

UNIVERSITY FOR DEVELOPMENT STUDIES

**STAKEHOLDER PARTICIPATION IN THE MANAGEMENT OF THE
BLACK AND WHITE VOLTA BASINS IN THE CENTRAL GONJA
DISTRICT OF THE SAVANNAH REGION, GHANA**

SAAKA TAKORA

2026



**UNIVERSITY FOR DEVELOPMENT STUDIES
FACULTY OF NATURAL RESOURCES AND ENVIRONMENT
DEPARTMENT OF ENVIRONMENT AND SUSTAINABILITY SCIENCES**

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BY

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(UDS/DES/0017/21)

**THESIS SUBMITTED TO THE DEPARTMENT OF ENVIRONMENT AND
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MANAGEMENT AND SUSTAINABILITY**

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DECLARATION

I hereby declare that this thesis is the result of my own research carried out in the Department of Environment and Sustainability Sciences, under the supervision of Prof. Conrad-J. Wuleka Kuuder and Prof. Rikiatu Hussein. I have appropriately acknowledged all references to the work of others. I also declare that this thesis has not been submitted previously for any degree, in whole or in part, at this University or any other institution.

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DEDICATION

I would like to dedicate this thesis to my family, whose love, support, and encouragement have been the bedrock in this academic journey. To my parents, who instilled in me the value of hard work, persistence, and quest for knowledge, I am eternally indebted.



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ABSTRACT

Sustainable management of river basins has become increasingly challenging due to climate change impacts, population growth, pollution, and competing demands for freshwater resources. In Ghana, the Black and White Volta Basins are critical livelihood-supporting ecosystems, yet concerns remain regarding weak coordination and limited stakeholder participation in their management. Although participatory governance is widely promoted as a pathway to sustainable water resource management, there is limited empirical evidence providing a holistic assessment of stakeholder participation and its implications for sustainability outcomes within the Black and White Volta Basins, particularly in the Central Gonja District of the Savannah Region. This study therefore examined the extent, determinants, and sustainability implications of stakeholder participation in the management of the Black and White Volta Basins.

The study specifically sought to (i) assess stakeholders' knowledge and attitudes towards basin management, (ii) examine the level and forms of stakeholder participation in planning, implementation, monitoring, and benefit-sharing, (iii) evaluate the contribution of stakeholder participation to basin sustainability, and (iv) identify the key challenges and opportunities influencing effective basin management. A convergent parallel mixed-methods design was employed, integrating quantitative and qualitative data collected concurrently. Quantitative data were obtained through structured questionnaires administered to 400 respondents selected using a multi-stage sampling technique. Qualitative data were collected through in-depth interviews with



key informants, focusing on indigenous participation and traditional ecological knowledge in basin governance.

Quantitative data were analyzed using SPSS Version 22.0 through descriptive statistics, factor analysis, and Kendall's Coefficient of Concordance, while qualitative data were analyzed using content and discourse analysis. The findings revealed a high level of awareness of Integrated Water Resource Management (IWRM) principles, with 82.8% of respondents acknowledging their importance. Indigenous communities were found to play a significant role in sustainable basin management, particularly through participation in planning processes where traditional ecological knowledge contributed to identifying key water-related challenges. The study recorded an overall sustainability score of 70.5, indicating a generally positive sustainability outlook for the basins. Principal Component Analysis showed that attitudes, stakeholder effectiveness, and access to resources accounted for 65.98% of the variance in participation outcomes. However, conflicts over water allocation emerged as the most significant challenge, with a mean score of 2.03.

The study concludes that stakeholder participation remains essential for sustainable basin governance, especially when stakeholders are meaningfully involved in planning, implementation, monitoring, and benefit-sharing. It is recommended that the Ministry of Sanitation and Water Resources, in collaboration with the Water Resources Commission and District Assemblies, strengthens participatory governance structures and prioritizes the development of community-managed irrigation systems tailored to the ecological conditions of the Black and White Volta Basins.



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LIST OF ABBREVIATIONS

DFID	Department for International Development
EPA	Environmental Protection Agency
GSS	Ghana Statistical Services
IWRM	Integrated Water Resources Management
MMDAs	Metropolitan, Municipal and District Assemblies
NGO	Non-Governmental Organisation
RBOs	River Basin Organizations
UDS	University for Development Studies



CHAPTER ONE

INTRODUCTION

1.0 Background of the Study

In recent decades, growing global concern has emerged regarding the sustainable management of natural resources due to rapid environmental change, increasing population pressure, and widespread water and food insecurity (Sheth & Iyer, 2021). Water basins worldwide are increasingly confronted with climate change impacts, demographic expansion, uneven economic development, and weak institutional cooperation, all of which undermine effective governance of freshwater systems (Cosgrove & Loucks, 2015; De Stefano et al., 2012; Mishra et al., 2021; UNDESA, 2015; UNESCO, 2020). These pressures have accelerated freshwater degradation through pollution and overexploitation, resulting in water stress across many regions, including Sub-Saharan Africa, South Asia, the Middle East, North America, and parts of Europe (UNESCO, 2020). Although Europe provides a useful example of water stress management through coordinated policy frameworks, water insecurity remains a global phenomenon, and effective solutions must be tailored to the ecological, institutional, and socio-economic realities of each region (UNESCO, 2020).

Projections further suggest that by 2050 the number of people living in water-stressed basins could double due to intensified exploitation, pollution, and climate change impacts (UNESCO, 2018; World Resources Institute [WRI], 2019). It is also estimated that more than 40% of the world's population already experiences chronic water scarcity, hydrological uncertainty, and extreme weather events, posing significant threats to human development and global stability (UNESCO, 2020). These trends



highlight that water insecurity is not only an environmental concern but also a governance and development challenge, requiring coordinated institutions capable of regulating water use, resolving conflicts, and safeguarding ecological integrity (OECD, 2015).

Despite the increasing recognition of Integrated Water Resources Management (IWRM) as a guiding framework for sustainable basin governance, many river basins still face weak regulatory systems, fragmented institutional responsibilities, and low stakeholder participation (Hailu et al., 2019). This governance weakness often leads to inefficient water use, deteriorating infrastructure, and unsustainable exploitation of water resources, with implications for ecosystems, biodiversity, and human health (Giri, 2021; Ngene et al., 2021). Furthermore, competing claims over water for agriculture, industry, and domestic use are intensifying, especially in developing regions where rapid population growth and livelihood dependence increase pressure on limited freshwater resources. In many contexts, climate change has further worsened scarcity and contributed to conflicts over water allocation and access (Wolf et al., 2005).

While global experiences such as the Mekong River Commission, the EU Water Framework Directive, and IWRM experiments in Latin America provide important lessons on basin-level coordination and stakeholder dialogue, the effectiveness of such models remains highly context-dependent. For instance, evidence from the Lerma-Chapala Basin in Mexico shows that even when IWRM principles are formally adopted, weak governance capacity and institutional underperformance can undermine



implementation (Godinez-Madrigal et al., 2019). This reinforces the view that basin sustainability requires more than technical frameworks; it demands strong institutions, inclusive governance, and locally grounded stakeholder engagement.

These challenges are particularly critical in Africa, where river basins serve as lifelines for agriculture, domestic supply, hydropower generation, and ecosystem services (World Bank, 2010). Many African river basins are increasingly vulnerable to pollution, scarcity, and competing water uses, while governance systems often remain fragmented and under-resourced (Kleinschroth et al., 2021). River Basin Organizations (RBOs) such as the Niger Basin Authority, Lake Chad Basin Commission, and the Senegal River Basin Development Authority have demonstrated the potential of cooperation frameworks, but their effectiveness is often constrained by political, financial, and institutional challenges (Schulze & Schmeier, 2012). This underscores the need for stakeholder-driven approaches that build legitimacy, strengthen compliance, and improve shared responsibility in basin management.

Within West Africa, the Volta River Basin is one of the most significant transboundary water systems, spanning six countries: Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali, and Togo (Volta Basin Authority [VBA], 2014). The basin supports nearly 19 million people whose livelihoods depend on agriculture, fisheries, transport, and domestic water use, making it central to socio-economic development in the riparian states (Liersch et al., 2023). However, the Volta Basin faces persistent challenges including pollution, competing water uses, weak coordination, and increasing climate variability, all of which threaten sustainability and long-term water security. In



response to these pressures, the Volta Basin Authority was established in 2007 to promote shared governance, sustainable resource use, and poverty reduction through coordinated basin management (VBA, 2014).

In Ghana, the Black and White Volta Rivers represent two major sub-basins of the wider Volta system and are critically important for livelihood sustainability, especially in northern Ghana. These rivers support agriculture, domestic water supply, small-scale irrigation, transportation, and emerging tourism activities. In the Central Gonja District of the Savannah Region, fertile riverbanks support the cultivation of yam, maize, millet, rice, cassava, and groundnuts, while the White Volta sub-basin provides strong potential for rice production and irrigation farming due to seasonal tributaries (Ghana Statistical Service, 2020). The Black Volta also serves as a transport corridor, with the inland port at Buipe facilitating trade and movement of goods (Ghana Statistical Service, 2020). Despite these benefits, the district remains vulnerable to recurrent flooding, partly influenced by the periodic spillage of the Bagre Dam in Burkina Faso, which causes seasonal inundation and displacement of riverine communities (Ministry of Finance and Economic Planning, 2022).

Empirical evidence further suggests that weak coordination and limited stakeholder collaboration contribute to environmental degradation, water pollution, and rising social tensions in the Volta sub-basins (Owusu et al., 2016). This reflects broader global and African observations that effective basin management requires integrated, inclusive, and participatory governance approaches that recognize both technical and socio-cultural realities (Rasul & Sharma, 2016; UNESCO, 2020). Consequently,





strengthening stakeholder participation remains essential, not only for enhancing sustainable water use but also for improving cooperation, reducing conflicts, and ensuring equitable distribution of benefits derived from shared basin resources.

It is within this context that the current study examines stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region. Specifically, the study identifies key stakeholders involved in basin governance and assesses how their participation influences the sustainability and effectiveness of water resource management practices. The study is motivated by the need to generate evidence-based insights that can inform improved policy frameworks and promote sustainable basin governance that aligns with Ghana's development priorities and broader water security goals.

1.2 Research Problem

Water resources are central to human survival and socio-economic development, providing drinking water, irrigation for agriculture, fisheries, sanitation services, and energy generation. However, increasing population growth, rapid urbanization, and climate variability have placed unprecedented pressure on river systems, making their management increasingly complex and contested (Mishra et al., 2021; Okello et al., 2015). Globally, the sustainable governance of river basins has become difficult due to competing demands, pollution, weak institutional enforcement, and limited adaptive capacity to respond to climate-related shocks.

In many developing contexts, including Sub-Saharan Africa, the management of river basins has often been dominated by centralized governance structures. Such



approaches tend to suffer from fragmentation, weak inter-agency coordination, and limited accountability, which often results in ineffective implementation of policies and reduced compliance at the community level (Eppel & Dingfelder, 2021; Miranda & Reynard, 2020). Consequently, the absence of meaningful stakeholder engagement has become a major challenge to sustainable water resource governance, particularly in rural communities where livelihoods are directly dependent on rivers and associated ecosystems.

Stakeholder participation has therefore emerged as a widely promoted governance strategy due to its potential to improve transparency, inclusiveness, shared responsibility, and local ownership of water management decisions (Jiménez et al., 2020; Ngene et al., 2021). Participatory governance is particularly relevant in river basin contexts because it integrates local knowledge, strengthens compliance with regulations, and enhances collective problem-solving, especially where resources are shared and contested (Nabiafjadi et al., 2021; Scolobig et al., 2015). Despite this recognition, stakeholder participation in practice remains uneven and frequently constrained by institutional weaknesses, power imbalances, and limited coordination between local and external actors.

In Ghana, the Black and White Volta Rivers form important sub-basins of the wider Volta Basin system and play a critical role in supporting livelihoods in the northern part of the country. In the Central Gonja District of the Savannah Region, these rivers provide water for domestic use, agriculture, irrigation farming, fishing, and small-scale economic activities. However, the sustainability of these basins is increasingly



threatened by environmental degradation resulting from poor land-use practices along buffer zones. These practices include deforestation, encroachment on riparian areas, and the use of agrochemicals, which contribute to declining water quality, soil fertility loss, and reduced ecosystem resilience (Awotwi et al., 2016; Awuku, 2016; Klutse, 2022; Njora & Yilmaz, 2022). Such pressures have implications not only for ecological health but also for local livelihoods, food security, and long-term water availability.

Although Ghana has implemented several water governance interventions such as Community-Based Water Resource Management, Integrated Water Resources Management (IWRM), and the Water, Sanitation and Hygiene (WASH) programme, concerns remain regarding the effectiveness of these initiatives, particularly with respect to low community participation, weak enforcement, and limited stakeholder coordination (Adu-Boahen, 2020; Geoffrey et al., 2021; Madon et al., 2018; McMichael, 2019; Woodhouse & Muller, 2017). This indicates that policy frameworks alone may be insufficient unless they are supported by meaningful stakeholder engagement mechanisms that promote shared governance and accountability.

Despite the growing global literature on participatory water governance, there remains limited empirical evidence that provides a focused and holistic assessment of stakeholder participation within the specific context of the Black and White Volta Basins in Ghana. While previous studies have examined stakeholder engagement in other geographical settings and basin governance systems (Cumming et al., 2022;

Eaton et al., 2021; Nalumu et al., 2021; Sigalla et al., 2021), little is known about the extent of stakeholder involvement, the institutional factors shaping participation, and the sustainability implications of participation within the Central Gonja District of the Savannah Region. In particular, there is inadequate evidence on how local and external stakeholders interact in basin governance processes, the challenges they encounter, and the opportunities that exist for strengthening inclusive water resource management.

This study therefore seeks to address this knowledge gap by examining the state of stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District. Specifically, the study assesses the roles, levels of involvement, challenges, and opportunities for improving stakeholder participation and evaluates how stakeholder engagement influences sustainability outcomes in the basins. The findings are expected to contribute to policy and practical interventions aimed at improving participatory governance and ensuring sustainable water resource management in the Savannah Region of Ghana.



1.3 Study Question

1.3.1 General Study Question

What is the nature of stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region, Ghana?

1.3.2 Specific Study Question

The study thus sought to answer the following research questions;

1. What is the perceived stakeholder's knowledge and attitude towards management of the Black and White Volta Basins?
2. What is the level of stakeholder's participation in the planning, implementation, monitoring, and benefit-sharing processes within the Black and White Volta Basin catchment areas?
3. How does stakeholder participation in the management of the Black and White Volta Basins contribute to their sustainability?
4. What are the key factors that influence stakeholder participation in the management of the Black and White Volta Basins?
5. What challenges are encountered in the management of the Black and White Volta Basins?
6. What opportunities exist for improving management practices within the Black and White Volta Basins?



1.4 Research Objectives

1.4.1 General Objective

To examine the nature of stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region, Ghana.

1.4.2 Specific Objectives

Specifically, the study sought to;

1. Explore the perceived stakeholder's knowledge and attitudes towards the management of the Black and White Volta Basins.
2. Assess the level of stakeholder's participation in the planning, implementation, monitoring, and benefit-sharing processes within the Black and White Volta Basin catchment areas.
3. Evaluate how stakeholder participation in the management of the Black and White Volta Basins contributes to their sustainability.
4. Identify the key factors that influence stakeholder participation in the management of the Black and White Volta Basins.
5. Examine the challenges encountered in the management of the Black and White Volta Basins.
6. Identify the opportunities for improving management practices within the Black and White Volta Basins.





1.5 Justification of the Study

Stakeholder involvement in natural resource management is one of the key ingredients to ensure the sustainability of the ecosystems, more so in a region like the Savannah Region of Ghana, which depends very heavily on the two water bodies for livelihoods and economic activities. The Black and White Volta Basins form a very important source of water, agricultural resources, and energy for the region. Hence, a study on stakeholder participation in the management of such basins becomes very important for sustainability and development in the region.

The study is justified because it aligns with SDG 6, Clean Water and Sanitation; in particular, goals 6.1, to have universal and equitable access to safe and affordable drinking water; 6.4, to increase water-use efficiency and ensure sustainable withdrawals; 6.5, to implement integrated water resources management; 6.6, to protect and restore water-related ecosystems; and 6.8, to support local communities in the management of water resources. Such research will go directly to contribute to the efforts of the sustainable management of water resources, promotion of equitable access, and enhancement of water-use efficiency, by investigating the nature of stakeholder participation in the management of the Black and White Volta Basins, thereby aligning with the targets of SDG 6.

The study highlights the role of local communities, government agencies, and other stakeholders in making decisions concerning resource management. Understanding how stakeholders interact with each other and their effect in managing the Black and White Volta Basins will help in empowering local communities by allowing them a

say in decisions directly affecting their environment and livelihood. This insight is very instrumental in enhancing community involvement, which is very critical in realizing sustainable outcomes.

Not only that, but the Black and White Volta Basins are also fragile ecosystems that need proper management in ensuring their conservation. The study takes a critical look at the present practices in managing them and points out the loopholes or challenges hence recommending a way forward for better conservation practices. In so doing, it will contribute to protecting sources of water, preserving biodiversity, and ensuring sustainability of agricultural practices within the region.



CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter reviews related research which is relevant to this study. The chapter is divided into three sections. The theoretical concepts guiding the study are discussed herein in the first part. The second part presents review of important literature based on the study objectives while the third and final, part presents the conceptual framework that guided the study.

2.1 Theoretical Framework

A number of theories have been used to explain the complexities in the management of common-pool resources such as water and land and how these challenges can be managed by the participation of stakeholders. In this study, four of such theories have been adopted. They are Arnstein's Ladder of Citizen Participation (1969), Stakeholder theory, Social-ecological systems (SES) theory and Social Exchange theory.

2.1.1 Arnstein's Ladder of Citizen Participation (1969)

Arnstein (1969) conceptualizes participation as a continuum of citizen involvement in governance and decision-making. She argues that participation is often misunderstood, as many programmes claim to involve citizens while in reality excluding them from meaningful influence. The ladder is structured into eight rungs, grouped into three broad categories: Non-Participation, Tokenism, and Citizen Power.

The first category, non-participation, includes Manipulation and Therapy. These rungs represent situations where authorities involve citizens only to educate or engineer





support for decisions already made. Citizens are not empowered to influence outcomes, and participation becomes a tool of control rather than inclusion.

The second category, Tokenism, consists of Informing, Consultation, and Placation. At this stage, citizens may be informed of decisions or consulted through meetings, surveys, or forums. However, their contributions often have little impact on final outcomes because decision-making power remains with institutions. Arnstein argues that consultation without power-sharing is merely symbolic and does not represent genuine participation.

The third category, Citizen Power, includes Partnership, Delegated Power, and Citizen Control. These rungs reflect meaningful participation where citizens are actively involved in governance structures and have real authority over decisions. In partnership, power is shared between institutions and citizens through negotiation and joint planning. Delegated power occurs when citizens hold dominant decision-making authority in specific programmes. Citizen control represents the highest level, where communities independently govern processes and institutions only play supportive roles.

Arnstein's Ladder is widely recognized in governance and development studies because it provides a strong framework for evaluating whether participation is genuine or superficial. It is particularly useful in natural resource management contexts where communities depend directly on ecosystems for livelihoods and are affected by policy decisions. In river basin management, Arnstein's model helps to reveal whether local

communities are truly empowered to influence planning and resource allocation, or whether they are merely consulted without decision-making authority.

In Ghana, the management of water resources, including the Black and White Volta Basins, has historically been shaped by state institutions and external agencies, often through centralized planning structures. This has frequently limited the influence of indigenous communities despite their dependence on the basins for irrigation, fishing, farming, and domestic water use. Such limited engagement has contributed to poor compliance, resource degradation, and conflicts among water users. Therefore, applying Arnstein's Ladder provides an appropriate analytical lens to assess the depth of stakeholder participation and whether existing governance systems reflect tokenism or genuine citizen power in basin management.

Relevance and Application of Arnstein's Ladder of Citizen Participation to the Study

Arnstein's Ladder of Citizen Participation is highly relevant to this study because it provides a practical framework for examining the extent to which stakeholders particularly indigenous communities are involved in decision-making processes regarding the management of the Black and White Volta Basins. The study area involves communities whose livelihoods depend heavily on basin resources, yet management decisions often originate from formal institutions such as the Water Resources Commission, District Assemblies, and sectoral agencies. The ladder is therefore useful in assessing whether participation in basin governance is empowering or merely symbolic.





In applying Arnstein's model, this study uses the ladder to evaluate stakeholder participation across key governance stages, including planning, implementation, monitoring, and benefit-sharing. Specifically, the study assesses whether participation falls within the lower rungs of non-participation (manipulation and therapy), the middle rungs of tokenism (informing, consultation, and placation), or the higher rungs of citizen power (partnership, delegated power, and citizen control). This provides a structured way to determine whether stakeholders have real influence over water management decisions or are only consulted after major decisions have already been taken.

The application of Arnstein's Ladder is also important for explaining sustainability outcomes in the basin. When communities are placed at the tokenism level, they may lack motivation to comply with regulations, leading to illegal farming in buffer zones, pollution, and over-extraction of water resources. Conversely, when participation reflects partnership or delegated power, communities are more likely to develop a sense of ownership, enforce local rules, and contribute indigenous ecological knowledge to strengthen sustainable practices. Thus, the ladder helps this study interpret why some management interventions succeed or fail based on the degree of citizen empowerment.

2.1.2 Stakeholder Theory

Stakeholder theory arose in the 1960s and 1970s as a challenge to the dominant view of corporate social responsibility then held by shareholder concerns (Freeman, 1994; Parmar et al., 2010). The basic premise of stakeholder theory holds that firms ought to



consider, in decision-making, the interest of all stakeholders and not only those of the shareholders (Parmar et al., 2010). Edward Freeman first used the term stakeholder in 1994 to refer to any group or individual that can affect or is affected by the achievement of the organization's objectives. This includes shareholders, employees, customers, suppliers, and the surrounding community in which the organization operates. The theory holds that companies which consider the interests of all stakeholders in their decision-making process will likely succeed in the long run. This is because stakeholders have a natural interest in the success of the organisation and hence, work in tandem to promote its objectives (Freeman, 1994). For instance, if an organization creates a good working environment for the employees, they will tend to work more productively and be satisfied with the firm, which benefits the company. The theory also posits that organizations have a moral responsibility to take into consideration the interests of all stakeholders. Since they have such significant influence on society, organizations have a duty to use their resources and influence to improve society at large (Sen & Cowley, 2013). Despite its importance, stakeholder theory has been subjected to much debate and criticism. Some say that companies have a primary responsibility to maximize shareholders' interests and that prioritizing other stakeholders can sometimes act at the expense of the firm itself (Chen et al., 2021; Lin et al., 2018; Ruostesaari & Troberg, 2016). Others have maintained the position that the theory is not very specific in relation to which stakeholders a priority in decision-making should be granted (Tashman & Raelin, 2013; Engster, 2011). Despite various criticisms, stakeholder theory has influenced the attitude of companies toward social responsibility in a big way. Codes of conduct and sustainability policies considering



all stakeholders' interests are common in many companies today. Moreover, corporate social responsibility is increasingly finding relevance in today's business, with companies slowly realizing the benefits that come from factoring in all stakeholders' interests while making decisions. This theory would be most applicable to the management of natural resources, such as the Black and White Volta Basins, that have multiple stakeholders, including local communities, farmers, fishers, and government agencies.

These stakeholders have entirely divergent interests and priorities when it comes to the management of the basins' natural resources, including water and land. For instance, local communities would emphasize water for domestic and agricultural purposes, while government agencies would emphasize hydroelectric power generation. Similarly, farmers would emphasize land-use for growing crops, and conservationists would emphasize wildlife conservation. The fulfillment of the different interest of each stakeholder in the absence of well-defined property rights may lead to the depletion of the resource, since individuals lack incentives for preservation. For instance, Elinor-Ostrom, 1990, observed great diversity in resource governance outcomes in a variety of communities around the world. She noted that whereas some succeed in keeping common resources for hundreds of years, despite changes in government, wars, and natural disasters, others constantly fail, no matter how many designs for appropriate governance institutions are tried. To understand the sources of such diversity, Ostrom suggested that common-pool resources, including water, should be understood as "social-ecological systems" in which multiple interacting factors shape successful resource governance (Ostrom, 2009). Hence, there

is an important need to understand the social-ecological system theory and its application in resource management.

