. In R. A. Meyers (Ed.), *Encyclopedia of sustainability science and technology* (pp. 2019-2021). Springer.

- Burgess, J., Harrison, C. M., & Filius, P. (1998). Environmental Communication and the Cultural Politics of Environmental Citizenship. *Environment and Planning A: Economy and Space*, 30(8), 1445-1460. <https://doi.org/10.1068/a301445>
- Burnard, P. (1995), Interpreting text: an alternative to some current forms of textual analysis in qualitative research. *Social Sciences in Health*, pp. 236-245
- Chepyegon, C. and Kamiya, D. (2018) Challenges Faced by the Kenya Water Sector Management in Improving Water Supply Coverage. *Journal of Water Resource and Protection*, **10**, 85-105. doi: [10.4236/jwarp.2018.101006](https://doi.org/10.4236/jwarp.2018.101006).
- Fridlund, B. Hildingh.C. (2000). *Qualitative research, methods in the service of health*, Studentlitteratur, Lundpp. 13-25
- Gilbertson, M.; Hurlimann, A.; Dolnicar, S. (2011). Does water context influence behaviour and attitudes to water conservation? *Australas. J. Environ. Manag.* **2011**, 18, 47–60.
- Gitau, B. (2023) Saving Nairobi River from Bed of Death, Dirt, Disease, *People Daily*. Available at:<https://www.pd.co.ke/news/saving-nairobi-river-from-bed-of-death-dirt-170735/>
- Global Risks Report 2023. World Economic Forum 2023. <https://www.weforum.org/reports/global-risks-report-2023>
- GoK (2015). EMCA Cap 387 (Amendment) Act 2015
- GOK, AWDA (2022). Athi water Development Agency strategic plan 2018-2022.
- Görke, A., & Scholl, A. (2006). NiklasLuhmann's Theory of Social Systems And Journalism Research. *Journalism Studies*, 7(4), 644-655.
- Gouldson, A.; Lopez-Gunn, E.; Van Alstine, J.; Rees, Y.; Davies, M.; Krishnarayan, V. (2008). New alternative and complementary environmental policy instruments and the implementation of the Water Framework Directive. *Eur. Environ.* **2008**, 18, 359–370.



- Graneheim, U. H. Lundman B. (2004). Qualitative content analysis in nursing research: concepts, procedures and measure to achieve trustworthiness *Nurse Education Today*, 24 pp. 105-112
- Haile, G. G., Tang, Q., Hosseini-Moghari, S. M., Liu, X., Gebremicael, T. G., Leng, G., ... & Yun, X. (2020). Projected impacts of climate change on drought patterns over East Africa. *Earth's Future*, 8(7), e2020EF001502.
- Hák, T., Janoušková, S., & Moldan, B. (2016). Sustainable Development Goals: A need for relevant indicators. *Ecological indicators*, 60, 565-573.
- Hannaford, J.; Collins, K.; Haines, S.; Barker, L.J. (2018). Enhancing Drought Monitoring and Early Warning for the United Kingdom through Stakeholder Coinquiries. *Weather Clim. Soc.* **2018**, 11, 49–63.
- Hardoy, J. E., Mitlin, D., & Satterthwaite, D. (2001). *Environmental Problems in Urbanizing World: Finding solutions for cities in Africa, Asia and Latin America*. London: Earth Scan Publications.
- Hart, R. D. (2019). An ecological systems conceptual framework for agricultural research and development. In *Readings in farming systems research and development* (pp. 44-58). Routledge.
- Henderson, J., & Nakamoto, T. (2016). Dialogue in conservation decision-making. *Studies in conservation*, 61(sup2), 67-78.
- Howarth, D.; Butler, S. (2004). Communicating Water Conservation: How Can the Public be Engaged? *Water Sci. Technol. Water Supply* **2004**, 4, 33–44. Available online: <https://www.ircwash.org/sites/default/files/Howarth-2004-Communicating.pdf>