Relevance and Application of Stakeholder Theory to the Study

Stakeholder Theory is relevant to this study because the Black and White Volta Basins involve multiple stakeholders with different interests, responsibilities, and levels of influence. These include government agencies such as the Water Resources Commission, district assemblies, NGOs, traditional authorities, farmers, fisherfolk, and local communities. Since the basins provide water for domestic use, agriculture, transport, and ecosystem services, competition over resource access and control is inevitable. Stakeholder Theory provides a strong foundation for understanding these competing interests and the need for coordinated decision-making.

In applying Stakeholder Theory, this study uses the theory to identify key stakeholder groups and examine how their roles and interactions affect the management of the basins. The theory guides the study in assessing whether basin governance is inclusive or dominated by powerful institutions, and whether marginalized groups such as rural farmers and women have meaningful representation. It also helps to explain how poor coordination among stakeholders can result in fragmented management efforts, weak enforcement of regulations, and unsustainable exploitation of basin resources. Thus, Stakeholder Theory supports the study's assessment of governance effectiveness and provides justification for recommending collaborative and multi-stakeholder approaches in basin management.



2.1.3 Social-Ecological Systems (SES) Theory

The social-ecological systems theory is an interdisciplinary framework to understand comprehensively the interlinkages between human society and the natural environment (Schlüter et al., 2014). The theory emerged in response to growing dissatisfaction in the late 20th century with the failure of conventional approaches to environmental management and conservation to deal with the new, complex, and multifaceted problems of climate change, biodiversity loss, and land-use change. The basis of SES theory lies in the fact that social and ecological systems are not independent things but intertwined and dependent upon each other (Schlüter et al., 2019). This means that any change in one system could have strong repercussions for the other, and solving environmental problems needs consideration of solutions that account for both social and ecological factors. The feedback loop becomes very important in SES theory: it explains how a change in one system can trigger a change in the other, either positive or negative (Elshafei et al., 2014). For instance, changes in land use practices leading to deforestation would result in a decrease in biodiversity and a reduction in the ability of the ecosystem to provide key services such as carbon sequestration. This can then lead to even more deforestation, creating a negative feedback loop (Doe, White & Green, 2023).

The second core concept within the SES theory is that of resilience: the ability of a system to absorb disturbance and still keep functioning (Masnavi, Gharai & Hajibandeh, 2019). Resilience becomes important in that it allows the systems to adjust to changed conditions but at the same time maintain their integrity. Scholars in SES theory view the argument that the diversity and complexity of a system are





essential informants of its resilience and, therefore, efforts to build resilience must centrally be placed on the enhancement and maintenance of these qualities (Cote & Nightingale, 2012). More importantly, SES theory focuses on the crucial aspect of viewing environmental problems from their social dimensions. This involves researching how different social groups are affected by environmental change and realizing the differences in values, beliefs, and priorities of different groups. The second aspect involves considering the effect of institutions and governance on environmental outcomes (Gifford, Kormos & McIntyre, 2011). The SES theory then generally provides a wide framework for understanding the complex interaction between human societies and the natural environment. This view realizes the complex and multi-faceted nature of the challenges facing the environment and assumes that the solutions to such problems need consideration both in their social and ecological dimensions. Focusing on mechanisms for feedback, resilience, and consideration of the social, SES theory guides toward sustainable and fair environmental management and conservation. The application of SES theory within this case study delineates the linkages between the human and natural systems, and most importantly, the role of stakeholders in governance within the natural resources. This theory underlines the need to appreciate the complex dynamics between social and ecological systems, emphasizing full involvement of all stakeholders in the management of natural resources. SES is criticized for being rather complex and, as a consequence, over-general, not lending itself easily to application in specific contexts (Walker et al., 2009). The dynamic nature and the context dependency make resilience and feedback loops measurement difficult (Perrings et al., 2010). It underestimates the power



dynamics and social inequalities relevant for governance and participation (Agarwal, 2001). Institutional challenges, for instance, multi-level governance coordination, are not strongly developed (Ostrom, 2009). First, it normally assumes that ecosystems are resilient to disturbances, which may not be true in cases of irreversible degradation of some ecosystems (Folke et al., 2010). Secondly, its focus on sustainability may overlook the need for transformative changes in response to environmental crises (Fischer et al., 2015).

Relevance and Application of Social-Ecological Systems (SES) Theory to the Study

Social-Ecological Systems (SES) Theory is highly relevant to this study because the Black and White Volta Basins represent a complex system where human activities and ecological processes are deeply interconnected. The theory explains that environmental challenges cannot be understood separately from social and institutional dynamics, because the actions of communities, institutions, and economic systems shape ecological outcomes. In the Volta Basin context, land-use practices such as deforestation, farming near riverbanks, and the use of agrochemicals affect water quality, biodiversity, and ecosystem resilience. These ecological changes, in turn, affect human livelihoods through reduced water availability, declining fish stocks, and increased vulnerability to floods and droughts.

In applying SES Theory, this study uses the framework to analyze the relationship between stakeholder behaviour and basin sustainability outcomes. It supports the study in explaining how governance failures, weak institutional coordination, and poor stakeholder participation contribute to ecological degradation and reduced



sustainability. The SES perspective also strengthens the study's interpretation of sustainability indicators (social, economic, and environmental) as interconnected dimensions rather than separate outcomes. Therefore, SES Theory provides a comprehensive lens for understanding how sustainable basin management requires integrated approaches that balance ecosystem protection with livelihood and development needs.

2.1.4 Social Exchange Theory

The basis of the social exchange hypothesis is taken from two fields, that is, social psychology and economics. Much of the propositions originate from experimental studies carried out on animals in laboratories under artificial conditions where behavior from group "A" both affects and gets affected by behavior of group "B" or any other. Economics, however, offers quite a number of proposals which reflect statements on supply and demand in a perfect market (Chadwick-Jones, 1976). Social Exchange Theory is a body of explanations, propositions, and theories that attend to particular issues about social behaviour. The theory is based on the assumption that processes of evaluation, decision-making, and social interaction cannot be understood apart from the social context within which they are embedded (Chadwick-Jones, 1974) and personal context and trust are key components of exchange processes (Lawler & Thye, 1999). Since any study of social behavior necessarily involves making assumptions, a deep appreciation of concepts used in the construction and analysis of social behaviour lies at the core of theory development. This theory only suggests that, within the context of stakeholders' involvement in the management of natural resources in the Savannah Region of Ghana, people and groups will be ready to

participate in resource management efforts if they feel that the benefits from participation outweigh its costs. This would be evident in the case in point, by the example of the Black and White Volta Basins, where stakeholders such as local communities, government agencies, and private companies would hold different views on the sharing of benefits and costs regarding the management of the resources. A critical assessment of the black and white Volta Basins would be that the extent of stakeholder participation in resource management decisions of the basins is evaluated against the benefits they gain or enjoy from such participation in the management and assess how effective the current resource management practices of the basins are in ensuring sustainability.

Relevance and Application of Social Exchange Theory to the Study

Social Exchange Theory is relevant to this study because stakeholder participation in basin management is often shaped by perceptions of costs and benefits. The theory assumes that individuals and groups will participate in collective activities when they believe that the rewards outweigh the sacrifices. In the context of the Black and White Volta Basins, stakeholders such as farmers, fisherfolk, and local communities may be willing to engage in conservation practices if they perceive clear benefits such as improved water quality, access to irrigation, reduced flooding, or livelihood support. However, if stakeholders believe that participation only imposes restrictions without tangible rewards, they may resist management initiatives or fail to comply with regulations.



In applying Social Exchange Theory, this study uses the theory to explain why participation levels may vary among stakeholder groups. It provides a framework for interpreting issues such as conflicts over water allocation, mistrust in institutions, and weak cooperation in management activities. The theory also helps the study to understand why benefit-sharing is critical for sustaining long-term stakeholder involvement. As a result, Social Exchange Theory strengthens the study's recommendations that basin governance should incorporate incentives, transparency, trust-building mechanisms, and equitable distribution of benefits to ensure continuous stakeholder commitment to sustainable management.

2.2 Concept of Sustainability

The concept of sustainability is very complex and multifaceted, gaining much prominence over recent years. At its very core, sustainability deals with meeting the needs of the present in such a manner that it does not compromise the ability of future generations to meet their own needs (Holden, Linnerud, & Banister, 2014). This concept is normally broken down into three interconnected pillars that are environmental, social, and economic sustainability.

2.2.1 Environmental Sustainability

The principle of environmental sustainability is very important since meeting the needs of the present is necessary while ensuring that future generations can meet their own needs (Mensah, 2019). This will ensure long-term health and resilience of the ecosystems, biodiversity, and water resources within basins. Preservation of such natural ecosystems, like wetlands, forests, and other types of habitats, is very important



to ensure the sustainability of the environment in river basins (Anokye, 2020). Those ecosystems provide key services in controlling the flow of water, preventing erosion, and supporting many life forms in a wide range of biodiversity (Mengesha, 2017). Those ecosystems are very important for maintaining ecological balance and biodiversity. Therefore, biodiversity can be defined as the variety of different living organisms within an ecosystem, which is very essential in keeping the stability and adaptability of the ecosystem. Habitat protection and restoration are therefore important for the maintenance of biodiversity within basin ecosystems, coupled with the adoption of conservation strategies that will significantly reduce the risks of habitat loss and fragmentation. The Murray-Darling Basin in Australia is a good example of the practice of habitat restoration and conservation. In this regard, much emphasis has been given through the Murray-Darling Basin Plan by the authorities to the use of water in a sustainable way, restoration of habitats, and involvement of communities, leading to improved water quality and revitalized ecosystems that give support to diverse flora and fauna (MDBA, 2018). On the other hand, the Aral Sea Basin in Central Asia represents what happens when sustainability measures are not put into practice. This has led to huge amounts of water being abstracted for irrigation accompanied by habitat destruction, severe ecological degradation, loss of biodiversity, and negative socio-economic impacts to local communities (Micklin, 2007). These are contrasting examples showing the importance of proactive conservation measures for achieving sustainable management of natural resources. This is particularly an important fact to preserve water quality in basins for the long-term sustainability of the environment (Zhuang, 2016). Water is very essential for



human health, ecosystems functioning, and welfare in general. Watershed management, pollution control, and sustainable agriculture practices have been very effective in ensuring protection of the water quality and the ability to provide clean water for this and future generations. The practices of sustainable land use can be an important factor in ensuring environmental sustainability of basins (Sanz et al., 2017). Undertaking activities such as reforestation, wetland restoration, soil conservation, and sustainable agriculture is a way to maintain ecosystem health, prevent soil erosion, improve water retention, and enhance landscape resilience. Long-term sustainability of the basin environment can be strengthened by sustainable management of land under stakeholders in the present (Carvalho et al., 2019).

2.2.2 Social Sustainability:

Social sustainability relates to the needs and wellbeing of local communities, depending on water resources for various uses: farming, fishing, domestic uses, and livelihoods (Smyth & Vanclay, 2017). In that spirit, this will mean ensuring equal access to water use for all persons in a society, enhancing participative decision-making processes, and guaranteeing cultural traditions attached to water use (Chowdhury et al., 2018). The objective of sustainable development projects should therefore be focused on improving quality of life in parallel with the protection and respect of local culture and traditional knowledge (Magni, 2017).

This involves various challenges associated with the limited availability, quality, and distribution of water resources to meet the diversified needs of community members (Cosgrove & Loucks, 2015).



According to Clark and Wise (2018), only inclusive decision-making processes can ensure social sustainability in the management of water resources. For example, community-managed water systems are showing the effect of participatory approaches in Bolivia. By involving the local community in major decisions pertaining to water distribution, use, and its maintenance, the Cochabamba Water Management Initiative has been able to foster a strong sense of ownership and accountability, allowing for better management of the resource and equitable distribution of the resources available (Bustamante et al., 2020). For instance, in the Jal Swaraj project in India, through participatory governance, the participation of local rural communities in decision-making with regard to water resource planning and conservation drastically improved the outcome of water availability and its conservation (Narain, 2016). Participatory methods enhance transparency and accountability in governance, as suggested by Akhmouch and Clavreul (2016), which only goes to add itself to the making of sustainable water management of resources. Participatory approaches increase the level of transparency, accountability, and inclusiveness in water governance (Akhmouch & Clavreul, 2016).

Social sustainability involves the preservation of cultural practices that are associated with water use within communities. Many indigenous cultures have very strong traditions and knowledge systems related to the management of water (Chua et al., 2015; Engster, 2011). As we incorporate these cultural traditions in our sustainable development projects, we not only protect our cultural heritage but also increase the effectiveness and adoption of our water resource management practices (Nocca, 2017). An important barrier to social sustainability is how to find a harmonious balance

between improving living conditions through development projects and respecting indigenous culture and knowledge (Ferretti, 2016). Culturally appropriate sustainable development projects must consider the interdependence of social, environmental, and economic aspects of sustainability (Burford et al., 2013).

2.2.3 Economic Sustainability

Economic sustainability ensures the facilitation of effective water management practices that will contribute to sustainable economic development and the preservation of natural resources. In this regard, there is an investment in the infrastructure of irrigation systems, hydropower generation, and water supply networks towards the increase in productivity and resilience to the impacts of climate change (George, Schillebeeckx & Liak, 2018). Incentives in the form of economic benefits can encourage conservation efforts and bring about long-term economic growth that will also ensure the protection of valuable resources, like water (Barbier, 2011).

Efficient water management practices for agriculture and industry, including investment in the building of infrastructure related to an irrigation system, hydropower generation, and water supply networks, is very vital to economic sustainability. Investment in water infrastructure can play a very important role in enhancing productivity through better access to water and minimizing losses due to water wastage. This provides resilience against climate change by assuring a supply during extreme weather events (Srivastav et al., 2021).





In many cases, the SLM practices have been effective in achieving economic sustainability. The Sustainable Land Management Program (SLMP) contributed much to this aspect by turning degraded landscapes into productive farmlands through introduction of terracing, reforestation, and agroforestry practices in Ethiopia. These have increased soil fertility, agricultural productivity, and farm incomes for the farmer contributing highly to economic sustainability (Gebregziabher et al., 2016). Similarly, large-scale adoption of SLM practices such as reforestation and soil conservation in China's Loess Plateau reduced soil erosion and restored degraded ecosystems. This helped in rejuvenating not only the land but also the local economy with increased crop yields and livelihood opportunities (World Bank, 2007). Financial incentives are indeed a very critical factor in encouraging farmers and landowners to adopt practices such as conservation tillage, crop rotation, and agroforestry (World Bank, 2007). We can reduce the negative impacts of agriculture on water resources and improve soil health and biodiversity by promoting sustainable land management practices. Investment in water infrastructure has very large economic benefits. The World Bank has remarked that in 2020, one dollar invested in irrigation infrastructure can give an average return of \$5.60. Investments in hydropower generation also bring about both environmental benefits and renewable energy to contribute to economic growth (Gurney et al., 2016).

The United Nations Development Programme identified some of the successful initiatives on economic sustainability that precisely focus on water management. In Ethiopia, large-scale irrigation projects have significantly increased productivity and reduced dependence on rain-fed agriculture (UNDP, 2019). The National River

Linking Project in India aims at mitigating water scarcity by transporting water from areas that have surplus water to areas facing water shortages through an interconnecting canal system (UNDP, 2019).

2.3 Concept of Participation

The discussion of participation in development became prominent in the 1960s as a reaction to the hierarchical and top-down approaches that dominated earlier development practices (Moore & Schmitz, 2016). These approaches proved difficult to implement, and thus, in the 1970s, participatory methods were adopted owing to their perceived benefits and potential for community engagement (Rondinelli, 2017). Early participation efforts were largely confined to the provision of resources, including labor and funding, but by the late 1960s, critiques of modernization theories began to coalesce around the need for more people-centered approaches that emphasized community involvement (Dibua, 2017; Kumar, 2017).

From the mid-to-late 1970s, participation began to emphasize local perspectives, decentralization, and stakeholder involvement in a shift away from a project-centered approach toward people-centered approaches (Chambers, 2007). It meant involving the marginalized in decision-making through decentralized development processes, making the decision-makers accountable (Hainz et al., 2016; Peters, 2015). In the 2000s, participatory approaches evolved to anchor themselves in public consultations and collaborative mechanisms that further focused on democratic accountability and service delivery (Hostettler et al., 2019; Kabogo et al., 2017).





Critics, however, argue that with all the advances, participatory approaches often still do not address power dynamics in any meaningful way and bring about significant social change (Carpentier, 2018). The COVID-19 pandemic has underlined the importance of inclusive participation in decision-making to ensure that the projects are implemented in a sustainable manner and underpin their relevance in achieving the SDGs (Lampayan et al., 2015; United Nations, 2018). Participatory approaches now have worldwide attention for their potential in fostering community engagement and ensuring effective and sustainable development outcomes.

2.4 Concept of Participation in Natural Resource Management

Participatory natural resource management entails the active involvement of people and communities in decisions and control over natural resources, such as land, water, and forests (Herath & Prato, 2017; Maclean, Robinson & Natcher, 2015). The basic underlying premise of the concept is that people who get directly affected by the use and management of natural resources should have a say in their use and management. Integral to participation in the management of natural resources, though, is the inclusion of the very same marginalized and vulnerable groups: women, the elderly, persons with disabilities, indigenous peoples, and rural communities (Ratner et al., 2017). Traditional participation has lacked the involvement of these groups; as a consequence, the ensuing policies and strategies for management did not take the needs and priorities into account (Ensor & Harvey, 2015). Participation in natural resource management ranges from community-based management to a formal representation in decision-making (Gurney et al., 2016).



One of the research questions identified by Prell et al. (2016) was the determination that effective participation involves more than the simple representation of actors included in the decision-making process of managing natural resources. This logically means that inclusion is not just about bringing marginalized groups into decision-making but also about taking consequent action in the outcomes of those decisions and ensuring access to all resources under management (Leisher et al., 2016). Moreover, strengthened capacity and support infrastructure can empower marginalized groups and facilitate their involvement in natural resource management and in the decision-making and management undertakings that occur (Sterling et al., 2017). This can be realized, for example, through education in natural resource management, promotion of the formation of community-based organizations, and empowering such kinds of organizations with information and resources so that they can contribute meaningfully. Second, participation can improve the conservation outcomes of natural resource management. It has been established in literature that local communities, when involved in the management of natural resources, develop feelings of ownership and stewardship over the resources, which should lead to better conservation outcomes (Perry & Davenport, 2020; Schild, 2019; Ntuli et al., 2019). This is predicated on the fact that local communities have an intimate knowledge of the resources and ecosystems in which they live, making them more inclined to exercise sustainability and be in a position to resist external forces that would seek to compromise the value of their resources (Liburd & Becken, 2020). Besides, participation in the management of natural resources would reduce poverty among the community—most at-risk groups—as expressed by Magni (2017). That shall further mean inclusion of the



involved local communities, making decisions for them within its management process; hence, creating benefits accruable from those accessible natural resources for sustainable income generations. For example, community-based forest management programs in Ethiopia have proved highly effective in improving the livelihoods of local communities through granting access to forest resources for fuel, food, medicine, and generation of income through forest-based enterprises (Mekuria et al., 2018). The different levels of participation in natural resource management can be categorized into a number of quite distinct levels with different characteristics and implications.

In consultative participation, stakeholders are informed and their opinions are asked, but it is not a requirement that their input will be part of the decision-making. This approach is mostly used to fulfill legal requirements or to give legitimacy to decision-making processes (Arnstein, 1969). For instance, in South Africa, there have been public consultations in the management of water to source inputs, although the final decisions usually remain with government authorities (Mckenzie et al., 2020).

Collaborative Participation: At this level, there is an active participation and shared decision-making between stakeholders and the decision-makers with the aim of achieving outcomes that are mutually beneficial. The key features of collaborative participation include partnership and co-management. For instance, in Tanzania's Wildlife Management Areas, communities share the management of wildlife resources with government authorities to balance conservation goals with community livelihoods (Nelson, 2010). Joint management agreements and institutional frameworks particularly reinforce the collaborative efforts.



Self-Mobilized Participation: This is the seventh and highest level of participation according to Pretty (1995), whereby stakeholders manage resources independently without any external oversight. Traditional land and water management practices by indigenous communities in Mexico's Oaxaca Valley illustrate this level of participation. These are based on long-standing cultural traditions that ensure sustainable use of the resources (Toledo et al., 2003).

Empowering Participation: This is the highest level of participation, where stakeholders are empowered with resources and authority to make decisions on resource management. Empowerment participation can be clearly observed in Nepal's Community Forestry Program, as decision-making powers are devolved to local forest user groups, which has been found to result in better forest conditions and improved livelihoods of communities (Acharya, 2002). Such mechanisms may include community-based management, capacity building, and devolution of decision-making powers (Martini et al., 2017; Ahmad & Abu Talib, 2015).

According to Pretty (1995), functional participation is the fourth rung in his typology of participation. This level of participation involves the active involvement of local communities in decision-making but is characterized by relatively low levels of empowerment compared to higher rungs, such as "interactive participation" (rung 6) and "self-mobilization" (rung 7), which signify full participation. Pretty points out that functional participation 'is often externally driven, stakeholder participation occurring to satisfy an externally defined requirement rather than on its own agency'. This does make it a lesser 'transformative participation' compared to the higher levels.



Still, the importance of functional participation in any sustainable natural resource management has become widely recognized because of the requirement that diverse dimensions, including women's participation, will be brought into play. Andrews et al. (2021) highlight that this approach can increase the acceptability of resource management decisions and lead to more equitable and effective outcomes. Leisher et al. (2016) discovered that when the participation of women in decision-making processes in South Asia was fostered, the sustainability and equity of resources improved. Tanto and Simatele (2017) further underline that integrating local knowledge through functional participation in Africa increased the effectiveness of resource management initiatives.

However, while functional participation contributes to more inclusive decision-making, its limited empowerment of communities may restrict its potential to achieve transformative outcomes. Combining Pretty's higher rungs of participation interactive participation and self-mobilization could provide a more robust framework for fostering local agency and long-term sustainability. These higher levels involve collaborative partnerships, where communities actively influence or even lead decision-making processes, moving beyond externally driven objectives.

2.5 Concept of Natural Resource Management

Natural resource management encapsulates the activities and processes executed to use, protect and conserve the resources in a way that is sustainable for the present and future generations. It includes land, water, air, and biodiversity management, and extraction and exploitation of natural resources by human beings, such as wood,



minerals, and oil (Cleaver, 2017). Natural resource management, therefore, by itself, becomes an interdisciplinary field that combines the ecological, economic, social, and political perspectives in developing a sustainable solution toward the use and management of the resources. It entails comprehension of the complicated relationships between natural resources and human societies, excluding the environmental impacts of such activities by humans, according to Wang et al. (2016). One of the fundamental principles in managing natural resources involves sustainable use, where attempts are made to strike a balance between societal needs and the imperative to save natural resources for future generations, as observed by Mensah (2019). The latter includes the exploitation and utilization of renewable resources, such as solar and wind energy, and that of non-renewable ones in a responsible way. Another major component of natural resource management is integrated management, whereby coordination among various sectors and stakeholders in the efforts toward sustainable use of the resources takes place. This calls for cooperation among the government agencies, non-governmental organizations, and the local communities in preparing and implementing management plans and policies (Margerum & Robinson, 2015). The area of natural resource management is of great importance for the sustainability and conservation of resources for future generations. It is, finally, a multi-dimensional and intricate field that must derive from diversification of outlooks and engage all stakeholders in active participation to realize an ideal of sustainable use of resources. Society should realize the values of natural resources, and act responsibly for their conservation and management towards benefits to the present and future generations.