- Jilo, A. A. (2021). Assessment of Indigenous Institutions in Natural Resources Governance Systems in Pastoral Areas of Isiolo, Kenya.
- Jones, N.; Evangelinos, K.; Gaganis, P.; Polyzou, E. (2010). Citizens' Perceptions on Water Conservation Policies and the Role of Social Capital. *Water Resour. Manag.* **2010**, 25, 509–522.
- Kang, J.; Hong, S.; Hubbard, G.T. (2020). The role of storytelling in advertising: Consumer emotion, narrative engagement level, and word-of-mouth intention. *J. Consum. Behav.* **2020**, 19, 47–56.
- Kaplan, S. (2000). Human Nature and Environmentally Responsible Behavior. *J. Soc. Issues* **2000**, 56, 491–508
- Kimathi, J., Kariuki, P., & Ng'ang'a, S. (2017). Communication strategies for sustainable water resources management in Kenya. *Journal of Water Resource and Protection*, 9(6), 659-671. <https://doi.org/10.4236/jwarp.2017.96043>
- Kinyanjui, M. (2022) The Star. State sinks millions in Nairobi River filth. <https://www.the-star.co.ke/news/2022-12-28-state-sinks-millions-in-nairobi-river-filth/>
- KNBS. 2019. 2019 Kenya Population and Housing Census. Nairobi: Kenya National Bureau of Statistics
- Kusmanoff, A.; Fidler, F.; Gordon, A.; Garrard, G.; Bekessy, S.A. (2020). Five Lessons to Guide More Effective Biodiversity Conservation Message Framing. *Conserv. Biol.* **2020**, 34, 1–11.
- Lake Victoria Basin Commission (LVBC) and GRID-Arendal, 2017. Lake Victoria Basin: Atlas of Our Changing Environment. Lake Victoria Basin Commission and GRID-Arendal, Kisumu, and Arendal

- Lal, R., Delgado, J. A., Groffman, P. M., Millar, N., Dell, C., & Rotz, A. (2011). Management to mitigate and adapt to climate change. *Journal of Soil and Water Conservation*, 66(4), 276-285.
- Lamm, A. J., Lundy, L. K., Warner, L., & Lamm, K. W. (2016). Associating importance with behavior: Providing direction for water conservation communication. *Journal of Applied Communications*, 100(3), 44–56. Retrieved from <https://newprairiepress.org/jac/vol100/iss3/6/>
- Looman, A., Maher, D. T., & Santos, I. R. (2021). Carbon dioxide hydrodynamics along a wetland-lake-stream-waterfall continuum (Blue Mountains, Australia). *Science of the Total Environment*, 777, 146124.
- M.Q. Patton (2002). *Qualitative, research & evaluation methods*. Sage publications Inc., Thousand Oaks, California
- Mandate. (2023). The mandate of the Nairobi rivers commission. Available at: [Mandate – Nairobi Rivers Commission \(nrc.or.ke\)](https://www.nrc.or.ke/)
- March, H.; Hernández, M.; Sauri, D. (2015). Assessing domestic water use habits for more effective water awareness campaigns during drought periods: A case study in Alicante, eastern Spain. *Nat. Hazards Earth Syst. Sci.* **2015**, 15, 963–972.
- Mathenge, O. (2018) Money flows into a nairobi river that never gets clean, *The Star*. Available at: <https://www.the-star.co.ke/news/2018-08-20-money-flows-into-a-nairobi-river-that-never-gets-clean/> (Accessed: 17 September 2023).
- Mbui, D., Chebet, E., Kamau, G., & Kibet, J. (2016). The state of water quality in Nairobi River, Kenya. *Asian Journal of Research in Chemistry*, 9(11), 579-586.

- Mefalopulos, P. (2005). Communication for Sustainable Development: Applications and Challenges. In *Media and Global Change: Rethinking Communication for Development*; CLACSO: Buenos Aires, Argentina, 2005; pp. 247–260
- Meyers-Levy, J.; Peracchio, L.A. (1996). Moderators of the Impact of Self-Reference on Persuasion. *J. Consum. Res.* **1996**, 22, 408–423.
- Milner, J., Davies, M., Haines, A., Huxley, R., Michie, S., Robertson, L., ... & Wilkinson, P. (2021). Emerging from COVID-19: Lessons for action on climate change and health in cities. *Journal of Urban Health*, 98, 433-437.
- MJ, Moher D, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ* 2021;372:n160
- Mugambi, P., Gikuma-Njuru, P., & Wairimu, J. (2021). Communicating water resources management information to riparian communities: A case of the Mara River Basin, Kenya. *Journal of Environmental Management*, 285, 112094. <https://doi.org/10.1016/j.jenvman.2021.112094>
- Mugo, D. (2020). The Riparian Dilemma and Why the Zones Matter, Nation. Nation. Available at: <https://nation.africa/kenya/life-and-style/dn2/the-riparian-dilemma-and-why-the-zones-matter-120232> (Accessed: April 15, 2023).
- Muiruri, D. W., & Njiru, J. M. (2018). Riparian land-use practices and implications for sustainable water resources management in Kenya. *Journal of Environmental Science and Engineering*, 7(6), 130-140.
- Mwenzwa, E. M., & Misati, J. A. (2014). Kenya's social development proposals and challenges: review of Kenya Vision 2030 first medium-term plan, 2008-2012.