2.6 History of the Black and White Volta Basins

The Black and White Volta Basins, flowing through West Africa, are shared water resources among several countries in the region, including Ghana, Burkina Faso, and Côte d'Ivoire. These basins play a very important role in the livelihood of millions, providing water for irrigation, agriculture, transportation, and supporting biodiversity in surrounding regions, including the Mole National Park. The Black Volta River flows through the northern parts of Ghana and Burkina Faso, and the White Volta River flows on the eastern Ghana, providing almost a guaranteed huge source of water across the country; together they make up a settled land area, basin systems of which the Black Volta basin extends to around 39,000 square kilometers sq (Ahmadou &Thebaud 2003).

The Black and White Volta Basins are generally located in the northern and upper parts of Ghana, including areas such as the Upper East, Upper West, and Northern Regions. These regions have heavily relied on the water resources from the basins to pursue agriculture, with the rivers supporting both rain-fed and irrigation-based farming systems. This water from the basins is also very important in supplying local communities with their daily needs, especially where there is limited access to other sources of water.

Of great importance, management of the Black and White Volta Basins faces a myriad of challenges, as it is well reflected in literature. Issues of water scarcity, environmental degradation, pollution, and contesting claims on the use of water resources have negatively impacted management of these key water systems (De

Stefano et al., 2012; Mishra et al., 2021). This apart, the quality and quantity of water are getting degraded day by day due to continued encroachment of urban settlements and industrial activities. This thus gives the very strong demand for integrated management approach that has water use collaborative management practice stakeholder collaboration to promote the basin's and dependent communities' health for sustainability in the long run.

2.7 Forms of Stakeholder Participation

Natural resource management usually needs active participation by diverse stakeholders with diverging interests and perspectives. These normally include government agencies, local communities, private sector firms, and NGOs, whose role is to ensure that natural resources are managed in a sustainable and equitable way. While there are many types of stakeholder participation, it would be appropriate to distinguish types of participatory approaches according to specific circumstances and their use in resource management settings.

One of the most prominent forms of stakeholder participation is community-based natural resource management, CBNRM. The model emphasizes the participation of local communities in decision-making regarding the natural resources within their environment. CBNRM has been often propagated as a way to empower local people, assure sustainable management of the resources, and improve livelihoods (Mbaiwa, 2015; Sebele, 2010). This has been especially successful in some contexts where the interactions with the resources are direct. However, other researches have shown that CBNRM can equally create conflicts between local communities and other

stakeholders, especially those of the private sector if it is not well managed (Elliott & Sumba, 2013; Snyman, 2012). CBNRM is usually implemented in contexts where local communities are highly dependent on natural resources and where their involvement is likely to ensure long-term sustainability.

Another form of stakeholder participation is the creation of partnerships among government agencies, private sector companies, and NGOs. This can be in the form of public-private partnerships that bring together the different perspectives and resources of each stakeholder with the aim of achieving more effective and sustainable resource management outcomes. The partnership will potentially bring more investment into conservation and sustainable development projects (Tsani, Koundouri & Akinsete, 2020). Such partnerships, however, sometimes result in power imbalances where interests of the more powerful stakeholders would override those of less powerful stakeholders, usually coming from marginalized communities (Barletti et al., 2020; Cheyns & Riisgaard, 2014). In cases where there is clearly an apparent need for pooling of resources, expertise, and capabilities across the diverse sectors in managing complex environmental issues, then partnerships are usually effective.

Another one is the consultative processes, such as public consultations and participatory planning, which involve stakeholders in decision-making processes through the eliciting of views on policies and plans of resource management (Nasr-Azadani et al., 2022). The kind of participation described above would often be used to make policy-making more transparent and participatory with stakeholder involvement. It has been evidenced through research that consultative processes can





bring about more inclusive decision-making (Kelly & Axon, 2022; Pita, Pierce & Theodossiou, 2010). On the other hand, consultative processes may come short if they exclude marginalized groups in the process or are not appropriately structured (Lanyon, Rose & Worrall, 2013; Coulter, 2012). Normally, such consultative processes are instituted in cases where stakeholders have to give inputs into policy design or where the wider public has to be involved in decision-making.

2.8 Benefits of Stakeholder Participation

The academic literature has identified and highlighted many of the benefits accruable from stakeholder participation in resource management. These include better management of the resources, increased community involvement, and heightened sustainability. One of the most appreciated benefits of stakeholder involvement is that of improved resource management. Empirical research has shown that when stakeholders are involved in decision-making processes, their acceptance and support toward the management decisions are considerably higher (Ferrón-Vílchez et al., 2021; Cascetta et al., 2015). This would increase the effectiveness and efficiency of natural resource management practices since, for the simple reason, stakeholders would understand better and commit themselves more to the broader goals and purposes of the management decisions being put into practice (Ferrón-Vílchez et al., 2021).

The second benefit from stakeholder participation: increased engagement with the community. If the stakeholders participate in management, it makes the community more oriented towards acquiring and being responsible for natural resources (Dyer et



al., 2014). It results in greater participation on the side of the community members concerning involvement in the activities, with increased ability in spreading awareness concerning natural resources and their importance to the communities (Dyer et al., 2014). Also, stakeholder engagement contributes to promoting sustainability. Since stakeholders are part of the decision-making process, it allows consideration of long-term impacts and how to ensure that natural resources are sustainable (De-Vente et al., 2016). This results in the adoption of sustainable management practices hence raising the chances that the natural resources will be conserved for future generations (De-Vente et al., 2016).

Incorporating stakeholder participation into natural resource management has quite a number of benefits, including increased accountability, improved decision-making, and increased sustainability (Asiaei et al., 2022). Increased accountability arises because stakeholders are more likely to support and stick to the decisions in which they have participated actively (Barnea & Rubin, 2010). Valuable insights and information contributed by the stakeholders ensure decisions are well informed and responsive to localized conditions and needs (Hornsby et al., 2017). More importantly, stakeholder participation furthers greater sustainability since decisions promoting the long-term health and wellbeing of natural resources are more liable to receive support and compliance by the stakeholders involved (Pimentel, Gonzalez & Barbosa, 2016).

Among other things, one of the major advantages of stakeholder management is conflict identification and mitigation. This indeed becomes possible when there is early engagement with the stakeholders and subsequent consultation—thus, one will



be enabled to foresee and form strategies aimed at the issues. This will ensure the outcome of efficient and effective decision-making and increased stakeholder buy-in and support for natural resource management (Jami & Walsh, 2014). Secondly, stakeholder management includes building cooperation and trust among stakeholders; this becomes all the more critical in the case of natural resources, which have different uses running into hundreds and are often at odds with one another (Prell, Hubacek & Reed, 2016). One such way to create trust and cooperation among stakeholders might be stakeholder involvement in the decision-making process, taking into account their needs and interests, which may lead to more sustainable results (Prell, Hubacek & Reed, 2016).

Second, stakeholder management will result in management strategies that are both effective and efficient. The involved stakeholder is able to come up with strategic management that is more responsive to the varied concerns and requirements of various groups, as they are involved in the decision-making process and their perspectives are put into consideration (Feeney et al., 2019). Lastly, stakeholder management ensures greater accountability and transparency in the management of natural resources. In addition, transparency and accountability may be achieved through the involvement of stakeholders in decision-making that will culminate in incorporating their needs and interests into natural resource management; this may yield more sustainable results and additional trust and support from the stakeholders (Feeney et al., 2019).



2.9 Stakeholders Participation and Management of Natural Resources

The management of the lake involves different stakeholders, notably the Volta River Authority; and regional entities representing farmer associations. On their part, LVAC will focus on a range of objectives by advising governments, conducting or suggesting research where applicable, leading education and promoting environmentally friendly alternatives while VRA undertakes general regulation of the amount of water meant for power production. More specifically, the local communities—most of which depend on the fishing industry—participate in the management of aquatic resources for livelihood. This management approach has succeeded because of collaboration among the government agencies, non-governmental organizations, and the local stakeholders in ensuring that the use of the aquatic resource is sustainable, together with the implementation of policies to this effect (Acakpovi, 2019). However, the decision with challenges arose where coexistence of industrial water use with fishing activities brought reduced fish stock and local resistance to large-scale water projects in the area (Alemzero et al., 2021).

For instance, the management of Yellowstone National Park represents government-led management of resources. Here, the National Park Service has been able to coordinate with local communities, tourism businesses, and environmental NGOs in an effort to conserve biodiversity, together with the promotion of eco-tourism. This includes strong NPS regulatory frameworks, coupled with public-private partnerships assisting in funding conservation efforts. Still, in some cases, this system may fail due to the lack of direct involvement by local communities that results in inadequate support for some of the regulations set for the parks (Rahman et al., 2017).



This commission, like Water Resource Management in Ghana, typifies how a government agency like the Water Resource Commission collaborates with private entities like the Daasgift Community Water Project and local communities in the management of water resources. The success factors entail effective community participation in decision-making where local knowledge is integrated into the management plans. Nevertheless, some have been unsuccessful due to the challenges relating to irregular water access and pollution, indicating that specific initiatives have failed to produce sustainable results (Twum & Abubakari, 2020).

The Forestry Commission of Ghana, under the Management of Forest Resources with local communities and environmental NGOs, manages forest conservation initiatives. A few private companies have also joined in through sustainable logging practices. Success has been attributed to community-based conservation efforts and careful regulation of resource extraction. However, some challenges, like illegal logging and inadequate enforcement, have been drawbacks to long-term sustainability (Ayuk et al., 2020).

Mining in South America demonstrates the interaction among private companies, local communities, and government entities in the management of mineral resources. While mining companies are significantly involved in resource extraction, the negative impacts such as pollution and land displacement—are mostly borne by the local communities. Among the failure factors are the lack of inclusion of the local community in the decision-making process and a lack of adequate environmental safeguards (Gualandris & Klassen, 2018). In Southeast Asia, wetlands conservation



shows that NGOs, such as the International Union for Conservation of Nature (IUCN), are collaborating with government bodies and local communities in wetlands conservation. Success has been driven by community-based management and involvement of multiple stakeholders in monitoring and protection of such resources. Nevertheless, inconsistent policy implementation and conflicting land-use interests remain a constant challenge (Rhama & Kusumasari, 2022).

2.10 Factors influencing Stakeholders' Participation and Management of Natural Resources

Stakeholder engagement in natural resource management is critical to achieving the goals of sustainable development and conservation. Meaningful participation of stakeholders would therefore ensure effective execution of conservation policies and the integrity of biodiversity. However, this level of participation of stakeholders in resource management depends on several economic, political, social, and environmental factors combined (Hebsale-Mallappa & Babu, 2021; Adams, 2010). These are enabling or constraining factors that would influence stakeholder engagement and thus the effectiveness of the management interventions.

Economic incentives are one of the most important drivers that motivate stakeholders' participation in resource management. If the natural resources have commercial value attached to them, then stakeholders will be motivated to participate in their management with expectations of financial gains (Musavengane & Simatele, 2017). On the other hand, a lack of economic value or financial incentives can discourage participation (Hart & Dowell, 2011). Moreover, poverty and unemployment can also



be barriers to stakeholder engagement, since their focus will be on basic needs rather than investment in conservation activities (Katusiime & Schütt, 2020). In resource-scarce communities, financial constraints often become the reason for incomplete participation (Irvin & Stansbury, 2004).

Socio-economic class, ethnicity, and gender are some of the social factors that can cause power imbalances in decision-making processes that may confine participation from marginalized groups (Ruiz Castro & Holvino, 2016). For instance, poor people may have to involve themselves in income-generating activities at the expense of participatory efforts (Kala & Bagri, 2018). In such situations, elite capture by some ethnic groups that dominate decision making may be very possible (Devy & Davis, 2020). Gender roles also affect participation, especially in the governance of rural water. In many cultures, women are expected to perform domestic chores, which restricts their participation in formal activities related to resource management (Mandara et al., 2017). Also, gender-based exclusion in decision-making bodies has been documented in many regions, including Thailand (Dayley & Sattayanurak, 2016) and Zimbabwe (Muchemwa-Munasirei, 2018).

Political factors include government policies, regulations, and political stability influencing stakeholder participation in resource management. Empowering policies by pro-sustainability governments foster stakeholder involvement (Ariti et al., 2018), while unstable political environments or conflicting policies hinder it (Glynn et al., 2017). A sound legal framework for the governance of natural resources builds trust

and assures fair resource allocation (Hostettler et al., 2019; Banovac, Pavlović & Pudić, 2021).

Communities that heavily rely on specific resources are likely to take part in their management (Chua, Roth & Lemoine, 2015). Cultural beliefs and practices may also either help or hinder the involvement of stakeholders in the conservation process. For example, when the management of a resource goes against tradition, there may be resistance in taking part in the process. Moreover, the environmental status of resources whether they are under threat of depletion—often affects stakeholders' willingness to participate (Wassie, 2020; Liburd & Becken, 2020). Natural disasters and climate change further exacerbate the challenges arising from participation, depleting resources and reducing the incentives of stakeholders to invest in conservation (Kousky, 2019).

One of the greatest determinants of stakeholder participation is trust in the authorities managing the resources (Riley et al., 2018). If stakeholders believe that their input will lead to a positive outcome, they will be more willing to participate. Full transparency in decision-making processes makes people trust and therefore participate more (Fuller et al., 2020). Similarly, community-based natural resource management approaches that empower local communities to take an active role in decision-making have been found to enhance stakeholder involvement and improve conservation outcomes (Zafar et al., 2022; Tantoh, Simatele & Ebhuoma, 2020).

For example, economic incentives such as payment for ecosystem services usually work to motivate stakeholders' participation in conservation work (Thompson &





Friess, 2019). These help to offset some of the costs related to resource management and motivate communities toward practices that are sustainable (Zoysa, 2022). It has been established that the proximity of communities to the resources, especially rivers, increases their likelihood to participate in the conservation of those resources, as the resources serve as a source of livelihood (Bateman & Mace, 2020; McKinley et al., 2017).

2.11 Constraints face in Management of Natural Resources

Effective management of natural resources faces a multidimensional and complex challenge, requiring subtle comprehension of the interplay of ecological, economic, and social factors. One of the big challenges arises since most areas have no clear governance and regulatory frameworks, creating a clash of interests among various stakeholders and hence no conducive approach to developing sustainable practices in the management of the resources (Djosetro & Behagel, 2020; Venugopal, 2014). This often leads to the lack of comprehensive policies and regulatory guidelines, which results in fragmented approaches in resource management and further complicates the efforts at ensuring long-term sustainability.

The second major factor that hinders effective management of resources is a lack of dependable data and information. In order for one to make proper decisions, there should be a need for timely and accurate data concerning the status of the resources and how various strategies for their management will affect these resources. However, most of the world's countries have poor infrastructure and capacity to collect and

analyze data, which engenders wide knowledge gaps in occurrence and impedes sound resources management (McKinley et al., 2017; Ezeaku & Davidson, 2008).

The other challenge relates to inadequate participation of the communities in the management of the resources. Effective management of the resources calls for active participation by the local communities whose livelihood depends on the same resources being managed. When the communities are not properly involved, mistrust and conflicts might break out between the resource managers and local populations, jeopardizing the very success of management initiatives. Involvement of that kind will ensure that the perceptions and needs of the community find their way into the management strategies—a very essential inclusion for sustainable outcomes (Musavengane, 2019; Idrissou et al., 2013).

Another, and increasingly important, challenge in the management of natural resources is climate change. The changing climate affects availability and the pattern of distribution of those resources sensitive to changes in temperature and precipitation levels, such as water and forests. This brings potential risks to the ecosystems and the communities' dependent on these natural resources for their livelihood (Iglesias et al., 2011).

Economic pressures stemming from rapid population growth and expanding economic development further increase the demand for natural resources. These pressures can force resource managers to extract resources at unsustainable rates, thereby leading to overexploitation and environmental degradation. Reconciling economic development with the sustainable use of resources remains a daunting task (Maja & Ayano, 2021).





Corruption also contributes to the mismanagement of natural resources. Activities like bribery, embezzlement, and illegal trades generally nullify management efforts, through which resources may be channeled into other unrelated functions (Douglas & Alie, 2014). In this way, corruption creates an environment where policies are simply not enforced, resulting in the exploitation of resources in a way that is detrimental to long-term sustainability.

This, in itself, would make the governance of natural resources even more difficult as the policies and regulatory frameworks are under frequent change. Such shifting political landscapes can easily disrupt ongoing projects, destabilize resource management strategies, and hinder the effective adoption of conservation practices (Lockwood et al., 2010). Stability in governance is key to consistency in resource management focused on long-term sustainability.

Besides, it also faces large challenges from conflicting stakeholders' interests within the idea of balanced management. For example, companies that extract these resources often have the desire to make short-term financial gains instead of conservation. This may coincide with the demands that local communities put on them—meeting the latter's instant needs (Besada & Martin, 2015). Therefore, competing interests lead to tensions and conflicts and make a good balance between conservation and development unattainable. Lastly, ignorance about ecosystems and natural resources makes their effective management difficult.



2.12 Opportunities for improving the Management of Natural Resources

Natural resource management is very critical to the health of an ecosystem, to maintaining its productivity, and providing various goods and services necessary for human life (Haines-Young & Potschin, 2010). This provides the raw materials and energy needed to feed life and attain economic growth. Most of the time, bad management leads to environmental degradation, loss of biodiversity, and social conflicts (Reed et al., 2016). Therefore, there is an overwhelming need to improve the management of natural resources for sustainable development and conservation of ecosystems for future generations.

The effective means through which better management of natural resources may be attained would be the inclusion of traditional knowledge and local communities in the decision-making process (Shaw et al., 2022). Traditional knowledge passed from one generation to another gives insight into ecological, social, and cultural dimensions of resource management (Nakamura & Kanemasu, 2020). The knowledge is very important in recognizing the critical plant and animal species, understanding the dynamics of ecosystems, and making forecasts about the impacts of climate change (Harmsworth, Awatere & Robb, 2016). Involving indigenous and local communities in resource management ensures fairness and social justice because these are the communities that normally depend on natural resources for their livelihood and, therefore, are the first victims of poor management practices (Harmsworth, Awatere & Robb, 2016).



Moreover, innovative technologies present huge opportunities in the area of resource management. Modern technologies of remote sensing, Geographic Information Systems (GIS), drones, and robots support efficient data collection and analysis for better monitoring and identification of threats to natural resources (Gavin, Solomon & Blank, 2010). Such technologies can map and track land use, vegetation, and water resources in a manner that allows more accurate and effective management strategies.

A third promising approach to improve resource management is a systems approach. This perspective realizes the linkages among different resource systems and their feedbacks, taking the specific context of the ecosystem into consideration (Plummer & Armitage, 2007). That is, by understanding these systemic relationships present among different elements of the resources, managers could trace back the very source of challenges and find more sustainable solutions to them.

Another important element in the conservation of natural resources is sustainable management practices. Practices like conservation measures, including protected areas and corridors, contribute to the maintenance of biodiversity and ecosystem integrity. Sustainable harvesting methods, such as selective logging and controlled hunting, ensure that resources are not depleted and can regenerate over time (Graziano, Deguire & Surasinghe, 2022). These approaches help balance ecological conservation with resource utilization.

The other avenue for improving the management of natural resources comes from community-based management approaches. Under the community-based fisheries management programs, resources are utilized in a sustainable manner, and their benefits are equitably shared among stakeholders by involving local communities in decision-making and resource management (Cox, Arnold & Tomás, 2010).

2.13 Conceptual Framework

The conceptual framework in Figure 2.1 illustrates how stakeholder involvement and participation in basin management could lead to improved outcomes. This research draws heavily from Stakeholder Theory, which advocates for the inclusion of indigenous knowledge, cultural belief systems, history of experience, and traditional ecological knowledge into decision-making processes. All of these elements give way to a decision-making process that is genuinely inclusive, transparent, and accountable. Inclusive decision-making, with consideration for divergent views, shall be a case leading to equity in sustainable practices underpinning the melding of indigenous wisdom with modern approaches. It also draws on SES theory, which holds that social and ecological systems in resource management are mutually dependent, and on Participation Theory, which highlights community involvement in making decisions.

Sustainable development in the basins should be framed as a balance between economic growth, social equity, and environmental preservation. Attaining balance among these dimensions requires stakeholders to make the basins sustainable in the long run. Some of the major factors that influence sustainability in the basins include institutional frameworks, governance structures, socio-economic conditions, cultural influences, political dynamics, and channels of communication. Challenges for effective management in this regard include conflicts, resource depletion, water pollution, impacts of climate change, land degradation, competing interests, inadequate infrastructure, lack of funding, insufficient data, regulatory complexities, and failures in governance. Addressing these challenges opens opportunities such as capacity building, integration of technology, collaborative governance, policy reforms, knowledge exchange that would help to enhance sustainability.



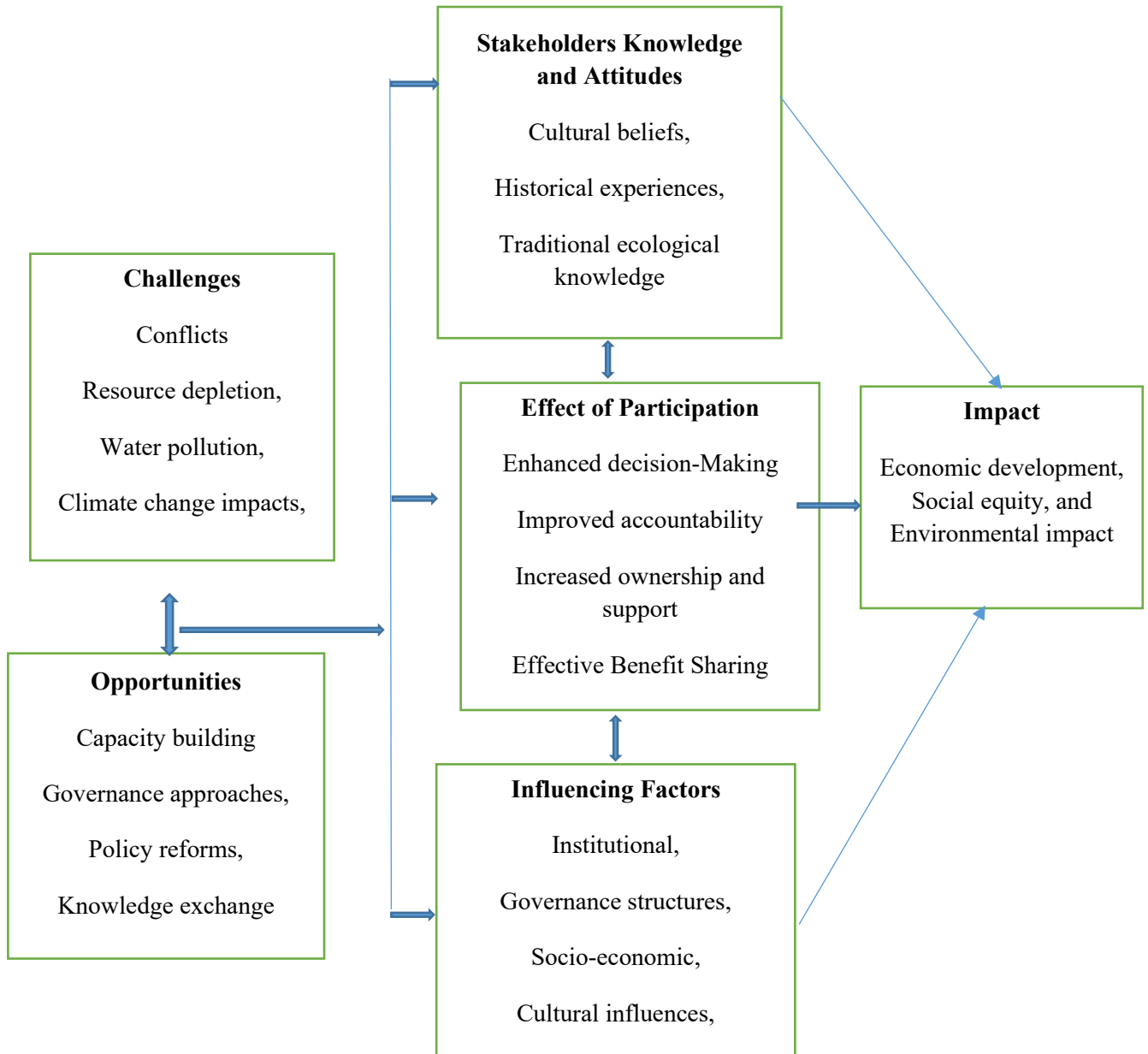


Figure 2. 1: Conceptual framework for Stakeholder Participation in Water Resource Management

Source: Adapted from Stakeholder theory (Freeman, 1984)

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter discusses the methodology of research to be used in the study and data collection and analytical methods. A brief description of the study area, the instruments to be used in collecting data necessary for the study, the research design of the study, procedure of sampling, methods of data collection, and methods of data analysis are presented herein.

3.1 Underlying Research Philosophy of the Study

The underlying philosophy of this research is pragmatism. It is the philosophical approach that emphasizes practical consequences and the utility of knowledge. Knowledge by nature is not a subject without being linked to action and its consequences. Pragmatism is a philosophical tradition that was born in the late 19th century, basically from the works of Peirce, James, and Dewey in 1878, 1907, and 1938 respectively. It posits that the value of ideas and theories depends on the degree of practical effectiveness and applicability. Unlike other philosophical approaches, which may privilege abstract theorizing or quests for objective truths, pragmatism is held dear for its practical results in applying to real-world problems. The benefits of pragmatism in research involve flexibility in the choice of methods, which allow incorporation of both qualitative and quantitative approaches as needed to answer the research questions (James, 1907; Dewey, 1938). In so doing, it supports the use of different methods in data collection and analysis that will generate information useful for practice and decision-making (Peirce, 1878). This is particularly the case in the





study of the Black and White Volta Basins through pragmatism. Basin management involves a complex interaction of social, environmental, and economic components. Pragmatism is considerate of the subjective nature of experiences and perceptions belonging to individuals—a fact very important in understanding the divergent motivations of stakeholders (Dewey, 1938). Pragmatism respects the practical application of knowledge and, hence, stands as an ideal philosophy in a study aimed at stakeholder involvement. This is because pragmatism allows for the inclusion of stakeholders' views from government agencies, local communities, NGOs, and private sector entities in understanding how these groups impact water management practices (James, 1907). The research does not only seek to contribute to theoretical knowledge but also aims at providing practical recommendations on how to improve basin management. Pragmatism allows this dual focus on theory and practice by guiding the research toward producing useful insights that can help improve the management strategies (Peirce, 1878). Its methodological flexibility allows it to integrate different research methods, which are necessary for the complex issues arising in basin management. Pragmatism also emphasizes cooperation and mutual respect among stakeholders, encourages open dialogue, and is transparent; hence, it would enhance participation and consensus-building within its focus on practical problem-solving (Dewey, 1938).



3.2 Research Approach

This study adopted a mixed-methods research approach, integrating both quantitative and qualitative techniques to provide a comprehensive understanding of stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region, Ghana. The choice of a mixed-methods approach was considered appropriate because stakeholder participation is a multidimensional phenomenon that involves measurable patterns (such as levels of awareness, participation frequency, and perceived challenges) as well as deeper socio-cultural explanations that require qualitative interpretation.

Specifically, the study employed a convergent parallel mixed-methods design, where quantitative and qualitative data were collected concurrently, analyzed separately, and then merged during interpretation to ensure triangulation and complementarity of findings. This design was suitable because it allowed the study to generate statistically reliable evidence from a large sample while also capturing rich contextual explanations from key informants regarding indigenous participation, local governance practices, and traditional ecological knowledge systems.

The quantitative component of the study was designed to generate generalizable evidence on stakeholder knowledge, attitudes, participation levels, and perceived sustainability outcomes. Data were collected through structured questionnaire administration among 400 respondents, and analyzed using descriptive statistics, factor analysis, and Kendall's Coefficient of Concordance. This enabled the study to



identify dominant participation factors, rank key challenges and opportunities, and establish measurable relationships between participation and sustainability indicators.

The qualitative component complemented the quantitative findings by exploring stakeholder experiences, perceptions, and socio-cultural dynamics that influence participation in basin management. In-depth interviews with key informants were conducted to generate deeper explanations on the roles of indigenous communities, traditional institutions, and local norms in water governance. Qualitative data were analyzed using content and discourse analysis to identify recurring themes and interpret how stakeholder interactions and power relations shape basin management practices.

3.3 Study Design

This study adopted a cross-sectional research design, which was considered appropriate for assessing stakeholder participation and sustainability issues in the Black and White Volta Basins within a limited period. The design enabled data to be collected from a relatively large sample at one point in time, making it suitable for examining stakeholder knowledge, attitudes, participation levels, roles, challenges, and opportunities associated with basin management in the study area (Theofanous et al., 2016).

3.4 The Study Area

The study focuses on the Black and White Volta Basins in the Central Gonja District of the Savannah Region of Ghana. The study has selected this area because the basins play a major role in water resource management, linked to the complicated interactions



of social, economic, and environmental factors that determine sustainable management of these basins. The basins provide livelihood opportunities for the local communities in various forms: agricultural production, fishing, and hydroelectric power generation. This region also faces some challenges—water pollution, land degradation, and climate change impacts—making it very essential to understand stakeholder engagement in basin management. The research aims at exploring the extent to which government agencies, local communities, and private sector actors are involved in the management of these vital resources, contributing to broader academic discourse on water governance and sustainable development. The Savannah Region was carved out of the Northern Region in 2019 and is one of two new regions. It has a geographical area of approximately 35,853 square kilometers. It constitutes roughly 15% of the total land area of Ghana. The regional capital is Damongo. The region shares borders with the Upper West, North East, and Northern Regions to the north; the Oti Region to the east; the Bono East Region to the south; and Ahafo Region to the west. The region has seven administrative districts. Two of the districts are municipalities: Bole, Central Gonja, North Gonja, East Gonja, Sawla/Tuna/Kalba, West Gonja, and North East Gonja. The Bole District has its capital as Bole, the East Gonja has its capital as Salaga, West Gonja has its capital as Damongo, Sawla Tuna Kalba has its capital as Salwa, Central Gonja has its capital as Buipe, North Gonja has its capital as Daboya and North East Gonja has its capital as Kpalbe. The region boasts of great culture, historical values, and natural beauty, including the Black and White Volta Basins (GSS, 2021). The Black Volta basin is an area in the northern part of the region that features fertile, dark soils and abundant vegetation.



It also harbours a variety of wildlife such as elephants, lions, and hyenas. The White Volta Basin, that forms the southern part of the region, is characterised by light-coloured soils, with sandy particles and scanty vegetation. The climate in the White Volta Basin is very hot and dry; therefore, crops like sorghum and millet grow well in this region (La Pierre, 2004). Both basins support agriculture that includes major crops like corn, sorghum, millet, and yam. The Black and White Volta Basins are very critical to the sustenance of natural resources within the surrounding regions, which include the Mole National Park. These rivers supply water for irrigation, which helps local agriculture and supplies water to livestock that are key to livelihoods of the communities within the catchment area (Baldwin & Owusu, 2021). Besides, the rivers contribute much to the activities of fishing in supporting the local economy and food security (Ntiamoah & Agyemang, 2020). The movement of goods and people on matters of transportation is possible because of the rivers, which in turn bring together isolated communities and help in facilitating trading activities (Aidoo et al., 2019). More significantly, the rivers indirectly support the natural resources in the park. The basins sustain the ecosystem of the park by providing for water flows that feed the wild animals and plants (Ellicott & Blackwell, 2018). The availability of water from these rivers has impacts on species such as elephants, antelopes, warthogs, and a host of birdlife that all depend on the availability of water sources at all times (Acquah et al., 2021). Furthermore, the water flow sustains natural cycles that support biodiversity within the park and points out the direct link between the health of these river systems and long-term sustainability of the park's ecosystems (Adjei & Boateng, 2022). It is obvious, therefore, that effective management of the Black and White Volta Basins is

critical not only to the livelihoods of local communities but also to the conservation of the rich biodiversity found in Mole National Park (Baldwin & Owusu, 2021).

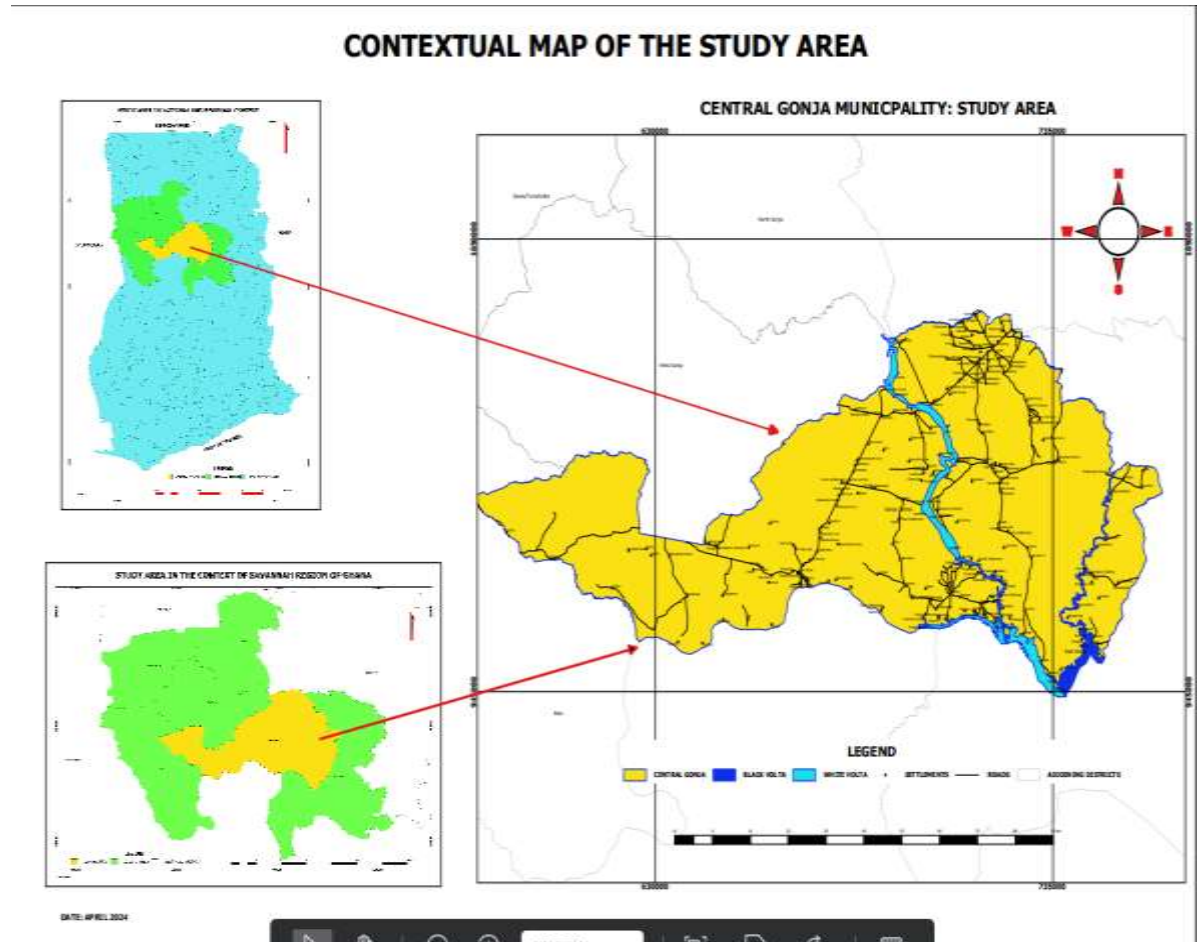


Figure 3. 1: Map showing Central Gonja District

Source: Author, (2024).

3.4 Study Population

The population for this study comprised key stakeholder groups involved in the management and governance of natural resources, particularly the Black and White Volta Basins, in the Central Gonja District of the Savannah Region. The target population included relevant government institutions and regulatory agencies such as





the Water Resources Commission, Volta Basin Authority, Forest Services Division, Lands Commission, and other district-level agencies responsible for water and environmental management. It also included traditional authorities and community members whose livelihoods depend directly on basin resources, as well as NGOs and community-based organizations engaged in natural resource conservation and water governance activities within the district.

3.5 Sampling Procedure and Sample Size

3.5.1 Sampling

Sampling in research involves the selection of a subset of the population that represents the whole population (Mujere, 2016). It reduces the data to be collected, analyzed, and interpreted hence making research more efficient and timelier.

The nature of the study and its research questions drove the sampling technique used, which needed an application of both probability and non-probability sampling methods. The first stage of sampling was used in the selection of the study district in the Savannah Region.

Purposive sampling a non-probability method where participants are chosen based on certain criteria or characteristics they hold (Etikan & Bala, 2017) was applied in selecting the study stakeholders. The stakeholders consisted of representatives: two (2) from the Friends of Rivers and Water Bodies, two (2) from the Water Resource Commission, one (1) from the Forestry Commission, and two (2) from the Volta River Authority (VRA). The only NGO identified was the Friends of Rivers and Water Bodies, which was instrumental in supporting lake management. Their diverse roles

in regulating the Black and White Volta Basins made them appropriate in responding to the qualitative research questions. This is in agreement with the information in Table 2, which shows that the sole NGO is Friends of Rivers and Water Bodies.

The design used is that of multistage probability simple random sampling technique in the selection of communities along the Black and White Volta Basins. The sample comprises towns and communities, especially those in Buipe and Yapei townships, located along the banks of the rivers and near the Black and White Volta Rivers. These were chosen because farming and fishing are two important local industries undertaken along the riverbanks.

Ten (10) communities along the White Volta and Black Volta rivers were randomly selected using a simple random sampling that guarantees unbiased selection. To this end, a list of all eligible communities was compiled along each river. For each river, community names were assigned unique identification numbers and then placed in a randomization tool or drawn from a container. They were selected at random from below White Volta: Amedzirovi, Junto, Yapei, Kantanga, and Gbansah. In this respect, from the list below Black Volta, five communities were randomly selected: Bridge East, Bridge West, Dibriport, Peposu, and Kikali No. 4. This was fair because each of them had equal chances of being selected for the study. The total number of households in the Central Gonja District is estimated at 11,413 by the National Development Planning Commission (2017). As such, this number was used for the calculation of the sample size for the study.



Cochran’s (1977) sample size determination formula was then applied in calculating the sample size. Applying Cochran (1977), sample size (n) computation formula as:

$$n = \frac{N}{1+Ne^2} \dots\dots\dots (1)$$

Where n = sample size

N = target population of study

e = marginal error (5%)

N = 11,413

$$n = \frac{11,413}{1 + 11,413 (0.05)^2} = 386.4$$

The sample size for this study was set at 400 households from communities within the Black and White Volta Basin catchment areas in the Central Gonja District. This sample size was considered adequate because it provides reliable representation for a cross-sectional survey at a 95% confidence level and 5% margin of error, and is also appropriate for robust statistical analysis such as factor analysis and PCA, which require relatively large samples for stable results.

3.5.2 Sampling at Household Level

The sample selection follows the sampling methods or techniques indicated above, and the study adopts both probability and non-probability techniques. Under the probability sampling procedure, the administering of a questionnaire to prospective respondents is carried out; the respondents were selected proportionally within the two localities (Table 3.1). The researcher, together with research assistants, visited Buipe and Yapei and narrowed their focus to specific communities along the Black and White Basins respectively. The researcher built from the good affinity created during





the reconnaissance visits and observing the etiquettes in the research processes. The researcher used the simple random sampling method in selecting the respondents from each of the selected community along the Black and White Volta Basins. The researcher used simple random sampling method because the people living along the Black and White Basins are primary beneficiaries and users of the basin for their domestic and economic purposes. Hence, simple random sampling method gives each respondent an equal opportunity of being selected as illustrated in Table 3.1. The researcher and his assistants did take their time to explain to the respondents, concerning their rights to take part in the survey or to decline. When a respondent agrees to be part of the study, he/she was taken through the various sections of the questionnaire.

The process continued till the quota for each community was covered. The researcher and his assistants repeated the processes till the sample size (400) was covered (Table 3.1). Furthermore, Table 3.2 present the selected agencies and key informant for the study. However, selected agencies and key informants were purposively selected as these agencies and key informants directly engage in the operation and management of the Black and White Volta Basins.

Table 3. 1: Sampled Communities for the Study

No.	Community Name	Number of Households	Number sampled
1	Amedzirovi,	49	13
2	Junto,	62	17
3	Yapei,	700	170
4	Kantanga,	96	26
5	Gbansah.	110	30
6	Bridge East,	105	28
7	Bridge West,	95	26
8	Dibriport,	74	20
9	Peposu,	100	27
10	Kikali No.4	85	23
Total		1406	400

Source: Fieldwork, (2023)



Table 3. 2: Key Informants and Stakeholders Interviewed

Stakeholder/Unit	Representative	Location	Number
	Interviewed		Interviewed
Friends of Rivers and Waterbodies	Field Officers	Buipe and Yeipi	2
Water Resource Commission	Regional Managers and assistant	Tamale	2
Volta River Authority (VRA)	Operational Staff	Buipe and Yeipi	2
Forestry Commission	District Manager	Damango	1
TOTAL			7

Source: Fieldwork, (2023)

3.6 Data Sources

The study depended on primary data for both the qualitative and quantitative aspects. The quantitative data came from various stakeholders in the study areas. Qualitative data was obtained from Friends of Rivers and Water bodies, Water Resource Commission, Forestry Commission, and Volta River Authority (VRA). The better involvement of stakeholders in the management of the White and Black Volta Basins calls for an in-depth understanding of stakeholders' perspectives, attributes, potentials, and challenges. Hence, collecting first-hand information from them is appropriate for further analysis (Cresswell, Hinch & Cage, 2019). This study therefore, relied on secondary sources of data emanating from the records of the Central Gonja District



Assembly, the Central Gonja NADMO District Office, and other institutional records relating to the use of the White and Black Volta Basins.

3.7 Data Collection Process

Data collection is a process of gathering and measuring information on variables of interest in a systematic way, which allows the researcher to answer questions and evaluate the outcomes of the research accordingly (Mohajan, 2020). A survey is a technique of collecting data from a large number of persons through structured questions (Roopa & Rani, 2012). It is an important tool in research since it enables the researcher to gather information on attitudes, opinions, behaviours, and other demographic information from a sample of the population (Hutchinson, 2003). Data was collected by use of structured interview schedules through face-to-face interviews among the community members.

The structured interview schedules are especially useful when respondents cannot read or write since they allow the researcher to guide the participants through standardized questions while keeping consistency of the data collected. Such interviews allow generalizable data to be collected for making inferences about the larger population (Cochran, 1977). The interview schedules were designed clear and concise with no bias or leading questions that would influence responses. For key informants, an interview guide was used during in-depth interviews. This approach allowed specific and appropriate data to be collected from the organizational representatives answering the research questions thoroughly.



3.7.1 Structured Interview Schedule

The structured interview schedule items were planned to be typical, and the concepts were built clearly in a way to omit different interpretations. It also involved at least two indicators to guarantee respondents gave correct answers for flawless consistency and reliability (Azzara, 2010).

The constructs of the structured interview schedule items covered stakeholders' involvement in natural resource management. It allowed participants to select options and, in some cases, to provide additional information. As indicated in Appendix A, the constructs apart from section A which covers socio-economic characteristics of participants also included section B covers indigenous communities perceived knowledge and attitude towards management. While Section C of the constructs looked at the roles and responsibilities of the stakeholders in the management, D looked at how stakeholder participation influences the sustainability of the Black and White Volta Basins. While E considers the factors that influence stakeholder participation in the management, F looks into the challenges and opportunities for improving the management of the Black and White Volta Basins. The constructs are arranged into two phases, that is, closed and open-ended. The open-ended questions allowed the respondents to express their opinions on some of the issues discovered in the sections. The research focused on community members who were primarily involved in fishing and farming. The structured interview schedule was asked face-to-face since most of the people in the catchment areas are not educated. The researcher used teaching assistants from the University for Development Studies Nyankpala Campus as research assistants to collect data. The research assistants were taken





through the research instrument to ensure they understood it. This was necessary because they had to explain portions of the instrument that participants may not understand during the identification and distribution of data collection instruments. A total of 400 respondents were interviewed from the selected study communities, as shown in Table 3.1.

3.7.2 Use of Focus Group Discussion (FGD)

To this study, therefore, two focus group discussions were conducted—one at each of the Buipe and Yapei townships. Each FGD had six participants: three women and three men, bringing the total number of participants to twelve (12). The FGDs were held to determine challenges and potentials of community involvement in the management of the Black and White Volta Basins.

The FGDs, therefore, provide a great method of collecting data on ground-level situations that may not be reflected in secondary data or literature. The discussions in each FGD were related to participants' perception of predictors of participation, challenges, and potentials of participation, and general management of the Black and White Volta Basins.

An FGD guide, prepared based on available literature, was used to lead the discussions and ensure that all key topics were covered. The discussions were also conducted in the local dialect to ensure that all participants could express themselves freely. Responses were recorded, transcribed, and coded into themes for analysis.

3.7.3 In-depth Interview (IDI) Sessions

An in-depth interview (IDI) is a qualitative research technique involving a long, thorough conversation with a single individual to obtain a comprehensive insight into their experiences, attitudes, beliefs, and perceptions (Gill & Baillie, 2018) using an interview guide. Most IDIs are conducted one-on-one and based on a semi-structured or structured set of questions, though the interviewer can also let unstructured and exploratory conversations occur. An IDI is designed to elicit information that is in-depth and expansive, to gain insight into the experiences and perceptions of the interviewee. An interviewer asks open-ended questions where one being interviewed or an interviewee is meant to expound and elucidate more information; follow-up or probing questions that clarify, delve deeper the information sourced through use of the interview guide. IDIs are particularly helpful in exploring sensitive or controversial subjects, where it is of importance to create an open and completely non-judgmental space for the respondent to express themselves freely (Boyd & DeLuca, 2017).

Thus, an IDI was conducted with key stakeholders (see Table 3.2). The participants responded to various topics including the level of participation in decision-making and management of the Black and White Volta Basins, how their participation influences the management of these basins, roles and responsibilities of stakeholders in their management. Finally, the challenges and opportunities for improving the management of the Basins were discussed. Based on information gathered from the IDI with key informants, some of the data helped in supporting the development of the main questionnaire and was used in writing the study report.

3.8 Validity, Reliability, Response Bias, and Ethical Considerations

To ensure the credibility and trustworthiness of the study findings, measures were taken to address validity, reliability, response bias, and ethical issues throughout the research process.

Validity was enhanced through careful development of the research instruments to ensure that the questionnaire and interview guides captured the key variables aligned with the study objectives. The instruments were reviewed by experts in environmental management and research methodology to ensure content validity. A pilot study was also conducted in a community with similar characteristics to the study area to test clarity, relevance, and appropriateness of the questions. Feedback from the pilot exercise was used to revise ambiguous items and improve the overall quality of the instrument.

Reliability of the quantitative instrument was strengthened by ensuring consistency in the measurement of variables. The questionnaire items were structured using standardized Likert-scale responses to reduce inconsistencies in interpretation. Internal consistency reliability was further assessed using Cronbach's alpha to confirm the stability of key constructs such as stakeholder attitudes, participation effectiveness, and perceptions of sustainability outcomes.

Given that the study relied partly on self-reported responses, possible **response bias** was addressed through multiple strategies. First, respondents were assured of anonymity and confidentiality to reduce fear of victimization and encourage honest responses. Second, questions were phrased in a neutral manner to minimize leading





responses. Third, trained research assistants were used to administer questionnaires and interviews consistently, while efforts were made to avoid influencing respondents through tone or interpretation. In addition, triangulation was achieved by combining quantitative survey findings with qualitative interviews to validate and cross-check responses from different stakeholder groups.

Ethical considerations were also strictly observed. Ethical clearance and institutional approval were obtained before data collection. Respondents were informed about the purpose of the study, the voluntary nature of participation, and their right to withdraw at any stage without any consequences. Informed consent was obtained from all participants prior to questionnaire administration and interviews. Privacy was respected during data collection, and no personal identifiers were recorded in the final dataset. All collected data were securely stored and used solely for academic purposes. These ethical safeguards ensured that the study was conducted responsibly and in line with accepted research standards.