- NETWAS, (2002). The pollution monitoring/assessment of the Nairobi River Basin Project Phase.
- Ngetich, J. K., & Ndiema, A. C. (2020). Challenges and opportunities in environmental impact assessment and environmental audit practice in Kenya. *Journal of Geography and Regional Planning*, 13(3), 70-76.
- Niederdeppe, J.; Bu, Q.L.; Borah, P.; Kindig, D.A.; Robert, S.A. (2008). Message Design Strategies to Raise Public Awareness of Social Determinants of Health and Population Health Disparities. *Milbank Q.* **2008**, 86, 481–513.
- Nisbet, E.K., Zelenski, J. & Murphy, S.A. (2010). Happiness is in our Nature: Exploring Nature Relatedness as a Contributor to Subjective Well-Being. *J. Happiness Stud.* **2010**, 12, 303–322.
- Nisbet, E.K.L. & Gick, M.L. (2008). Can health psychology help the planet? Applying theory and models of health behaviour to environmental actions. *Can. Psychol. Can.* **2008**, 49, 296–303
- NWP, 2021. National Water Policy, Ministry of Water & Sanitation, Republic of Kenya. <https://www.water.go.ke/policies-regulations/>
- Nyangito, M. M., Wasonga, O. V., & Nyabenge, M. (2014). Effects of water tower degradation on downstream water access and livelihoods in Kenya. *Journal of Environmental Science and Engineering*, 3(11), 34-45.
- Nyika, J. M. (2022). Climate change situation in Kenya and measures towards adaptive management in the water sector. In *Research Anthology on Environmental and Societal Impacts of Climate Change* (pp. 1857-1872). IGI Global.
- Odada, E. O., & Oyieke, H. A. (2019). *The Mara River Basin: A pledge for governance, conservation, and development.* Springer.

- Omondi, S. (2020). Tailored Communication Strategies for Effective Water Source Conservation in Kenya." *Water Resources Management*, 28(5), 89-101.
- Opiyo, F. E., Wasonga, O. V., Nyangito, M. M., & Dulo, S. O. (2019). Climate change impacts, vulnerability, and adaptation strategies among small-scale farmers in Kenya: A review. *Climate Risk Management*, 24, 27-40.
- Otieno, J. (2023) The Star. Why cleaning Nairobi rivers is no walk in the park for task force. <https://www.standardmedia.co.ke/article/2001295030/why-cleaning-nairobi-rivers-is-no-walk-in-the-park->
- Pachauri, R.K. and Meyer, L.A. (2014) Ar5 synthesis report: Climate change 2014, IPCC. Available at: <https://www.ipcc.ch/report/ar5/syr/> (Accessed: February 15, 2023).
- Padgett, D.; Allen, D. (1997). Communicating Experiences: A Narrative Approach to Creating Service Brand Image. *J. Advert.* **1997**, 26, 49–62.
- Prakash, S. (2021). Impact of Climate change on Aquatic Ecosystem and its Biodiversity: An overview. *International Journal of Biological Innovations*, 3(2).
- Pulizzi, J. (2012). The Rise of Storytelling as the New Marketing. *Publ. Res. Q.* **2012**, 28, 116–123.
- Rajak, J. (2021). A preliminary review on the Impact of climate change and our environment with reference to global warming. *Int. J. Environ. Sci*, 10, 11-14.
- Republic of Kenya. (1999). Environmental management and co-ordination ACT. *No. 8*.
- Richetin, J., Perugini, M., Mondani, D., & Hurling, R. (2016). Conserving water while washing hands: The immediate and durable impacts of descriptive norms. *Environment and Behavior*, 48(2), 343–364. doi:10.1177/0013916514543683