3.9 Data Analysis

Data analysis is the process of extracting meaning and understanding from the collected data sets in research, which serves as a foundation for further action and theory development (Elliott, 2018). Qualitative data refers to non-numeric information sought from sources such as interviews, transcripts, notes, and documents (Newcomer, Hatry & Wholey, 2015). Since qualitative data is gathered through interviews and observations from the respondents, it often contains a large quantity of irrelevant information and may be difficult to handle. This research study has adopted the use of



content analysis and discourse analysis. Discourse analysis is one of the methods used for data analysis where there is interaction of people interacting with each other and involves examining the social context within which the communication takes place between the researcher and the respondent (Raclaw et al., 2020; Tedlock, 1991).

The data analyzed consisted of the tape recordings and the notes taken during the interview sessions. In this study, data analysis employed thematic areas that entailed going through the gathered data for a start in identifying the emerging patterns. Patterns and themes emerged by first organizing the common responses to the research question with the use of verbatim comments and keywords in content, which were presented and further explored for analysis. Quantitative data were coded and entered into SPSS version 20.0. The analysis of the data was done through descriptive statistics, factor analysis, and Kendall's Coefficient of Concordance. The findings were presented using percentages and frequencies, and were displayed in the form of tables and charts.

3.9.1 Qualitative Analysis

Qualitative data analysis involves gathering information and documenting data from in-depth interviews and non-observations. The level of participation by stakeholders in decision-making and management in the case of the Black and White Volta Basins was assessed using qualitative methods of content analysis and respondents' narratives. This was done with a focus on four main areas, which included planning, implementation, monitoring, and benefit sharing regarding the Black and White Volta Basins.



3.9.2 Assess the perceived stakeholder's knowledge and attitudes toward management in the Black and White Volta Basins.

This section was achieved by first identifying perceived stakeholder's knowledge and attitudes statements regarding water resource management from literature. Furthermore, a five point Likert scale responses (1=Strongly Agree, 2= Agree, 3= Not sure, 4= Disagree and 5= Strongly Disagree) were used to assess the respondents views. The responses were measured using means, frequency and percentages.

3.9.3 Analysis of how stakeholder participation in the management of the Black and White Volta Basins contributes to the sustainability of the basins.

Analysis of how stakeholder participation influences the sustainability of the Black and White Volta Basins was achieved using the three indicators of sustainability namely economic, social and environmental factors.

Economic Sustainability Implications: This shows how the activities by economic sectors affect the sustainability of the basins in the long term. For example, the unsuitable ways of agricultural farming may result in soil and water pollution and so jeopardize future farming activities. Unchecked tourism could result in habitat loss and cultural erosion.

Social Sustainability Implications: This looks at how social dynamics impact the sustainability of the basins. For example, inequitable access to resources and decision-making powers may cause conflicts that could impair effective initiatives in resource management.

Environmental Sustainability Implications: This assessed how environmental impacts bear on the long-term sustainability of the basins. For example, water pollution and soil erosion impair natural resources, reducing their ability to provide livelihoods and support ecosystems. Deforestation and habitat destruction reduce biodiversity and ecosystem resilience, making them more vulnerable to environmental changes.

Sustainability Index for the Black and White Volta Basins

Economic Sustainability Index (ESI):

- Agricultural Productivity Sub-Index (API)
- Tourism Sub-Index (TSI)

Social Sustainability Index (SSI):

- Social Interactions and Networks Sub-Index (SINI)
- Power Relations Sub-Index (PRI)
- Equity, Access, and Inclusion Sub-Index (EAI)
- Social Cohesion and Conflict Sub-Index (SCCI)

Environmental Sustainability Index (ENSI):

- Water Pollution Sub-Index (WPI)
- Soil Erosion Sub-Index (SEI)
- Deforestation Sub-Index (DSI)





The model for achieving Economic Sustainability Index are as follows:

$$\text{Economic Sustainability Index (ESI)} = (\text{API} + \text{IDI}) / 2$$

$$\text{Agricultural Productivity Sub-Index (API)} = \text{API} = (\text{Productivity score} / \text{Max productivity score}) * 100$$

$$\text{Tourism Sub-Index (TSI)} = (\text{Tourism score} / \text{Max tourism score}) * 100$$

$$\text{Social Sustainability Index (SSI)} = (\text{SINI} + \text{PRI} + \text{EAI} + \text{SCCI}) / 4$$

$$\text{Social Interactions and Networks Sub-Index (SINI)} = \text{SINI} = (\text{Interaction score} / \text{Max interaction score}) * 100$$

$$\text{Power Relations Sub-Index (PRI)} = (\text{Power score} / \text{Max power score}) * 100$$

$$\text{Equity, Access, and Inclusion Sub-Index (EAI)} = (\text{Equity score} / \text{Max equity score}) * 100$$

$$\text{Social Cohesion and Conflict Sub-Index (SCCI)} = (\text{Cohesion score} / \text{Max cohesion score}) * 100$$

$$\text{Environmental Sustainability Index (ENSI)} = (\text{WPI} + \text{SEI} + \text{DSI}) / 3$$

$$\text{Water Pollution Sub-Index (WPI)} = (\text{Pollution score} / \text{Max pollution score}) * 100$$

$$\text{Soil Erosion Sub-Index (SEI)} = (\text{Erosion score} / \text{Max erosion score}) * 100$$

$$\text{Deforestation Sub-Index (DSI)} = (\text{Deforestation score} / \text{Max deforestation score}) * 100$$

Interpretation:

The overall Sustainability Index for the Black and White Volta Basins were the weighted average of the ESI, SSI, and ENSI. Furthermore, a higher index score indicates higher sustainability, while a lower score suggests lower sustainability.



3.9.4 Analysis of Factors that influence Stakeholders' Participation and Management of the Black and White Volta Basins

Analysis of factors that influence stakeholders' participation and management of the Black and White Volta Basins was achieved using factor analysis conducted using principal component analysis (PCA) to identify underlying factors that explain the correlations among observed variables. Varimax rotation was applied to simplify the interpretation of the extracted factors. The significance of each factor was assessed based on eigenvalues, scree plot, and factor loadings.

Variables for the analysis

1. Attitudes towards Basin Management (five point- likert Scale): Assessed through survey questions capturing attitudes towards the effectiveness of stakeholder participation, importance of basin management, and willingness to engage in collaborative efforts.
2. Perception of Stakeholder Effectiveness (five point- likert Scale): Assessed through survey questions evaluating stakeholders' perceptions of their own effectiveness in influencing basin management decisions.
3. Access to Resources (five point- likert Scale): Assessed through survey questions measuring stakeholders' perceived access to financial resources, time, information, and infrastructure for participating in basin management activities.

Model Specification:

The factor analysis model is specified as follows:

$$X=LF+E$$

Where:

X is the matrix of observed variables ($n \times p$), where n represents the number of stakeholders and p represents the number of observed variables.

LF is the matrix of latent factors ($n \times k$), where k represents the number of factors extracted through PCA.

E is the matrix of error terms ($n \times p$).

Principal Component Analysis (PCA) was used to extract latent factors from the observed variables. Eigenvalues, scree plot, and Kaiser-Guttman criterion were employed to determine the number of factors to retain. Variables with higher absolute factor loadings (>0.4) on a particular factor were considered to be strongly associated with that factor. However, only factors with eigenvalues greater than 1 and meaningful interpretations were retained.

3.9.5 Analysis of the Challenges and Opportunities for improving the

Management of the Black and White Volta Basins

Analysis of the challenges and opportunities for improving the management of the Black and White Volta Basins was achieved using Kendall's coefficient of concordance. Kendall's coefficient of concordance analysis was used to test for the agreement of the rankings by the participants. Kendall's coefficient of concordance (W) is a measure of the agreement among several (P) judges who are assessing a given set of n objects (challenges and opportunities) (Legendre, 2005). W is an index that measures the ratio of the observed variance of the sum of ranks to the maximum possible variance of the ranks. The idea behind this index is to find the sum of the



ranks for each challenge and opportunity being ranked. If the rankings are in perfect agreement, the variability among these sums were a maximum. Kendall's concordance coefficient (W) is therefore given by the relation:

$$W = \frac{12S}{p^2(n^3-n)-pT} \quad (3.5)$$

Where W denotes Kendall's Concordance Coefficient, P denotes the number of challenges and opportunities, n denotes the number of respondents (sample size), T denotes the correlation factor for tied ranks and S denotes the sum of square statistics. The value of W lies between 0 and 1, where 1 indicates perfect concordance or agreement and 0 indicates perfect disagreement among the rankers of the rankings.

The sum of a square statistic (S) is given as:

$$S = \sum_{i=1}^n (R_i - \bar{R})^2 \quad (3.6)$$

Where: R_i = row sum of ranks, \bar{R} = the mean of R_i

The correlation factor for tied ranks (T) is also given as:

$$T = \sum_{k=1}^m (t_k^3 - t_k) \quad (3.7)$$

Where: t_k = the number of ranks in each (k) of m groups of ties.

The test of significance of the Kendall's concordance was done using the chi-square (X^2) statistic which is computed using the formula;

$$X^2 = P(n - 1)W \quad (3.8)$$

Where n= sample size, p=number of constraints, W= Kendall's coefficient of concordance.



CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the findings of the study conducted to assess stakeholder participation in the management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region, Ghana. The chapter is divided into six (6) sections. The first section presents findings and discussions on the socio-demographic characteristics of respondents, which provide context for understanding stakeholder participation. The second section looks at findings on stakeholder's perceived knowledge and attitudes towards management in the Black and White Volta Basins. The third section considers the influence of the participation of indigenous communities in the processes of planning, implementation, monitoring, and benefit sharing within the basins. The fourth section looks at what stakeholder participation can do to ensure the sustainability of the Black and White Volta Basins. The fifth section delves into the challenges encountered in the management of the basins. Finally, the sixth section highlights opportunities for improving the management of the Black and White Volta Basins.

4.1 Demographics Characteristics of Respondents

This section presents the socio-demographic characteristics of the sampled respondents. The variables reported were selected based on their relevance to the study objectives and their established influence on participation in natural resource governance, as supported by existing literature.





With respect to sex distribution, the sample was male-dominated, with 291 respondents (72.8%) being males, compared to 109 respondents (27.2%) who were females. Regarding marital status, the majority of respondents were married (334; 83.5%), while 25 respondents (6.3%) had never married. In addition, 18 respondents (4.5%) were divorced and 23 respondents (5.8%) were widowed.

The educational profile of the respondents indicates generally low levels of formal schooling. A substantial proportion of the respondents, 251 (62.7%), reported having no formal education. Only 94 respondents (23.5%) had attained primary education, 36 respondents (9.0%) had completed junior high school, and 19 respondents (4.8%) reported secondary or vocational education.

In terms of occupation, livelihood activities were largely dependent on basin-related economic practices. Fishing was the most dominant occupation, reported by 183 respondents (45.8%). This was followed by farming, with 89 respondents (22.3%), while 65 respondents (16.3%) were engaged in trading. Additionally, 42 respondents (10.5%) combined farming and trading, whereas 21 respondents (5.3%) reported other occupations.

Concerning residency status, the majority of respondents were indigenous to the study area, accounting for 329 respondents (82.3%), while 32 respondents (8.0%) were migrants and 39 respondents (9.8%) were settlers. Finally, the age of respondents ranged between 19 and 74 years, with a mean age of 44 years, suggesting that the study captured perspectives from economically active and experienced household members.

Table 4. 1: Demographics Characteristics of Respondents (N=400)

Attributes	Frequency	Percentage
Sex of Respondents:		
Male	291	72.8
Female	109	27.2
Total	400	100.0
Marital status of respondents:		
Married	25	6.3
Never Married	18	4.5
Divorced	23	5.8
Widowed		
Total	400	100.0
Educational level of respondent:		
No Formal Education	94	23.5
Primary School	36	9.0
Junior High School	19	4.8
Secondary/Vocational Institute		
Total	400	100.0
Occupation of respondent:		
Farming only	89	22.3
Trading only	65	16.3
Farming/Trading	42	10.5
Fishing	183	45.8
Other	21	5.3
Total	400	100.0
Status of respondent:		
Indigene	329	82.3
Migrant	32	8.0
Settler	39	9.8
Total	400	100.0
Age of respondent: Minimum = 19 years Maximum =74 years Mean= 44 years		

Source: Field Survey Data (2024)



4.2 Perceived Stakeholder's Knowledge and Attitudes towards Management in the Black and White Volta Basins

This section assess stakeholder's perceived knowledge and attitudes towards management in the Black and White Volta Basins.

Table 4.2 presents respondents' perceptions regarding their knowledge and attitudes toward water resource management within the Black and White Volta Basins. Overall, the results indicate a generally high level of awareness of integrated water resource management (IWRM) principles and strong support for participatory governance approaches.

In relation to IWRM principles, a substantial majority of respondents expressed agreement that participatory water management practices exist at the local level. Specifically, 142 respondents (35.5%) strongly agreed and 189 respondents (47.3%) agreed, while 62 respondents (15.5%) were unsure and only 7 respondents (1.8%) disagreed. This suggests widespread recognition of IWRM principles within the study communities.

However, perceptions of government responsiveness to climate change adaptation and water management were more divided. While 121 respondents (30.3%) strongly agreed and 80 respondents (20.0%) agreed that government interventions support adaptation and basin management, a notable proportion expressed uncertainty (98 respondents; 24.5%) or disagreement (83 respondents; 20.8% disagreed, and 18 respondents; 4.5% strongly disagreed). This reflects mixed community confidence in the effectiveness and visibility of government-led interventions.





Conversely, respondents expressed strong agreement regarding the involvement of international organizations in water governance. A combined majority of 124 respondents (31.0%) strongly agreed and 206 respondents (51.5%) agreed that agencies such as the United Nations contribute positively to water resource management and climate adaptation. Only 64 respondents (16.0%) were unsure, while disagreement was minimal (6 respondents; 1.5%), indicating broad acknowledgement of external institutional support.

With respect to climate change awareness and adaptive practices, most respondents demonstrated strong understanding. A total of 178 respondents (44.5%) strongly agreed and 165 respondents (41.3%) agreed that they understand the impacts of climate change on water resources and have adjusted their farming and housing practices accordingly. Only 33 respondents (8.3%) were unsure, while 24 respondents (6.0%) disagreed, suggesting that climate-related awareness is relatively high in the basin communities.

Knowledge of traditional water management practices, however, was less consistent. While 116 respondents (29.0%) strongly agreed and 115 respondents (28.7%) agreed that they were familiar with traditional practices, a considerable proportion of respondents were uncertain (141 respondents; 35.3%), and 27 respondents (6.8%) disagreed. This implies that although traditional ecological knowledge remains relevant, generational or educational gaps may be affecting its transmission and retention.



Similarly, awareness of the habitat mosaic and its relevance to basin management was generally high, with 94 respondents (23.5%) strongly agreeing and 212 respondents (53.0%) agreeing, although 89 respondents (22.3%) were unsure. Respondents also strongly affirmed the importance of traditional ecological knowledge, as 116 respondents (29.0%) strongly agreed and 214 respondents (53.5%) agreed that indigenous knowledge is essential for sustainable water management.

Attitudes toward community participation were particularly strong. The majority of respondents emphasized that limited transparency and inadequate community involvement could generate mistrust in basin governance processes. This was reflected in 164 respondents (41.0%) strongly agreeing and 220 respondents (55.0%) agreeing, with only 14 respondents (3.5%) unsure and 2 respondents (0.5%) disagreeing. This suggests that community inclusion is widely viewed as a prerequisite for trust-building and legitimacy in water governance.

Support for community-driven initiatives was equally pronounced. A combined total of 212 respondents (53.0%) strongly agreed and 147 respondents (36.8%) agreed that community-led interventions can harness local knowledge to promote sustainable practices, while only 40 respondents (10.0%) were unsure and 1 respondent (0.3%) disagreed. In addition, 199 respondents (49.8%) strongly agreed and 161 respondents (40.3%) agreed that traditional practices can be sustainable and adaptable to local environmental conditions.

Respondents further recognized the value of indigenous ecological knowledge. Specifically, 186 respondents (46.5%) strongly agreed and 183 respondents (45.8%)



agreed that indigenous communities possess deep-rooted understanding of local ecosystems and water management practices, while only 31 respondents (7.8%) were unsure. This reinforces the view that indigenous knowledge systems remain central to basin sustainability.

The importance of education and awareness creation was also emphasized, as 144 respondents (36.0%) strongly agreed and 163 respondents (40.8%) agreed that environmental education can stimulate behavioural change. Nonetheless, 64 respondents (16.0%) were unsure, and 28 respondents (7.0%) disagreed, suggesting that while education is generally supported, its effectiveness may be questioned by some respondents.

Interestingly, responses regarding community-driven initiatives in natural resource management showed high uncertainty. While 94 respondents (23.5%) strongly agreed and 54 respondents (13.5%) agreed, a large majority of respondents were unsure (234 respondents; 58.5%). This suggests possible limited exposure to such initiatives or weak institutionalization of community-based natural resource management programmes in the area.

Regarding resistance to new conservation practices, perceptions were mixed. About half of respondents believed that traditional habits could hinder adoption of new water conservation measures (101 respondents; 25.3% strongly agreed and 92 respondents; 23.0% agreed). However, 137 respondents (34.3%) were unsure, while 68 respondents (17.0%) disagreed, indicating uncertainty about the extent of behavioural resistance within communities.



Similarly, respondents expressed varied views on conflicts among local authorities and stakeholders. While 83 respondents (20.8%) strongly agreed and 73 respondents (18.3%) agreed that conflicts hinder collaboration, a significant proportion were unsure (103 respondents; 25.8%) and many disagreed (139 respondents; 34.8%). This suggests that stakeholder conflict may not be uniformly experienced across all communities.

Respondents also expressed moderate recognition of community willingness to engage in environmental practices such as cleaning drainage systems and developing green spaces. This was reflected in 94 respondents (23.5%) strongly agreeing and 110 respondents (27.5%) agreeing, while uncertainty remained relatively high (131 respondents; 32.8%) and disagreement stood at 63 respondents (15.8%).

Finally, collaboration between authorities and stakeholders was viewed positively as a pathway toward resilience and adaptive water management. A combined majority of 172 respondents (43.0%) strongly agreed and 159 respondents (39.8%) agreed, while only 52 respondents (13.0%) were unsure and 16 respondents (4.0%) disagreed. This suggests broad support for cooperative governance structures as essential for sustainable basin management.

Table 4. 2: Stakeholders knowledge and Attitudes toward Management in the Black and White Volta Basins

Perceptive Statements	Level of Agreement				
	SA	A	NS	D	SD
Knowledge					
I am aware of the integrated water resource management principles that involve participatory approaches at the local level in the Black and White Volta Basins.	142 (35.5)	189 (47.3)	62 (15.5)	7 (1.8)	0 (0.0)
I know that the government is taking actions to help my community adapt to climate change and manage water resources in the Black and White Volta Basins.	121 (30.3)	80 (20.0)	98 (24.5)	83 (20.8)	18 (4.5)
I am aware that international agencies like the United Nations are taking actions to help my community adapt to climate change and manage water resources in the Black and White Volta Basins.	124 (31.0)	206 (51.5)	64 (16.0)	6 (1.5)	0 (0.0)
I understand how droughts, flooding, and other climate change effects have impacted water resources in the Black and White Volta Basins, and I have made	178 (44.5)	165 (41.3)	33 (8.3)	0 (0.0)	24 (6.0)



adaptations to my farming and housing practices.					
I am familiar with traditional water management practices that my community in the Black and White Volta Basins employed.	116	115	141	27	1
	(29.0)	(28.7)	(35.3)	(6.8)	(0.3)
Familiar with the mosaic of different habitat types in watershed management for efficient use of water resources in both the Black and White Volta Basins.	94	212	89	5	0
	(23.5)	(53.0)	(22.3)	(1.3)	(0.0)
I realize the importance of traditional ecological knowledge in sustainable water resource management within the Black and White Volta Basins	116	214	69	1	0
	(29.0)	(53.5)	(17.3)	(0.3)	(0.0)

Attitudes

Lack of transparency or community involvement in decision-making processes could lead to mistrust or dissatisfaction	164	220	14	2	0
	(41.0)	(55.0)	(3.5)	(0.5)	(0.0)
Community-led initiatives can harness local knowledge and resources to implement sustainable practices	212	147	40	1	0
	(53.0)	(36.8)	(10.0)	(0.3)	(0.0)





Traditional practices can be sustainable and adapted to local environmental conditions.	199	161	39	1	0
	(49.8)	(40.3)	(9.8)	(0.3)	(0.0)
Indigenous communities often have deep-rooted knowledge of local ecosystems and traditional water management practices.	186	183	31	0	0
	(46.5)	(45.8)	(7.8)	(0.0)	(0.0)
Education and awareness programmes can lead to behaviour changes that benefit the environment.	144	163	64	28	1
	(36.0)	(40.8)	(16.0)	(7.0)	(0.3)
They may involve community-driven initiatives that enhance local ownership and stewardship of natural resources	94	54	234	18	0
	(23.5)	(13.5)	(58.5)	(4.5)	(0.0)
Practices					
Some community members might resist adopting new water conservation practices due to traditional habits or skepticism about their effectiveness.	101	92	137	68	2
	(25.3)	(23.0)	(34.3)	(17.0)	(0.5)
Conflicting priorities and the political agenda of the local authorities or various stakeholders may completely dampen efforts for good collaborative water resource management.	83	73	103	139	2
	(20.8)	(18.3)	(25.8)	(34.8)	(0.5)



Many in the community might appreciate and even actively take part in such initiatives as cleaning public drainage systems or building green spaces, knowing the health and aesthetic benefits to the local populace.	94 (23.5)	110 (27.5)	131 (32.8)	63 (15.8)	2 (0.5)
Strong collaboration among local authorities, community members, and stakeholders in the design could lead to more resilient and adaptive water management strategies under changing conditions.	172 (43.0)	159 (39.8)	52 (13.0)	16 (4.0)	1 (0.3)
Sharing traditional ecological knowledge on water management might empower younger generations to become stewards of their environment and ensure that their practices remain sustainable	107 (26.8)	114 (28.5)	88 (22.0)	90 (22.5)	1 (0.3)

(*SA*= Strongly Agreed *A*= Agreed *NS*= Not Sure *D*= Disagreed and *SD* = Strongly Disagreed)

Source: Field Survey Data (2024)



4.3 Stakeholders Participation in the Planning, Implementation, Monitoring, and Benefit sharing within the Black and White Volta Basins

These will, in effect, bring out the detail role of stakeholders in participation in planning, implementation, monitoring, and benefit-sharing processes that result in good governance within water resource management. Stakeholders hold unique knowledge and cultural practices related to water and vested interests in the health of an ecosystem that they are born into.

4.3.1 Planning

Stakeholders have, therefore, been very instrumental in defining specific needs and challenges facing them in relation to water resource management. Their traditional knowledge, particularly in relation to local ecosystems and seasonal changes, enables them to provide useful guidance at the planning stage. An interview respondent in the Central Gonja District echoed this role:

“Identification of water-related needs, challenges, and priorities on the basins is helpful in effective planning. Unless what the communities need and the exact water challenges each community faces are understood, there will either be partial or misconstrued planning. It's not just identifying the general issues but, rather, understanding the local nuances that differ from area to area. For example, the water use patterns, sources, and distribution differ greatly between the basins, and these have to be integrated into the planning. Also, by dealing with the issues at hand and setting priorities that echo the needs of the people, we can adopt sustainable and effective solutions. Public involvement

in the diagnosis of these problems ensures the strategies applied in water management will suit the specific needs of the basins, resulting in better outcomes for everyone concerned” (IDI by Participant A@ Buipe-14/04/2024).