- Rogers, T.B.; Kuiper, N.A.; Kirker, W.S. (1977). Self-reference and the encoding of personal information. *J. Pers. Soc. Psychol.* **1977**, 35, 677–688.
- Rumble, J. N., Lamm, A. J., Martin, E. T., & Warner, L. A. (2017). Examining thought processes to understand the impact of water conservation messages on attitude. *Journal of Agricultural Education*, 58(3), 168–184. doi:10.5032/jae.2017.03168
- Schultz, P.W. (2000). New Environmental Theories: Empathizing With Nature: The Effects of Perspective Taking on Concern for Environmental Issues. *J. Soc. Issues* **2000**, 56, 391–406.
- Science Africa. (2023). Kenya: New Commission to Spearhead Cleanliness of Nairobi Rivers Launched. Available at: [Kenya: New Commission to Spearhead Cleanliness of Nairobi Rivers Launched – Science Africa](#)
- Shiklomanov, Igor. 1993. “World Fresh Water Resources.” In *Water in Crisis: A Guide to the World’s Fresh Water Resources*, edited by Peter H. Gleick, 13-24. New York: Oxford University Press.
- Smith, K.D. (2019). Four Ps for Effective Communication. *J. Am. Water Work. Assoc.* **2019**, 111, 54–59
- Sobowale, O. R. (2019). River restoration in Nairobi, Kenya: exploring public participation and learning outcomes (Master's thesis).
- Tien, N. H. (2019). *International economics, business, and management strategy*. Dehli: Academic Publications.
- Tunstall, S. M., & Palmer, J. (2010). Media, risk, and science. In S. Roeser, R. Hillerbrand, P. Sandin, & M. Peterson (Eds.), *Handbook of risk theory: Epistemology, decision theory, ethics, and social implications of risk* (pp. 1085-1112). Springer.

- Wackernagel, M., Hanscom, L., Jayasinghe, P., Lin, D., Murthy, A., Neill, E., & Raven, P. (2021). The importance of resource security for poverty eradication. *Nature Sustainability*, 4(8), 731-738.
- Wakaba, S. W., & Kinyanjui, D. N. (2015). Communication and governance challenges in managing water resources in Kenya. *International Journal of Innovative Research in Science, Engineering, and Technology*, 4(9), 8486-8495.
- Wambugu, D. W., Dida, G. O., Gichere, S., & Njiru, M. (2020). Promoting sustainable water use practices through education and communication in Kenya. *International Journal of Water Resources Development*, 36(3), 505-523. <https://doi.org/10.1080/07900627.2019.1671418>
- Warner, L. A., Kumar Chaudhary, A., & Lamm, A. J. (2016). Using importance-performance analysis to guide extension needs assessment. *Journal of Extension*, 54(6). Retrieved from <https://archives.joe.org/joe/2016december/a1.php>
- Warner, L. A., Kumar Chaudhary, A., Rumble, J. N., Lamm, A. J., & Momol, E. (2017). Using audience segmentation to tailor residential irrigation water conservation programs. *Journal of Agricultural Education*, 58(1), 313–333. doi:10.5032/jae.2017.01313
- Warner, L. A., Lamm, A. J., & Kumar Chaudhary, A. (2018). Florida residents' perceived role in protecting water quantity and quality through landscape practices. *Landscape and Urban Planning*, 171, 1–6. doi:10.1080/1533015X.2017.1388199
- Warner, L. A., Lamm, A. J., & Rumble, J. N. (2018). Can videos play a role in good landscape management practices? *Applied Environmental Education & Communication*, 17(3), 187–197. doi:10.1080/1533015X.2017.1388199
- Warner, L. A., Rumble, J. N., & Rogers-Randolph, T. (2019). Integrating personal involvement, goal orientation, and characteristics of innovations to inform fertilizer best practices video



- communications. *Journal of Agricultural Education*, 60(3), 47–61.  
doi:10.5032/jae.2019.03047
- Warner, L. A., Rumble, J. N., Martin, E., Lamm, A. J., & Cantrell, R. A. (2015). The effect of strategic message selection on residents' intent to conserve water in the landscape. *Journal of Agricultural Education*, 56(4), 59–74. doi:10.5032/jae.2015.04059
- Wearn, A.; Shepherd, L. (2020). The impact of emotion-based mass media campaigns on stigma toward cervical screening non participation. *J. Appl. Soc. Psychol.* **2020**, 50, 289–298.
- Weitkamp, E.; McEwen, L.; Ramirez, P. (2020). Communicating the hidden: Toward a framework for drought risk communication in maritime climates. *Clim. Chang.* **2020**, 163, 831–850.
- WMO. (2017). Multi-hazard Early Warning Systems: A Checklist. WMO.
- Zhuang, J.; Lapinski, M.K.; Peng, W. (2018). Crafting messages to promote water conservation: Using time-framed messages to boost conservation actions in the United States and China. *J. Appl. Soc. Psychol.* **2018**, 48, 248–256.

## APPENDICES

### Appendix 1: Contextualization of Research Themes

<b>Program</b>	<b>Objective/focus on Conservation and Restoration Themes</b>	<b>Code Symbol</b>	<b>Actors</b>	<b>CODE/SYMBOL</b>	<b>Problem atization</b>	<b>CODE/SYMBOL</b>
<b>Global/National program</b>	(i) Proposed approach on management of water resource	APPROCH (MCR)	Stakeholders and their roles	STAKEH (WCR)	Benefits to the people	CHALLENGE (C)
	(ii) Identification of frequency of water protection themes	WATERP (WCR)				
	(iii) Identification of frequency of River	FRR				
	Communication Strategy	CS				
<b>National Government Agencies Master/Strategic Plans</b>	(i) Identification of key action plans strategy themes	ACTPLAN (AP)	Stakeholders and their roles	STAKEH (WCR)	Benefits to the people	CHALLENGE (C)
	(ii) Identification of frequency of water protection themes	(WCR)				
	(iii) Identification of time frames	TM				

	(iv) Identification of frequency of River	FRR				
	Communication strategy	CS				
<b>Govern ment acts &amp; policies on water manage ment</b>	(i) Identification of themes on measures to protect water resource	WATERP (WCR)	Stakehold ers and their roles	STAKE H (NAM E)	Sanction s on abuse of water bodies	PROPS UNC (PS)
	(ii) Identification of budgetary allocation towards implementation of implementation of water management projects	COST(B)/ COST (E)			Challeng es	CHAL LENG E (C)
	(iii) Identification of frequency of River	FRR				
<b>Reports and studies</b>	(i) Thematic areas on achieved benefits/value and strategy deployed	VALUE( WCR)	Stakehold ers and their roles	STAKE H (WCR)	Areas of challeng e	CHAL LENG E (C)
	(ii) Identification of themes on	RECC(W CR)				

	recommended way forward					
	(iii)Identify cost of implementation /implications	COST (P)				
	(iv)Identification of frequency of Nairobi River	FRRNR				
<b>Main Stream Media News Paper Articles</b>	(i) Identification of thematic area of success or failure publicized	SCC(WCR)/FAIL(WCR)	Stakeholders and their roles	STAKE H (WCR)	Areas of challenge	CHALLENGE (C)
	(ii)Identification of frequency mentioning of Nairobi River	FRRNR				

**Appendix 2: Symbols and their meanings as applied in this study**

<b>SYMBOL</b>	<b>Meaning</b>
APPROCH(MCR)	Water Management and Conservation Approach
ACTPLAN (AP)	Action Plan Strategy
TM	Time Frame
CHALLENGE (C)	Area of water conservation and restoration challenge
COST(B)/ COST (E)	Cost identified relates to Cost Budget/ Cost Expenditure
WATERP (WCR)	Measure for water conservation and restoration
VALUE (WCR)	Value for water conservation and restoration
<b>RECC (WCR)</b>	Recommendation for water conservation and restoration
COST (P)	Project Cost
SCC(WCR)/FAIL (WCR)	Reported success of water conservation and restoration or reported water conservation and restoration
STAKEH (WCR)	Stakeholder water conservation and restoration
PROPSUNC (PS)	Proposed sanction
FRR	Frequency of which the name River is mentioned
FRRNR	Frequency of which the name Nairobi River is mentioned