This statement emphasizes the need for knowledge of local conditions in order to plan effectively for water management. It suggests that challenges like water scarcity, pollution, and climate change have to be assessed. Many community members also get involved in talking about the creation of policies that reflect their needs and ways of life. For example, one participant said:

“We have to make sure that the policies in place are reflective of our needs and ways of life. It's very important that decisions made at higher levels aren't just imposed on us but rather informed by our local knowledge and the realities we face every day. Our communities practice uniqueness, and our livelihoods depend on resources around us, especially water. Those who do not understand or give place to these dimensions may create policies that not only prove ineffective but even become harmful to the very resources they are intended to protect. That is why we want to be part of decision-making. Policies should not just come from outside but rather reflect our traditional ways and cultural practices so they truly benefit us. Only then will we be certain that we will continue to advance while safeguarding our way of life for the next generation” (IDI by Participant B@ Buipe-16/04/2024).



This points to the fact that policies should be locally relevant so as not to exacerbate challenges or overlook certain community needs.

4.3.2 Implementation

This often includes leading the implementation of water management projects within communities. Many of the stakeholders indicated their participation in such initiatives "Always" or "Often", which reflects the commitment of the study participants to ensuring the projects address their needs and priorities. As one respondent from the Central Gonja District stated:

“Active participation by us all will ensure our needs in water management are met, protecting our resources at the same time. In so doing, when we take part in their planning and execution, we are ascertained of its satisfaction, seeing that they shall fulfill our expectations under one community. You see, information on local resources of water, linked to a day-to-day life, plays a vital role. We understand the pattern of water availability, the challenges we have put in place, and solutions that work best within our environment. When external actors come with their own solutions without our input, it often results in mismatches and inefficiencies. But when we are part of the process, we get specific solutions to challenges ensuring sustainability and working for all. That way, we not only protect our resources but also reinforce our position in the management of water for the future of our community.” (IDI by Participant C@ Yeipi- 16/04/2024).



Furthermore, a participant emphasized the importance of monitoring during implementation:

“I always take part in the monitoring process since this is very vital for ensuring that our water resources are well managed. If we do not, then we end up losing everything” (IDI by Participant C@ Yeipi- 16/04/2024).

This active participation ensures that water management projects are designed with local realities in mind, increasing their sustainability. Stakeholders also discussed how their participation in enforcing local by-laws shows their deep commitment to these projects:

“In this way, we will self-enforce our bylaws—showing truly that we are caring about our resources and are ready to defend them.” (IDI by Participant D@ Buipe- 15/04/2024).

4.3.3 Monitoring

Involvement of stakeholders in monitoring the water management projects is a key issue. They are close to the environment and can trace changes, confirming whether the employed strategies are effective. One participant noted the importance of monitoring for supporting fisheries:

“It is, therefore, very important to monitor the river projects since they support fisheries that provide livelihood to a majority of families in our community. Inadequate monitoring could result in the loss of these resources that sustain





us. For many families here, the river is life, and the fishery sector is one of the major contributors to the economy of the country. Unless there was proper monitoring, there would be a very good chance that either unsustainable practices would be instituted, or that the benefits from the projects may not be accruing to all equally. Proper supervision ensures the projects are kept on track and their intended outcome for example, more fish in the sea, or access to water for all is achieved. This will also enable us to view and respond to any problems that may come up early on, before they can do lasting damage. This monitoring is important in ensuring that indeed the river projects benefit the people who depend on them.” (IDI by Participant F@ Buipe- 16/04/2024).

The stakeholders also emphasized their personal investment in the projects:

“If we monitor the projects ourselves, then we feel responsible for the outcome in terms of success and health of our environment. It gives us a sense of ownership over what is going to happen since the work we invest directly impacts the results. We are living with both positive and negative consequences of these projects. When we are involved, the things that will be done shall be carried out in such a manner that it is in line with our needs, values, and traditional practices. It will also help to keep all concerned, including the authorities and other stakeholders, accountable to ensure that the resources are used in a sustainable and efficient way. It creates a deeper relation with the environment, since we realize its health is linked to our well-being. Being part of the monitoring process also empowers us, strengthens our

communities, and fosters a sense of working together toward sustainability.”
(IDI by Participant G@ Buipe- 15/04/2024).

Such direct involvement fosters greater accountability and environmental stewardship.

4.3.4 Benefit Sharing

The sharing of benefits is also a very important aspect in the management of water resources, and stakeholders are actively involved in the call for its equitable distribution. The stakeholders called for transparency and fairness in distributing the benefits derived from the water resources. One of the stakeholders said:

“In a case where there's help, everyone gets an equal share. That is how we run things around here. We believe in equity and justice, especially when it comes to resources that are supposed to benefit all of us. Be it food or financial aid, or whatever form of help, no one will be left out. In fact, this has been such an integral part of our way of living for so long that it reflects the value system that we stand for. In any way of helping or resource sharing, we do it openly without being biased. It is not about the sharing of material things but unity and cooperation. We avoid creating division and ill will in society by sharing equally. This way, we strengthen our ties and ensure that each has his basic needs met to have collective well-being in the community.” (IDI by Participant H@ Buipe- 15/04/2024).

The effects of stakeholders' participation in the planning, implementation, monitoring, and benefit sharing within the Black and White Volta Basins are also presented herein.



4.4 Stakeholder Participation in the Management of the Black and White Volta Basins contributes to the Sustainability of the Basins

Stakeholder participation in the management of the Black and White Volta Basins and how this contributes to the sustainability of the basins is herein presented.

4.4.1 Social Sustainability Index

The Social Sustainability Index (SSI) presented in Table 4.3 reflects various aspects of social dynamics within the community. Social Interactions and Networks (SINI) received a high score of 80, signaling strong collaboration and communication among community members. Power Relations (PRI) scored 75, suggesting a generally equitable distribution of power, although some inequalities still persist. The score for Equity, Access, and Inclusion (EAI) was 70, revealing concerns over unequal access to resources, which affects overall fairness. Social Cohesion and Conflict (SCCI) scored 65, indicating that while there is a sense of community, occasional conflicts arise due to resource competition. The overall SSI score of 72.5.



Table 4. 3: Social Sustainability Index

Social Sustainability Index	Score	Comments
Social Interactions and Networks (SINI)	80	High levels of agreement on the importance of collaboration and communication among community members.
Power Relations (PRI)	75	Stakeholders reported a generally equitable distribution of power, but some inequalities still exist.
Equity, Access, and Inclusion (EAI)	70	Some stakeholders feel that access to resources is unequal, impacting overall equity.
Social Cohesion and Conflict (SCCI)	65	While there is the sense of community, resource competition can arise, causing an occasional conflict here and there.
Social Interactions and Networks (SINI)	80	High levels of agreement on the importance of collaboration and communication among community members
Overall SSI Score	72.5	Positive

Source: Field Survey Data (2024)





4.4.2 Economic Sustainability Index

Economic sustainability is probably one of the most important determinants of long-term viability and prosperity in any region, and most especially in areas like the Black and White Volta Basins, where livelihoods strongly depend on natural resources. The Economic Sustainability Index presented in Table 4.4 gives an overview of the main areas contributing to economic viability. The Agricultural Productivity Sub-Index (API) scored 78, meaning that high productivity levels and effective agricultural practices were found in the community. The Tourism Sub-Index (TSI) had a score of 72, meaning that tourism is considered an engine of potential economic growth; however, among the stakeholders is concern about environmental impacts. In general, ESI scored 75, showing positive economic sustainability.

Table 4. 4: Economic Sustainability Index

Economic Sustainability Index	Score	Comments
Agricultural Productivity Sub-Index (API)	78	Stakeholders reported high productivity scores, indicating effective agricultural practices
Tourism Sub-Index (TSI)	72	Stakeholders highlighted the potential for tourism but noted concerns about environmental impacts
Overall ESI Score	75	Positive

Source: Field Survey Data (2024)



4.4.3 Environmental Sustainability Index

Environmental sustainability is one of the backbones for long-term ecological health and human well-being, especially in regions like the Black and White Volta Basins, where natural resources are very vital to the livelihoods of local communities. Key environmental issues within the community have been put into focus using the ESI in Table 4.5. The WPI scored 65, which means that agricultural runoff and domestic sewage pose a concern to water quality locally. On the other hand, SEI scored 70, indicating very high soil erosion problems in areas with unsustainable agricultural practices. The DSI scored 60, indicating that biodiversity is harmed by logging and agricultural expansion in local ecosystems. The overall Environmental Sustainability Index score of 65 suggests generally positive.

Table 4. 5: Environmental Sustainability Index

Environmental Sustainability Index	Score	Comments
Water Pollution Sub-Index (WPI)	65	Stakeholders also reported pollution arising from agricultural runoff and domestic sewage.
Soil Erosion Sub-Index (SEI)	70	Soil erosion is a serious problem, especially in lands with unsustainable agricultural practices.
Deforestation Sub-Index (DSI)	60	Deforestation through logging and agricultural expansion is a concern, affecting local biodiversity
Overall SSI Score	65	Positive

Source: Field Survey Data (2024)



4.4.4 Overall Sustainability Index

The Overall Sustainability Index (OSI), as shown in Table 4.6, presents a comprehensive view of the community's sustainability across economic, social, and environmental dimensions. The Economic Sustainability Index (ESI) scored 75, indicating strong agricultural productivity and moderate tourism management. The Social Sustainability Index (SSI) received a score of 72.5. The Environmental Sustainability Index (ENSI) scored 65. The overall score of 70.5 signifies a generally positive sustainability status.

Table 4. 6: Overall Sustainability Index

Overall Sustainability Index	Score	Comments
Economic Sustainability Index (ESI)	75	Reflects strong agricultural productivity and moderate tourism management, indicating a positive economic outlook.
Social Sustainability Index (SSI)	72.5	Indicates strong social interactions but highlights areas for improvement in equity and conflict resolution.
Environmental Sustainability Index (ENSI)	65	Shows concerns regarding water pollution, soil erosion, and deforestation, impacting overall environmental health.
Overall Score	70.5	Positive

Source: Field Survey Data (2024)

4.5 Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

The factors influencing stakeholder participation in the management of the Black and White Volta Basins are herein presented.

4.5.1 Main Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Table 4.7 outlines the factors influencing stakeholder participation in managing the Black and White Volta Basins. The most significant factor is Attitudes towards Basin Management (eigenvalue of 3.45, 25% variance), with high factor loadings, indicating that stakeholders' beliefs and perceptions greatly impact their involvement. Perception of Stakeholder Effectiveness follows closely (eigenvalue of 2.78, 20% variance), suggesting that stakeholders are more likely to engage when they perceive management efforts as effective. Access to Resources (2.10 eigenvalue, 15% variance) and Environmental Concerns (1.65 eigenvalue, 10% variance) have moderate influence on participation. Lastly, Conflicts among Users (1.25 eigenvalue, 8% variance) shows the lowest impact, indicating that conflicts are less influential on participation.



Table 4. 7: Main factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Factor	Eigenvalue	Variance Explained (%)	Factor Loadings
Attitudes towards Basin Management	3.45	25.0	High (>0.4)
Perception of Stakeholder Effectiveness	2.78	20.0	High (>0.4)
Access to Resources	2.10	15.0	Moderate (0.3-0.4)
Engagement in Management Activities	1.95	12.0	High (>0.4)
Environmental Concerns	1.65	10.0	Moderate (0.3-0.4)
Conflicts among Users	1.25	8.0	Low (<0.3)

Source: Field Survey Data (2024)



4.5.2 Analysis of Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Table 4.8 presents the component matrix for the factors influencing stakeholder participation in the management of the Black and White Volta Basins. The analysis reveals three distinct components derived from principal component analysis. Component 1 is primarily influenced by the Attitudes and Stakeholder Effectiveness factors, with high loadings (e.g., .890, .861), indicating that stakeholders' attitudes and perceptions of effectiveness are crucial for participation.

Component 2 reflects the Collaboration and Networking factor, with significant loadings (e.g., .724, .601), highlighting the importance of networking and collaboration among stakeholders in basin management.

Component 3 involves a mix of Access to Resources and Collaboration and Networking factors, showing a more moderate contribution (e.g., .610, .257). This component suggests that while access to resources influences participation, collaboration remains a key factor).



Table 4. 8: Component Matrix on Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Factors	Component		
	1	2	3
Attitudes factor 1	.890	.124	-.111
Attitudes factor 2	.886	.088	-.143
Attitudes factor 2	.873	.107	-.085
Attitudes factor 3	.869	.004	-.072
Stakeholder Effectiveness factor 1	.861	.031	.094
Stakeholder Effectiveness factor 2	.858	.050	.055
Access to Resources factor 1	.838	.057	.018
Access to Resources factor 2	.785	-.010	.054
Access to Resources factor 3	.665	.134	.257
Access to Resources factor 4	-.600	.067	.229
Access to Resources factor 5	.593	.232	.276
Collaboration and Networking factor 1	-.174	.724	.116
Collaboration and Networking factor 2	-.368	.601	-.207
Collaboration and Networking factor 3	-.296	.471	.610
Collaboration and Networking factor 4	-.173	.550	-.601

Extraction Method: Principal Component Analysis.

a. 3 components extracted.

Source: Field Survey Data (2024)



4.5.3 Analysis of Total Variance explained in Principal Component Analysis

Table 4.9 shows the total variance explained by the components in a Principal Component Analysis (PCA). The first component has the highest eigenvalue of 7.327, explaining 48.85% of the total variance. The second component follows with an eigenvalue of 1.527, contributing 10.18%, and the third component has an eigenvalue of 1.043, explaining 6.96%. Together, these three components account for 65.98% of the total variance. Components 4 to 15 show decreasing contributions to the variance, with each explaining smaller percentages. The cumulative variance for the first three components reaches 65.98%, and the total variance explained by all 15 components is 100%.



Table 4. 9: Total Variance Explained

Component	Extraction Sums of Squared					
	Initial Eigenvalues			Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.327	48.845	48.845	7.327	48.845	48.845
2	1.527	10.178	59.023	1.527	10.178	59.023
3	1.043	6.956	65.980	1.043	6.956	65.980
4	.928	6.188	72.168			
5	.821	5.476	77.644			
6	.640	4.270	81.913			
7	.492	3.279	85.192			
8	.488	3.253	88.446			
9	.385	2.568	91.013			
10	.354	2.357	93.370			
11	.255	1.698	95.068			
12	.227	1.516	96.584			
13	.212	1.410	97.994			
14	.174	1.157	99.151			
15	.127	.849	100.000			

Extraction Method: Principal Component Analysis.

Source: Field Survey Data (2024)



4.6 Challenges in the Management of the Black and White Volta Basins

Table 4.10 presents the challenges faced in managing the Black and White Volta Basins. Conflicts over water allocation rank as the most significant challenge (mean rank of 2.03), highlighting the urgency of addressing resource distribution issues. The second most pressing challenge is inefficient irrigation practices and lack of water-saving technologies (mean rank of 3.45), emphasizing the need for improved water management techniques. Water pollution follows (mean rank of 4.10), indicating concerns about the quality of water resources. Limited financial resources and insufficient data for planning also rank high (mean ranks of 4.51 and 5.97), underlining the need for better funding and information systems. Other challenges include deforestation and land degradation (5.58), insufficient community involvement (5.16), and lack of infrastructure (5.21). The weak enforcement of regulations and changing weather patterns are also significant, but rank lower. The Kendall's W_a of 0.681 and Chi-Square value of 291.417 suggest a strong agreement among respondents on these challenges.



Table 4. 10: Challenges in the Management of the Black and White Volta Basins

Challenges statements	Mean Ranks	Ranking
Water pollution	4.10	3 rd
Deforestation and land degradation	5.58	7 th
Changing weather patterns, including irregular rainfall and prolonged droughts	6.93	10 th
Insufficient data and monitoring systems for effective planning and decision-making for water resources management	5.97	8 th
Inefficient irrigation practices and lack of water-saving technologies	3.45	2 nd
Conflicts over water allocation	2.03	1 st
The lack of proper infrastructure for water storage, distribution and flood control	5.21	6 th
Insufficient involvement of local communities and other stakeholders in decision-making processes	5.16	5 th
Weak enforcement of water management regulations and illegal activities on the water	6.07	9 th
Limited financial resources and human capacity on the implementation of comprehensive water management plans and projects	4.51	4 th
N	400	
Kendall's Wa	.681	
Chi-Square	291.417	
Df	9	
Asymp. Sig.	.000	

Source: Field Survey Data (2024)



4.7 Opportunities for Improving the Management of the Black and White Volta Basins

Table 4.11: Opportunities to improve the management of the Black and White Volta Basins. The highest-ranked opportunity is developing irrigation systems, with a mean rank of 2.38, as this is perceived to increase agricultural productivity while ensuring water resources are put to effective use. Ranked second in terms of priorities is sustainable fishing practices with a mean rank of 2.90; this helps to preserve aquatic biodiversity and provides support for local fishing communities.

Other notable opportunities include setting up a water quality monitoring network (mean rank of 3.96) and protecting wetlands (mean rank of 4.49), both very important actions to maintain ecosystem health. Investing in flood control infrastructure (mean rank of 5.61) and incorporating climate change considerations (mean rank of 4.67) also rank highly, underscoring the importance of resilience in managing future challenges. Lastly, involving local communities (mean rank of 3.91) in decision-making strengthens support for sustainable water management. The Kendall's W value of 0.684 indicates a strong agreement among respondents, with a Chi-Square value of 441.155 (p-value = 0.000), confirming the significance of these opportunities in improving basin management.



Table 4. 11: Opportunities for improving the management of the Black and White Volta Basins

Opportunities available statements	Mean Rank	Ranking
Developing irrigation systems enhance agricultural productivity, enabling farmers to utilize water resources effectively and increase crop yields	2.38	1 st
Implementing sustainable fishing practices and promoting responsible fishing can help preserve aquatic biodiversity and support local fishing communities	2.90	2 nd
Establishing a comprehensive water quality monitoring network helps identify pollution sources and ensures the provision of safe drinking water	3.96	4 th
Protecting and restoring critical wetlands and natural habitats in the basins promote biodiversity and enhance ecosystem services	4.49	5 th
Investing in flood control infrastructure, early warning systems, and floodplain mapping reduce the impact of floods on communities along the river	5.61	7 th
Incorporating climate change considerations into water management strategies allows for resilience and adaptation to potential future challenges	4.67	6 th
Involving local communities, NGOs, and other stakeholders in decision-making processes fosters ownership and support for sustainable water management practices	3.91	3 rd
N	400	
Kendall's Wa	0.684	
Chi-Square	441.155	
df	6	
Asymp. Sig.	0.000	

Source: Field Survey Data (2024)



CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter presents discussions of the findings of the study conducted to examine stakeholder participation in management of the Black and White Volta Basins in the Central Gonja District of the Savannah Region, Ghana. Hence, this chapter is structured into six (6) sections. Section one discusses socio-demographic characteristics of respondents. The second section discusses findings on stakeholders' perceived knowledge and attitudes towards management in the Black and White Volta Basins. The third section discusses the influence of stakeholders' participation in planning, implementation, monitoring, and benefit sharing within the basins. The fourth section explores the contribution of stakeholder participation to the sustainability of the Black and White Volta Basins. The fifth section discusses the problems encountered in managing the basins. Finally, the sixth section provides opportunities for improving the management of both the Black and White Volta Basins.

5.1 Demographics Characteristics of Respondents

This section provides evidence of the socio-demographic characteristics of the population under study. The chosen demographic characteristics are those identified as important to the study purpose, following the theoretical perspectives i.e., Participation Theory, Stakeholder Theory, Social-Ecological Systems (SES) Theory, and Social Exchange Theory. These demographic characteristics need to be understood in designing inclusive and efficient management programs for the Black





and White Volta Basins. The findings in Table 4.1 indicate a wide gender gap among the respondents, with men taking up 72.8% and women 27.2%. Participation Theory emphasizes that inclusive participation should guarantee the voices of the marginalized groups, including women, are integrated into resource management. The wide gender gap indicates the conventional gender norms where men dominate decision-making in natural resource management (Mandara et al., 2017). Yet Stakeholder Theory reminds us that the interests of all stakeholders, such as women, need consideration for successful management results. This gender disparity can therefore narrow the range of views required to sustain basin management.

In addition, the research indicated that a vast majority (83.5%) of the respondents were married. In Social Exchange Theory, individuals who have strong family obligations will be ready to make a commitment towards collective resource management as long as they are confident that their input will benefit their families in the long run (Mengesha, 2017). Married stakeholders are thus interested in managing basin resources sustainably owing to the tangible benefits to household livelihood and well-being.

Educationally, the majority of the respondents (62.7%) were not formally educated. Participation Theory accentuates the reality that effective stakeholder participation does not necessarily involve physical presence but also cognitive capacity to comprehend and meaningfully contribute. High illiteracy rates can severely limit communities' capacity to respond to technical resource management challenges (Mensah, 2019). Low education, based on SES view, handicaps the capacity of social



systems to respond to ecological change by impeding effective knowledge transfer and thus threatens the resilience of the system.

Occupational information demonstrates that the bulk of livelihood activity by respondents lay in fishing (45.8%) and agriculture (22.3%). Such interdependence of human livelihoods with the natural world is exactly as SES Theory identifies to assure exploitation of any nature poses straight-up risk to sustainability for communities, while its occupational attachment places accent on an ecosystem-based and inclusive approach towards managing it such that its acknowledgment of interdependence with basins for society represents acknowledgment of the necessity (Lanyon et al., 2013).

The results also reveal that 82.3% of the respondent population were locally indigenous. Stakeholder Theory places a high value on indigenous individuals as important stakeholders with critical localized knowledge necessary in effective resource management for sustainability. Their intimate knowledge of the environment implies high levels of stewardship potential but imply that indigenous understanding needs to form part of standard basin management platforms.

The age of the respondents varied from 19 to 74 years with a mean age of 44 years. The range in age indicates an intergenerational mix, which, according to Participation Theory and SES Theory, is essential for combined basin management. The youth bring innovation and openness to new technology, and the elderly bring traditional knowledge essential for sustainability over a long time (Hailu, Tolossa, and Alemu, 2019; District Development Plan, 2023). These strengths balance across generations and strengthen the adaptive capacity and resilience of the social-ecological system.



5.2 Stakeholders Perceived Knowledge and Attitudes towards Management in the Black and White Volta Basins

This section discusses stakeholders' knowledge and attitudes towards the management of the Black and White Volta Basins in Ghana. Table 4.2 presents perceptive statements measuring the level of agreement among respondents regarding their knowledge and attitudes toward water resource governance. This discussion is important because effective basin management depends not only on awareness of water governance principles, but also on the extent to which stakeholders are meaningfully involved in decision-making processes. In line with Arnstein's Ladder of Citizen Participation (1969), participation must go beyond symbolic consultation to include genuine power-sharing arrangements that promote community ownership and long-term sustainability.

Integrated Water Resource Management (IWRM) Principles Awareness

The results indicate that 82.8% of respondents expressed awareness of Integrated Water Resource Management (IWRM) principles, particularly participatory approaches (Table 4.2). This high level of awareness suggests that respondents recognize the importance of coordinated and inclusive water governance. However, Arnstein's Ladder emphasizes that awareness alone does not necessarily translate into meaningful participation. In many governance settings, communities may be informed about IWRM initiatives or consulted during meetings, yet remain excluded from final decision-making. Therefore, the findings imply that although knowledge of IWRM is high, the critical issue is whether local stakeholders are operating at the levels of

tokenism (informing and consultation) or citizen power (partnership and delegated authority).

Perceptions of Government and International Initiatives

Respondents expressed mixed views regarding government support for climate change adaptation and water management. Although 50.3% agreed that government efforts were adequate, a substantial proportion were either uncertain or disagreed (Table 4.2). Under Arnstein's framework, such uncertainty and dissatisfaction often reflect participation structures where communities are consulted but have limited influence over implementation decisions. This suggests that government interventions may be perceived as externally driven, with inadequate feedback mechanisms to incorporate local priorities.

In contrast, perceptions of international agencies were more positive, with a strong majority acknowledging their involvement in water resource management and climate adaptation efforts. While this recognition reflects the visibility of external support, Arnstein's Ladder cautions that development interventions can still fall within tokenistic participation if local communities are only recipients of projects rather than co-designers and decision-makers. Hence, the findings raise an important governance concern: external involvement may be appreciated, but sustainability depends on whether communities are empowered to shape and sustain interventions beyond project cycles.



Understanding of Climate Change Impacts and Traditional Knowledge

The findings further show that awareness of climate change impacts was high (85.8%), indicating that communities recognize the link between climate variability and water resource challenges. However, only 57.7% reported awareness of traditional water management practices, while a significant proportion remained unsure (Table 4.2). This gap suggests a weakening transmission of indigenous knowledge systems. From the perspective of Arnstein's Ladder, this has strong implications. Traditional ecological knowledge can only be sustained and effectively integrated into basin management when communities are involved at higher rungs such as partnership or delegated power, where their knowledge is treated as legitimate and influential in planning. If participation remains at the informing or consultation levels, traditional knowledge is often sidelined, leading to erosion of cultural practices and reduced local ownership of water governance.

Knowledge of Ecology and Habitat Management

The study found that 76.5% of respondents acknowledged the importance of the habitat mosaic for water management, reflecting an appreciation of ecological interdependence in basin sustainability. This indicates that local communities possess strong environmental awareness and recognize the value of biodiversity for water regulation and ecosystem stability. Practices such as protecting sacred groves, regulating fishing activities, and seasonal land-use controls are examples of community-based ecological strategies that could strengthen basin resilience.





However, Arnstein's model suggests that such ecological knowledge can only translate into effective governance outcomes when communities are empowered to influence decisions and enforce local rules. Without power-sharing mechanisms, these ecological practices may remain informal and vulnerable to external pressures such as commercial exploitation, weak enforcement, and political interference.

Attitudes toward Transparency, Community-Led Initiatives, and Traditional Practices

The results reveal strong community attitudes in favour of transparency and participatory governance. For instance, 96% of respondents agreed that lack of transparency leads to mistrust, while over 90% supported community-driven initiatives (Table 4.2). These findings reflect a clear demand for inclusive decision-making and accountability in basin governance.

Within Arnstein's Ladder, this suggests that communities are dissatisfied with participation that remains within tokenism and are more inclined toward higher participation levels where they can share authority. Support for community-led initiatives indicates that respondents favour governance arrangements that move toward partnership and delegated power, where community institutions actively shape decisions rather than merely receiving instructions from external authorities.

Challenges to Adopting New Practices and Partnering with Authorities

The findings show that resistance to adopting new practices and stakeholder conflict remain important challenges. A significant proportion of respondents agreed that some community members resist new conservation measures due to attachment to traditional

habits (Table 4.2). Additionally, perceptions of conflict among authorities and stakeholders suggest that cooperation may be undermined by competing priorities and weak coordination.

Arnstein's Ladder provides a useful explanation for this dynamic. Resistance and conflict often emerge when stakeholders perceive that decisions are imposed without genuine consultation or when participation is symbolic rather than empowering. When communities are engaged only at lower rungs, such as informing and consultation, they may feel excluded from control over decisions that affect their livelihoods. This can create distrust and reduce willingness to adopt innovations, even when such practices are beneficial for sustainability.

Stakeholder Engagement and Intergenerational Transfer of Knowledge

Although some respondents indicated participation in environmental initiatives, a considerable proportion remained uncertain, suggesting inconsistent engagement patterns. This reflects the possibility that participation mechanisms are not institutionalized and may depend on irregular project-based interventions rather than stable governance structures. Arnstein's Ladder suggests that sustainable stakeholder engagement requires moving beyond short-term consultation toward long-term empowerment and institutional inclusion. This is particularly relevant for intergenerational knowledge transfer. When younger generations are not meaningfully included in decision-making platforms, traditional ecological knowledge weakens, and basin governance becomes less culturally grounded. Therefore, strengthening intergenerational participation through community water committees, youth



involvement, and formal recognition of traditional authorities could elevate participation toward partnership, improve legitimacy, and strengthen long-term sustainability outcomes.

5.3 Stakeholders Participation in the Planning, Implementation, Monitoring, and Benefit sharing within the Black and White Volta Basins

The results on stakeholder participation in planning, implementation, monitoring, and benefit-sharing provide important insights into how governance processes operate within the Black and White Volta Basins. Beyond demonstrating that stakeholders are involved, the findings highlight a critical issue: participation is not only a social process but a governance mechanism that directly shapes sustainability outcomes. This is particularly relevant given the study's finding that 82.8% of respondents were aware of Integrated Water Resources Management (IWRM) principles, suggesting that the idea of coordinated and inclusive basin management is widely recognized among stakeholders. However, the findings also reveal that awareness does not automatically translate into effective practice, as the success of IWRM depends on how participation is structured and sustained across governance stages.

5.3.1 Planning

The study shows that stakeholders especially indigenous communities play a key role in identifying water-related needs and challenges during the planning stage. Their reliance on traditional ecological knowledge offers valuable insights into local hydrological patterns, seasonal variations, and community water use priorities. This is significant because IWRM promotes basin planning that is locally informed and



responsive to socio-ecological realities rather than externally imposed solutions. Thus, stakeholder involvement in planning reflects an important pathway through which IWRM principles can be operationalized at the community level.

However, the study further implies that planning participation is often shaped by the extent to which local priorities are genuinely reflected in policy design. Where stakeholder input is integrated into decision-making, communities perceive planning as legitimate, thereby improving compliance and long-term sustainability. This supports evidence that indigenous involvement strengthens context-specific planning and enhances sustainability outcomes (Hailu et al., 2019). Similarly, studies in Ghana emphasize that community involvement increases the relevance and acceptance of interventions by aligning them with local socio-cultural dynamics (Darko & Anokye, 2022). Nevertheless, the findings also point to the need for balance. While traditional knowledge improves contextual accuracy, overreliance without scientific integration may reduce adaptability to broader climatic pressures. This critique aligns with Nyarko et al. (2020), who argue that planning must integrate indigenous knowledge with technical expertise to strengthen resilience under climate change. Therefore, the implication is that the basin planning process should not only be participatory but also integrative, consistent with the core IWRM principle of combining knowledge systems.

5.3.2 Implementation

The results indicate that stakeholders are frequently involved in the implementation of basin management activities, suggesting that participation extends beyond





consultation into practical engagement. This is a key strength because IWRM emphasizes implementation through coordinated stakeholder action, not merely planning documents. When communities actively implement interventions, they develop a sense of ownership, which improves accountability and sustainability. The findings also suggest that stakeholder implementation is shaped by local experience with water challenges, making interventions more grounded and effective. This supports evidence from Ghana that indigenous participation improves the cultural appropriateness and effectiveness of water resource projects (Agyekum et al., 2020). In a broader African context, community-led implementation has been linked to improved project success because it strengthens commitment and reduces dependency on external institutions (Mdee & Mumma, 2019).

A major implication of this result is that high awareness of IWRM principles among respondents may be contributing to their willingness to support implementation activities. However, the sustainability of implementation depends on whether institutions provide sufficient resources and coordination. Without institutional support, participation may remain voluntary and inconsistent, weakening long-term outcomes. Furthermore, stakeholder involvement in monitoring during implementation indicates that participation is evolving into practical governance responsibility. This reflects a transition from passive involvement to active accountability, consistent with the IWRM goal of decentralization and stakeholder responsibility. Community-based monitoring systems have been shown to reduce misuse and improve transparency in Ghana (Boateng et al., 2021), reinforcing the importance of institutionalizing such mechanisms.

5.3.3 Monitoring

The findings show that stakeholders play an important role in monitoring basin management activities. Monitoring was viewed by participants as essential for ensuring compliance, preventing misuse, and sustaining water resources such as fisheries. This finding is highly significant because IWRM requires continuous monitoring and feedback mechanisms to support adaptive management. In practice, monitoring becomes the bridge between policy intentions and real ecological outcomes.

Community-led monitoring also strengthens accountability and reinforces stewardship norms rooted in traditional practices. This aligns with Hailu et al. (2019), who argue that integrating local knowledge into monitoring improves early detection of challenges and enhances project outcomes. Similarly, studies in Ghana confirm that local monitoring encourages environmental responsibility and compliance (Agyeman & Ayivor, 2021). However, the results also imply that the effectiveness of monitoring depends on capacity. Without training, logistical support, and institutional backing, monitoring may become weak and unsustainable. This concern has been raised by Asare and Boateng (2020), who caution that limited resources can undermine the quality of community monitoring. Therefore, although IWRM awareness is high, its practical realization requires investment in local monitoring capacity, especially in technical aspects such as water quality assessment and pollution reporting.

Comparatively, evidence from Nigeria shows that monitoring is often dominated by external state agencies with minimal community involvement, which reduces trust and



weakens outcomes (Eboh & Okoh, 2018). The stronger participation observed in this study suggests that Ghana's basin management structures may already contain promising participatory foundations, but these need to be strengthened through institutional support.

5.3.4 Benefit Sharing

The study reveals that benefit sharing is viewed as a critical factor in sustaining participation, promoting fairness, and reducing disputes among stakeholders. Participants emphasized that equitable sharing ensures social harmony and motivates continued engagement in basin management. This finding directly reflects the IWRM principle of equity, which emphasizes fairness in water allocation and access to benefits derived from shared resources.

Empirical studies in Ghana support this finding, showing that fair distribution of water-related benefits increases cooperation and strengthens trust between stakeholders (Agyemang et al., 2020). Similarly, Owusu-Ansah and Darkwah (2021) found that transparent benefit-sharing frameworks encourage community involvement and reduce inequality. However, the findings also align with broader African evidence that benefit sharing is vulnerable to elite capture and institutional weaknesses. For instance, Boateng et al. (2019) observed that inequalities in Ghana's water projects often emerge due to weak monitoring and unequal power relations. Similar patterns have been reported in Southern Africa, where exclusionary benefit-sharing practices have generated conflicts and marginalization (Ncube & Dube, 2016). This implies that even when communities are aware of IWRM ideals, inequitable benefit sharing can



undermine participation and trigger disputes, thereby weakening sustainability outcomes.

5.4 Stakeholder Participation in the Management of the Black and White Volta Basins contributes to the Sustainability of the Basins

This section examines how stakeholder participation contributes to the sustainability of the Black and White Volta Basins, using the sustainability indices generated from the study. In line with the study's theoretical framing, the discussion is interpreted through Arnstein's Ladder of Citizen Participation (1969), which provides a useful lens for assessing not only whether stakeholders are involved, but also the depth of their participation and the extent of their decision-making power. This is important because sustainability outcomes are often shaped less by participation in name and more by whether stakeholders are engaged at the levels of tokenism (informing, consultation, placation) or citizen power (partnership, delegated power, and citizen control).

The findings suggest that participation within the basin management system has produced relatively positive social and economic sustainability outcomes, but environmental sustainability remains comparatively weaker. This implies that although stakeholders may be involved in some governance processes, participation may not yet be sufficiently institutionalized at the higher rungs of citizen power to drive stronger ecological resilience.





5.4.1 Social Sustainability Index (SSI)

The Social Sustainability Index (SSI) produced an overall score of **72.5**, suggesting that stakeholder participation has contributed positively to social cohesion, interaction, and governance relationships within the basin communities. From Arnstein's perspective, this score reflects that stakeholders are not completely excluded from decision-making, since basic forms of engagement such as consultation and involvement appear to exist.

Social Interaction and Networks

The high Social Interaction and Network Index score (**80**) indicates that collaboration and community networking are strong in the basin communities. This reflects the presence of collective action mechanisms such as community meetings, informal negotiations, and traditional communication channels. Within Arnstein's ladder, this may be interpreted as evidence that basin management has moved beyond non-participation toward at least the consultation and partnership stages, where dialogue and shared engagement are possible. Strong social interaction is significant because sustainable management of common-pool resources such as river basins depends heavily on trust, cooperation, and shared norms.

Power Relations

The Power Relations Index score (75) suggests relatively balanced governance relationships, although the persistence of marginalization of women and youth implies that participation is not uniformly empowering. In Arnstein's ladder, this is a strong indication of tokenism, where participation may exist but decision-making influence

remains unequal. This suggests that while some groups may be consulted, real authority might still rest with dominant actors such as traditional leaders, local elites, or formal institutions. This finding highlights the need to deepen participation by creating structures that shift participation from consultation toward partnership and delegated power, especially for vulnerable groups.

Equity, Access, and Inclusion

The Equity, Access, and Inclusion score (70) reflects a generally positive situation but with noticeable inequalities. Under Arnstein's ladder, equity problems signal that participation has not reached the higher rungs where communities exercise stronger control over allocation and benefit-sharing decisions. If certain stakeholders perceive exclusion from access to water or related benefits, participation becomes weakened because people are less likely to invest in governance systems that do not serve their interests. This supports Arnstein's argument that participation without power redistribution may preserve existing inequalities rather than solve them.

Social Cohesion and Conflict

The Social Cohesion and Conflict score (65) shows that conflicts still occur, mainly due to competing demands over water allocation and access. This implies that stakeholder participation structures may not be strong enough to manage disputes effectively. Arnstein's ladder suggests that conflicts often intensify where communities operate at tokenistic levels, since consultation without decision-making authority creates frustration and mistrust. Therefore, the relatively lower cohesion score indicates the need to strengthen basin governance platforms that allow



stakeholders to jointly negotiate and resolve disputes, consistent with the partnership rung.

Overall, the SSI findings suggest that stakeholder participation has contributed significantly to social sustainability; however, the persistence of inequality and conflict implies that participation remains partially constrained within the tokenism category rather than fully reaching citizen control.

5.4.2 Environmental Sustainability Index (ENSI)

The Environmental Sustainability Index score (65) is the lowest among the sustainability dimensions, indicating that ecological challenges such as pollution, deforestation, and erosion remain major threats despite stakeholder participation. This reveals an important governance gap: although stakeholders may be involved socially and economically, participation has not yet translated into strong environmental outcomes. Arnstein's ladder helps explain this disconnect because environmental sustainability requires not only awareness and consultation, but actual decision-making authority and enforcement power at the local level.

Water Pollution Sub-Index (WPI)

The Water Pollution Sub-Index score (65) suggests persistent water quality deterioration due to agricultural runoff, waste disposal, and weak regulation. This indicates that stakeholder engagement in pollution control is likely limited to consultation or awareness creation, rather than community-led enforcement. Under Arnstein's ladder, this reflects participation at the informing and consultation levels,



where stakeholders may be educated about pollution but lack authority to regulate behaviours or enforce compliance.

This finding highlights that awareness alone is insufficient unless supported by enforcement systems. Stronger environmental outcomes require participation to move toward **delegated power**, where communities are empowered to implement monitoring mechanisms and enforce by-laws regarding waste disposal and farming along buffer zones.

Soil Erosion Sub-Index (SEI)

The Soil Erosion Sub-Index score (**70**) reflects serious erosion challenges, likely driven by poor farming practices, deforestation, and overgrazing. Although this score is slightly higher than pollution, it still indicates environmental vulnerability. In Arnstein's framework, this implies that communities may participate in some soil conservation initiatives, but such participation may remain voluntary and project-based rather than institutionalized. This reflects placation rather than citizen power. If communities had stronger authority and resources to regulate land-use practices, erosion levels would likely reduce more significantly.

Deforestation Sub-Index (DSI)

The Deforestation Sub-Index score (**60**) suggests that forest loss remains a major ecological threat in the basin. This implies that community involvement in forest governance is weak or poorly coordinated. Arnstein's ladder interprets this as evidence that local stakeholders may still be operating within tokenism, where communities may be consulted but do not control resource protection decisions. Deforestation often



persists where livelihoods depend on land expansion and communities lack incentives or enforcement support to conserve forests.

In this context, sustainability would require shifting participation toward partnership and delegated power, where communities are supported with alternative livelihood incentives (e.g., agroforestry support, eco-tourism opportunities) and empowered to regulate illegal logging and riparian encroachment.

Overall Environmental Implication

The overall ENSI score suggests that the basin is environmentally fragile. Arnstein's model helps explain this by highlighting that ecological sustainability requires deeper empowerment than mere consultation. Without citizen control or delegated power, communities cannot fully regulate pollution, enforce buffer protection, or prevent deforestation. Therefore, environmental sustainability challenges persist because stakeholder participation has not matured into stronger governance authority at the grassroots level.

5.4.3 Overall Sustainability Index

The overall sustainability index score of **70.5** presents a generally positive sustainability outlook for the Black and White Volta Basins. However, the differences among the economic, social, and environmental scores reveal an uneven sustainability structure, where progress is stronger in social and economic domains than in ecological resilience.



Economic Sustainability Index (ESI)

The Economic Sustainability Index score (**75**) indicates that the basin communities maintain a relatively strong livelihood base, largely supported by agriculture and water-dependent activities. However, the results also suggest that economic sustainability remains vulnerable because it depends heavily on natural resource exploitation, especially farming along riverbanks. Arnstein's ladder suggests that economic sustainability improves when communities are empowered to manage resources responsibly. If participation remains at tokenism levels, economic benefits may be short-term and may accelerate environmental decline, which will eventually weaken livelihoods.

Social Sustainability Index (SSI)

The SSI score (**72.5**) confirms that community interaction and stakeholder engagement contribute positively to social stability. However, the persistence of power imbalances indicates that participation has not fully reached citizen power. Arnstein's theory implies that stronger social sustainability can be achieved when stakeholder inclusion is institutionalized through shared authority and structured decision-making platforms.

Environmental Sustainability Index (ENSI)

The ENSI score (**65**) remains the weakest, indicating that environmental degradation threatens the long-term sustainability of the basins. Respondents' concerns about illegal mining (galamsey) affecting water quality show that environmental challenges may be influenced by upstream activities beyond local control. This reveals an important Arnstein-based implication: communities may lack sufficient power to





influence external actors and national enforcement agencies, meaning their participation remains constrained by higher-level governance structures. This reinforces the need for multi-level governance partnerships where local communities are empowered while institutions enforce regulations.

The sustainability indices suggest that stakeholder participation has contributed positively to social and economic sustainability but remains less effective in driving strong environmental sustainability. Using Arnstein's ladder, the results imply that stakeholder participation in the basin is largely situated within the **tokenism category**, where consultation and involvement exist but communities do not yet possess sufficient authority to enforce environmental regulations, control pollution, or manage land-use pressures.

This explains why awareness of IWRM principles and participation efforts have not translated fully into improved ecological outcomes. For basin sustainability to be strengthened, stakeholder engagement must move upward toward **partnership and delegated power**, where communities share decision-making authority with institutions and possess enforcement capacity supported by legal backing, logistics, and monitoring resources.

Therefore, the overall sustainability score of **70.5** reflects progress, but the lower environmental sustainability score signals that sustainability gains remain fragile unless participation is deepened from consultation to genuine citizen power, consistent with Arnstein's framework.

5.5 Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

The factors influencing stakeholder participation in the management of the Black and White Volta Basins are herein presented.

5.5.1 Main Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Table 4.7 presents an overview of the most relevant factors influencing stakeholder participation in the management of these basins together with respective eigenvalues, variance explained, and factor loadings.

Attitudes towards Basin Management

With an eigenvalue of 3.45 and explaining 25% of the variance, attitudes towards basin management is the most dominant factor influencing stakeholder participation. This factor's high loading (above 0.4) would mean that the manner in which stakeholders perceive and believe in the importance and effectiveness of basin management is very important in determining their level of participation. Positive attitudes toward basin management enormously help in increasing stakeholder participation since stakeholders that perceive the efforts of management as effective are likely to contribute actively (Hebsale-Mallappa & Babu, 2021). Conversely, negative perception leads to disengagement and opposition hence derail management initiatives. This puts forward that the development of positive attitude through appropriate communication and illustrating the benefits of management initiatives is



very crucial hence exemplifying findings that stakeholder perception is a critical determinant of participation levels as postulated by (Adams, 2010).

Stakeholder Perception of Effectiveness

The perception of stakeholder effectiveness is the second most influential factor and has an eigenvalue of 2.78 hence explaining a variance of 20%. This factor also records a high factor loading (above 0.4), hence stakeholders' beliefs in the effectiveness of their participation as a key determinant of their levels of participation. Economic factors tend to influence participation, whereby stakeholders are more likely to take care of resources with high commercial value (Musavengane & Simatele, 2017). In contrast, lack of economic incentives or high levels of poverty might serve as a barrier to participation (Katusiime & Schütt, 2020). This is consistent with the findings that stakeholder participation depends much on perceived benefits and how effective their input can be included in the implementation of policies, programs, or projects (Hart & Dowell, 2011)

Access to Resources

Access to resources had a moderate influence: eigenvalue= 2.10, accounting for 15% of variance in the scale of stakeholder participation. Influential as it may be, the eigenvalue value manifests its lesser strength than the perceived attitude and effectiveness in stakeholder participation (Kousky, 2019). This finding supports existing literature that suggests that, although access to resources is important, stakeholders' perceptions of the effectiveness and benefits arising from resource management initiatives are often more dominant drivers of engagement (Thompson &



Friess, 2019). As such, although access to resources is important, its influence is mediated by the overall attitudes and beliefs of stakeholders in relation to resource management (Sophat et al., 2019).

Engagement in Management Activities

The engagement in management activities has a high eigenvalue of 1.95, explaining 12% of the variance with a very high factor loading above 0.4. This presents a very important stakeholder engagement in the management of resources and hence is consistent with much research focusing on economic incentives as well as community involvement in promoting successful conservation practices (Thompson & Friess, 2019; Zafar et al., 2022). Thus, inclusion of economic, socio-cultural and political aspects into resource management will enhance stakeholder participation.

Environmental Concerns

Environmental issues make a significant influence on stakeholder participation in management, as established earlier, 10% of the variance was occasioned by this variable with a factor loading of between 0.3-0.4 indicating moderate. Indeed, this moderate influence puts into perspective that although environmental issues are at play, they do not strongly drive the nature of stakeholder engagement in comparison to other factors (Hebsale-Mallappa & Babu, 2021). In comparison, environmental concerns tend to have a more indirect impact. However important they may be, the influence of these concerns on stakeholder participation is moderated by other more proximate factors, like economic benefits and socio-cultural dynamics (Wassie, 2020; Thompson & Friess, 2019). Thus, though the environmental problems are crucial for



resource management, their impact on stakeholder engagement is comparatively less direct.

Conflicts among Users

The low eigenvalue of 1.25 for the conflicts among the users, which explains only 8% variance, having factor loading below 0.3, indicates that it has a limited importance when viewed as affecting the stakeholder engagement. This also runs contrary to many studies which claim that conflicts are one major barrier that hinders proper management of the resources (Hart & Dowell, 2011). Conflicts are a known concern in resource management (Devy & Davis, 2020), though the low factor loading here suggests that other factors will have a bigger impact on shaping stakeholder engagement like economic incentives and socio-cultural dynamics. This, though the least of the other factors, still presents a potential barrier to stakeholder participation. Conflicts around resource sharing, conflicting interests, and power dynamics can dissolve collaborative efforts and give way to disengagement or opposition from other groups of stakeholders.

5.5.2 Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

The management of the Black and White Volta Basins is very crucial to ensure that water resources are sustainable, since they are very important to local communities and ecosystems. One of the most important keys to successful management of these basins is stakeholder participation, and learning what factors influence participation can go a long way toward the development of effective strategies. Table 4.8:



Component Matrix from a Principal Component Analysis (PCA) of the main factors influencing stakeholder participation in the management of the basins. Three main components are considered, each representing a cluster of related factors.

Part 1: Attitudes and Stakeholder Effectiveness

Component 1 is dominated by factors related to attitudes towards basin management and perceptions of stakeholder effectiveness, with factor loadings ranging from .593 to .890. These particularly high factor loadings of the attitude-related latent factors therefore signal that stakeholder beliefs and perceptions of both the importance of and impact arising from basin management constitute key drivers for participation: for example, .890, .886, .873 and .869 respectively. These attitude factors are closely followed by stakeholder effectiveness factors, which also portray strong positive loadings (e.g., .861 and .858). This might mean that when stakeholders have a positive attitude toward basin management and believe that their participation is effective, they are more likely to take an active part in management activities. In contrast, economic and socio-cultural factors also play important roles. Economic value and financial gain can act as incentives to encourage stakeholders to participate in management, as revealed by various studies (Musavengane & Simatele, 2017; Hart & Dowell, 2011). Sociocultural barriers—like power imbalances and gender roles—might impede participation, shown through a plethora of case studies (Silva Rodríguez, 2018; Mandara et al., 2017).



Component 2: Collaboration and Networking

Component 2 represents factors to do with collaboration and networking, with loadings ranging from .471 to .724.

These factors seem to convey the importance of social interactions, communication, and cooperation among stakeholders in the management process. Thus, the positive loading of .724 for Collaboration and Networking factor 1 suggests that strong collaborative networks increase stakeholders' participation. However, some factors under this component have negative loadings, such as Collaboration and Networking factor 4, which possibly points out that problems or conflicts can emerge within such networks. On the other hand, the positive loading of .724 for collaboration and networking indicates that strong social interactions and networks are important in increasing participation. This however, has negative loadings for some of its factors, which might indicate conflicts or inefficiencies in these networks (Sophat et al., 2019). Effective stakeholder engagement hence involves not just the creation of a good network but also handling the possible conflicts so that there might be effective resource management in an all-inclusive manner (Thompson & Friess, 2019).

Component 3: Access to Resources and Barriers

Component 3 is more diverse and presents factors in relation to access to resources loaded both positively and negatively. Factor 1 related to access to resources is positively loaded at .838, showing that the mentioned factor, in relation to access to resources, has an overall positive effect on participation. The positive loading of .838 for Access to Resources factor 1, therefore, means that the better the access, the more



it will usually ensure effective involvement of stakeholders, hence in line with findings that financial and material resources motivate more participation (Katusiime & Schütt, 2020).

However, factor 4, Access to Resources, loads negatively with a score of $-.600$, which could be an indication of the existence of some barriers or inequities in access to resources that impede participation. This corroborates the literature that shows that economic constraints, poverty, and inequality can restrain stakeholders' participation (Musavengane & Simatele, 2017; Kala & Bagri, 2018).

5.5.3 Total Variance explained in Principal Component Analysis

Principal Component Analysis (PCA) is a powerful statistical technique for dimensionality reduction and simultaneously retaining as much variance as possible. The goal is to discover and interpret the underlying factors that contribute to the variability observed in the dataset. Table 4.9 presents the results from PCA for a set of components, summarizing the total variance explained by each component, both initially and after extraction.

Initial Eigenvalues and Variance Explained

Table 4.9 shows the outcome of the eigenvalue analysis, which decomposes how much of the total variability in data is explained by each component. In other words, it shows how various factors contribute to an understanding of data in its entirety. The first component is always the most important and explains almost 49% of the total variation in the dataset. This means that this single factor is important in explaining a large part of what's going on in the data. The second component explains a smaller but still





significant 10.2% of the variation. Together, the first two components cover nearly 59% of the data's variability, which is a fair amount. The third component adds another 7% of explanation, bringing the total of the first three components to nearly 66%. It goes without saying that after this, the components explain less and less, showing that the factors contributing less to the structure of data have a diminishing impact. This kind of analysis will help to answer the objective of establishing key factors and components that explain the variability in stakeholder participation and perceptions in the management of the Black and White Volta Basins.

Extraction Sums of Squared Loadings

After extraction, the result does not change for the first three components. The same eigenvalues and percentages of variance explained by the components before and after extraction further reinforce the fact that these components really are of major importance to the analysis.

The extraction keeps components with eigenvalues greater than 1, based on the rule that such values represent important components. For this dataset, the first three components meet this criterion, while the rest are below this threshold. This way, it ensures that only the most influential factors will be retained for further investigation, making the interpretation of the results simpler. The total variance explained by the retained components 1 to 3 amounts to 65.980%, which is a great deal of the total variability. This probably means that the first three components catch what is essential in the data, and hence all-important to understand the structure and relationships inherent in the dataset.

5.6 Challenges in the Management of the Black and White Volta Basins

The management of the Black and White Volta Basins faces several challenges that threaten the sustainable use of water resources and the well-being of communities dependent on these basins.

Results from Table 4.10 clearly identify and rank the key challenges in the management of the Black and White Volta Basins that have the most significant impact on the sustainability of the basin. Conflicts relating to the allocation of water were scored 2.03 in terms of their importance for relation to water use, rating them as the most important factor in local water management. This issue is of great importance, especially in water-scarce areas where there is an increase in competition for limited available resources. Conflicts have been cited in several local and global instances. For example, in countries such as India and South Africa, water scarcity is normally the source of tensions between agricultural users, urban areas, and industries; hence, it heightens the already existing social and political challenges (Schwermer et al., 2020). In such contexts, disputes over water rights and access can impede effective water management and cooperation among stakeholders.

Water pollution was voted as the third most critical problem with a ranking of 4.10 on average. This is parallel to global concerns on water contamination by agricultural runoff and by illegal mining activities, among others, as noted by Schwermer et al. (2020). In the context of this study, this represents not only a threat related to the quality of water but also to local biodiversity and public health.





In seventh place, deforestation and land degradation had a mean of 5.58. This shows that increased environmental pressures in the region are reflected in ever-increasing unsustainable logging practices and expansion of agriculture. Similar trends were also reported by Bukari et al. (2023) in a study on basin management in the region; hence, there is even more need for policy adjustments in land management to curb these environmentally destructive activities.

Another problem ranking sixth is the lack of infrastructure to store, distribute, and control floods in water, which stands at a mean of 5.21, showing a very big rating. This problem harmonizes with broader regional struggles, for instance, those set by the Volta Basin, where insufficient infrastructure always hinders effective management of water resources, also observed by Sheth and Iyer (2021). Inadequate infrastructure renders water resource management increasingly difficult, especially during periods of drought or flood, thus increasing the vulnerability of the region even more to climate change.

Particularly important for the identified problems was the enforcement of water management regulations and persistent illegal activities, which were placed ninth with a mean of 6.07. This seems to agree with the fact that in most African countries, illegal mining and misuse of natural resources are not usually enforced. Also, according to Bukari et al. (2023), part of the region's environmental problems has been contributed to by poor regulatory frameworks and the ineffective enforcement of regulations.

The other challenges, such as insufficient data for decision-making ranked eighth and financial resources ranked fourth, depict some of the systemic weaknesses in water

governance and resource allocation. These are common problems that are found with water management everywhere, as too often, the management of this sector suffers from a lack of reliable data and underfunded projects (Schwermer et al., 2020).

The study noted such challenges in the changing weather patterns, including erratic rainfall and longer periods of drought at a mean score of 6.93. The impacts of climate change on water resources are emerging as a very serious global challenge, especially in areas like the Volta Basin. From the research studies, it can be proven that climate change has severe implications on the availability of water in the Volta Basin. For example, Adiku et al. (2020) noted that the impacts of climate change are most likely to result in a huge reduction in water availability and crop productivity, largely due to erratic rainfall and drought. Agyemang et al. (2019) also indicated that the Volta Basin has been experiencing long periods of drought with changing rainfall patterns, hence affecting water supply and food security, which might further deteriorate in the future.

Moreover, Dixon and McKay (2021) observe that climate change in SSA, therefore Ghana, is projected to threaten directly the availability of water resources and agricultural productivity. Changes in weather patterns are expected to continue compromising the availability of water and continue affecting general development and stability in the region.

The fifth was the inadequate inclusion of the local communities and other stakeholders in the decision-making processes, with a mean score of 5.16. This has been one of the greatest challenges in resource management: top-down approaches tend to negate inputs from local populations most affected by problems associated with water. The





case of the Black and White Volta Basins makes this very clear: when local communities become disengaged from the policy procedures, it would only bring about a rift between the policies and the people who eventually are supposed to be the beneficiaries relying on the water resources.

Similarly, when local communities are in the decision-making processes, research proved that resource management would become sustainable and effective; for example, Bukari et al. (2023) found that inclusive governance that strongly involves local communities yields good results in water management. This article is in line with the findings of this study, since it asserts that a more participatory approach to water resource governance in the Black and White Volta Basins would result in greater effectiveness in management and community ownership of water-related initiatives.

Kendall's W coefficient of 0.681, together with the Chi-Square value of 291.417 ($p < 0.001$), reveals a strong agreement among the respondents regarding the ranking of these challenges. The implication that can be drawn here is that stakeholder perception in the region is homogeneous.

5.7 Opportunities for Improving the Management of the Black and White Volta Basins

Several opportunities are availed by the management to increase sustainable water resources utilization, promote environmental stewardship, and improve livelihoods for the local communities in the Black and White Volta Basins.

Table 4.11: Opportunities for improvement in management of the Black and White Volta Basins. The highest-ranking opportunity is the development of irrigation systems, with a mean rank of 2.38. This is very key to enhancing agricultural productivity by efficiently using water resources—a very critical strategy in increasing crop yields and hence supporting smallholder farmers. It has been noted that irrigation is among the important factors in increasing the resilience of agriculture, mostly for water-scarce regions (Akinwale et al., 2020).

The second most highly ranked opportunity arising is that concerned with the implementation of sustainable fishing practices for the conservation of aquatic biodiversity, with a mean rank of 2.90. Sustainable fisheries provide for the maintenance of ecosystem balance while ensuring the livelihoods of dependent local communities. Indeed, this supports global initiatives integrating sustainability into the management of aquatic resources, such as that of Cooke et al. (2016), who call for responsible fishing practices in the protection of biodiversity.

The third-ranked opportunity, which pertains to community participation, involvement of NGOs and other stakeholders in the decision-making process of water management, got a mean rank of 3.91. Community involvement is very important in the adoption and ownership of efforts for environmental management and therefore sustainable. Other findings are also seen in research work, such as that by Reed et al. (2018), which notes the importance of inclusive governance in natural resource management.

The fourth ranked water quality monitoring has a mean score of 3.96, which is also very important in the identification of pollution sources and assurance of safe drinking water. This becomes very true for areas prone to pollution from agricultural runoff and



illegal mining, as witnessed in the heightened concern about water contamination in the Volta Basin (Atinga & Teye, 2019). While important, it was placed lower in terms of priority compared to irrigation and sustainable fishing, most likely because of the complexity and costs associated with establishing networks for comprehensive monitoring.

Other opportunities, such as wetland protection and natural habitat restoration, with a mean rank of 4.49, and integration of climate change into water management practices, with a mean rank of 4.67, were relatively highly ranked, indicating the need for ecological conservation and climate resilience. Ma et al. (2019) used a set of research to show the importance of ecosystem restoration for biodiversity maintenance and improvement of ecosystem functions, especially in water-scarce regions.

Flood control infrastructure was ranked seventh with a mean score of 5.61 and, therefore, was the least urgent opportunity; however, it does play a critical role in the mitigation of flood risks, especially due to the increased threats posed by climate change. Works such as that carried out by Zhou et al. (2020) show the importance of flood protection measures in saving communities from the devastating effects of floods. Still, the variability in ranking would suggest that local contexts and more immediate needs like irrigation for food security versus long-term ecological restoration influence decision-making. What is more, the results of Kendall's W-test (0.684) and the chi-square value (441.155, $p = 0.000$) lend consistency and statistical confirmation to these priorities; hence, they identify the most relevant strategies for basin management sustainability.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary of the findings of the study, conclusions and recommendations which when implemented would improve the management of the Black and White Volta Basin.

6.2 Summary of Findings

The study was conducted to determine the level of involvement of stakeholders in the management of the Black and White Volta Basin. The study employed a descriptive study design with a mixed research approach. The study was conducted in the White Volta and Black Volta of the Central Gonja District of the Savannah Region, Ghana. Moreover, 400 respondents were interviewed with the aid of a structured interview schedule. In addition, in-depth interviews with key informants on indigenous communities' participation in the management of the Volta Basin was assessed using an interview guide. The study used both primary and secondary data. Data were processed using both SPSS Version 22.0. Quantitative data were analyzed using descriptive statistics, factors analysis, and Kendall's Coefficient of Concordance, while qualitative data were analyzed using content analysis.

6.2.1 Socio-demographic Characteristics of Respondents

The socio-demographic characteristics of the respondents reveal important information for the composition of the community and possible implications on resource management. There was an almost three-to-one male-to-female ratio, with





72.8% of the respondents being males and 27.2% females, reflecting the traditional gender roles in society, which may, therefore, influence participation in basin management. Most respondents (83.5%) are married, hence showing strong family ties and stability that might provide good support for long-term engagement in resource management. But a small percentage of unmarried, divorced, or widowed could likely indicate the community is pretty much composed of established families.

The study also revealed a high illiteracy rate, with 62.7% of the respondents having no formal education. This might impede effective participation in resource management, since comprehension of complex issues may be constrained by lower levels of education. Occupation-wise, fishing (45.8%) was the most dominant livelihood, followed by farming (22.3%), with a smaller proportion engaging in trading or a combination of farming and trading. About 82.3% of the respondents have indigenous status regarding the place, which, of course, hints at the strong attachment of the respondents to the area. Lastly, ages ranged from 19 to 74 years with a mean of 44, hence showing the diversity in the group balances both youthful energy and the wisdom that comes with older generations.

6.2.2 Stakeholders Perceived Knowledge and Attitudes towards Management in the Black and White Volta Basins

The key results show a high level of awareness with regard to the IWRM principles: 82.8% of the respondents showed an understanding of the concept. Still, there is a portion of the community (15.5%) uncertain about these principles, which indicates much more efforts in educating on participatory water management approaches. The



perception regarding government action on climate change adaptation and water management was mixed, with 50.3% agreeing that the government is doing appropriate things in that respect, while 25.3% did not agree. It may be an indication of possible gaps in communication or visibility of government initiatives. Traditional knowledge of water management was uncertain; 57.7% of respondents claimed to know these practices, thus showing transmission of traditional knowledge from one generation to the next may have eroded some aspects of traditional knowledge.

Concerning ecological knowledge, 76.5% of the respondents understood the function of diverse habitats in the management of water, and 82.5% saw the importance of traditional ecological knowledge in using the resources in a sustainable way. Strong community support for transparency, decision-making, and community-led initiatives was evidenced, with 96% agreeing that a lack of transparency could lead to mistrust. Despite this support, challenges in adopting new practices were identified with 48.3% of the respondents noting resistance due to traditional habits. Another challenge was that conflicts between local authorities and stakeholders were seen as a barrier to effective management, reported by 60.6%. This points out to another big problem the very low participation of people in environmental activities: only 51% of respondents participate. Similarly, 55.3% agreed that traditional ecological knowledge will give empowerment to younger generations.



6.2.3 Stakeholders Participation in the Planning, Implementation, Monitoring, and Benefit sharing within the Black and White Volta Basins

The results of the study on the effects of stakeholders' involvement in the planning, implementation, monitoring, and benefit sharing within the Black and White Volta Basins: The indigenous communities have a major role in identifying water-related needs and challenges in their environment; such communities provide insights from traditional knowledge, which is very useful. They call for sustainable water management policies reflecting their cultural practices and local realities to ensure effective planning tailored to their specific needs. Similarly, stakeholders are involved in the implementation of water management projects so that such initiatives address their needs and are culturally relevant. This fosters a sense of ownership, accountability, and commitment to protecting resources. This participation also ensures that such water management projects will be in good condition with the locals, increasing the sustainability of these projects. Moreover, stakeholders contribute a lot to monitoring water management activities using their deep knowledge of local ecosystems to follow changes and evaluate the effectiveness of management strategies. This frequent interaction increases the ecological balance and sustainability of water resources, further ensuring their role as custodians of nature. Lastly, communities emphasize the aspect of fair sharing of benefits accruing from water resources, with the call for transparency and equity in the benefit-sharing processes. It ensures that all members have access to key resources such as water, irrigation, fisheries, and tourism, fostering social cohesion and long-term sustainability in resource management.



6.2.4 Stakeholder Participation in the Management of the Black and White Volta Basins contributes to the Sustainability of the Basins

An SSI score of 72.5 would, therefore, imply that, in general, social dynamics are positive with high levels of community collaboration (SINI score of 80) and an equitable distribution of power among the actors (PRI score of 75). Equally, the unequal access to resources EAI score of 70 and inefficient conflict management SCCI score of 65 continue to test the resilience of social cohesion and sustainable water management. With an ESI score of 75, the economic outlook is positive, based on high agricultural productivity (API score of 78) and potential in tourism (TSI score of 72). The community has adopted effective agricultural practices contributing to food security and economic stability; however, tourism needs to be developed further to reduce dependence on agriculture. With an ESI score of 65, the state of environmental challenges faced, especially water pollution, with a WPI score of 65, and soil erosion with an SEI score of 70, is very serious. Agricultural runoff and poor waste management compromise water quality, while deforestation and unsustainable farming practices accelerate soil erosion. These environmental problems threaten ecosystem health and require more effective interventions to preserve water and soil resources.

6.2.5 Factors influencing Stakeholder Participation in the Management of the Black and White Volta Basins

Attitudes to Basin Management becomes the most influencing factor with the highest eigenvalue 3.45, explaining 25% of the variance. The second most important factor is Perception of Stakeholder Effectiveness with an eigenvalue of 2.78 and 20% variance



explained. Whether stakeholders feel that their participation is effective has a very influential role in the willingness to participate. Access to Resources has an eigenvalue of 2.10 and a moderate role explaining 15% of variance. Engagement in Management Activities (eigenvalue 1.95, 12% variance) reflects the importance of direct participation. Environmental Concerns (10% variance explained) had a moderate influence, meaning that environmental issues, though important, are not as directly participatory as economic and socio-cultural factors in driving participation. Conflicts among Users (8% variance) were the least influential with a low eigenvalue of 1.25. Similarly, attitudes and perceptions regarding stakeholder effectiveness were the principal factors (Component 1) uncovered by Principal Component Analysis (PCA) to be significant with respect to need for positive involvement in, and perceived effectiveness of, management efforts. Collaboration and Networking (Component 2) suggested that social interaction and cooperation are significant in facilitating participation; however, conflict within the networks can present an obstacle. Third, Component 3: Access to Resources and Challenges revealed that access to resources may lead to an increase in engagement but challenges like inequality can limit effective participation. When looking at the explained variance, the first three components explained 65.98% cumulatively—a strong effect that these components have on the outcome of stakeholder engagement.

6.2.6 Challenges in the Management of the Black and White Volta Basins

The findings have pointed out a few important challenges in managing the Black and White Volta Basins. Conflicts over water allocation ranked as the most critical issue (mean rank = 2.03), reflecting the tension arising from water scarcity and growing



demand. Inefficient irrigation practices and a lack of water-saving technologies were ranked second (mean rank = 3.45), followed by water pollution (mean rank = 4.10), highlighting the impact of agricultural runoff and illegal mining activities. Fourthly, limited financial resources were at a mean rank of 4.88, while insufficient involvement of local communities in decision-making ranked fifth (mean rank = 5.16), indicating governance gaps. The lack of infrastructure for water storage, distribution, and flood control was ranked sixth (mean rank = 5.21), indicating systemic deficiencies. Deforestation and land degradation was ranked seventh (mean rank = 5.58), reflecting environmental degradation pressures. The lack of data to inform decision-making was ranked eighth (mean = 5.87), and weak enforcement of regulations on water management was ranked ninth (mean = 6.07), further underlining governance challenges. Lastly, the impact of changing weather patterns, including irregular rainfalls and long droughts, was tenth-ranked with a mean of 6.93, showing the increasing influence of climate change. The Kendall's W coefficient (0.681) and Chi-Square value (291.417, $p < 0.001$) point out a strong agreement among respondents on the necessity to face challenges in cooperation.

6.2.7 Opportunities for Improving the Management of the Black and White

Volta Basins

The most important opportunities to improve the management of the Black and White Volta Basins. The highest ranked opportunity is developing irrigation systems with a mean rank of 2.38, putting much emphasis on increasing agricultural productivity. Next in the list are sustainable fishing practices with a mean rank of 2.90 and involvement of local communities, NGOs, and stakeholders in decision-making with

a mean rank of 3.91. A water quality monitoring network was ranked fourth (mean rank 3.96), with wetland protection and habitat restoration coming fifth (mean rank 4.49). Bringing climate change considerations into these plans (mean rank 4.67) and investment in flood control infrastructure (mean rank 5.61) were ranked sixth and seventh, respectively. These results emphasize a set of actions crucial for sustainable management of water resources, where irrigation, sustainable fishing, and community involvement will be the top priorities. Kendall's W-test (0.684) and the chi-square value (441.155, $p = 0.000$) confirm the consistency of these rankings.

6.3 Conclusions for the Study

Based on study findings, the following conclusions were drawn;

In conclusion, the study shows important lessons that can be learned from stakeholders and attitudes in managing the Black and White Volta Basins. There is a high level of awareness among respondents of the principles of Integrated Water Resource Management, showing that education on water management has taken place, though with some gaps, especially in participatory approaches. Government actions regarding climate change adaptation and water management were viewed with mixed feelings. Also, traditional ecological knowledge was recognized as being very important in using resources in a sustainable way, although it appears that the passing of the older generation has worn away this in some communities. Community support for transparency and participatory decision-making is strong, although challenges in terms of resistance to adopting new practices and conflicts between local authorities and stakeholders remain powerful barriers. Active participation of the people in



environmental initiatives was moderate, while empowerment of younger generations through traditional knowledge was an area identified as needing much further development.

The study further concludes that the importance of stakeholders' involvement in planning assures that their water management policies are culturally appropriate to the specific local challenges. In such ways, full implementation of projects by stakeholders ensures ownership and accountability, correspondence with local needs, and consequently enhances sustainability within the available water resources. Their contribution to the activities of monitoring, using traditional ecological knowledge, helps to maintain environmental balance and to assess the effectiveness of strategies. Moreover, their focus on the fair sharing of benefits promotes equity, transparency, and access to basic resources, which helps in bringing social cohesion and sustainable management of resources.

In addition, the study concludes that the management in the Black and White Volta Basins has strengths and weaknesses vis-à-vis the achievement of sustainability. On the social aspect, there is close community collaboration and equitable sharing of power, which guarantees good social dynamics. On the other hand, inequitable access to resources and the presence of conflict resolution mechanisms present threats to social cohesion and the long-term sustainability of the water management interventions. Economically, the basins benefit from the advantages of strong agricultural productivity and new opportunities in tourism that underpin their potential for economic growth and stability. However, additional investment in tourism is



needed in order to diversify income sources and decrease dependence on agriculture. Environmentally, there still exist major problems of water pollution and soil erosion threatening the health of ecosystems.

This study concludes that stakeholder participation in the management of the Black and White Volta Basins depends to a great extent upon attitudes towards basin management and perception of stakeholder effectiveness. Positive attitudes and a strong belief in their efficacy inspire active involvement in management activities. The access to resources is a moderate factor, bringing out the fact that the stakeholders should be availed with the resources and assistance needed for efficient participation. The closer the involvement in the management activities, the higher the level of participation, but environmental factors, although related, are less direct than the socio-economic and cultural ones. These provided the least influential factors, which are the conflicts among users; this indicates that, although conflict resolution is not a strong motivation for contribution, it is indeed a requirement for collaboration.

In conclusion, there are serious challenges in the management of the Black and White Volta Basins that demand urgent collaborative action. The most critical challenge is the conflict over water allocation driven by water scarcity and competing demands. Inefficiency in irrigation practices and pollution of water worsens the situation, hence better technologies in water saving and strict pollution controls. Furthermore, financial constraints and a lack of community involvement in decision-making demonstrate governance gaps that stand in the way of effective management. Added to these are the systemic deficiencies of the water-storing and distributing infrastructure and the



flood control combined with environmental pressures such as deforestation and land degradation, which complicate further the sustainable management. This is further compounded by weak regulatory enforcement, lack of information to make informed decisions, and impacts of climate change such as irregular rainfall and droughts.

This study has pointed out major areas that should be followed to enhance management of the Black and White Volta Basins. On this note, the leading areas are development of irrigation systems that increase productivity in agriculture, promote sustainable fishing to conserve biodiversity, and involve local communities, nongovernmental organizations, among other stakeholders, in the process of fostering sustainable water management. Equally important are the establishment of a global water quality monitoring network, protection of wetlands, restoration of natural habitats, incorporation of climate change impacts into water resource management plans, and investment in flood control.

6.4 Study Contribution to Knowledge

The study puts theoretical, practical and policy implications to contribute to literature on stakeholder participation in the management of natural resource.

6.4.1 Theoretical Contributions

The research enhances the theoretical framework of IWRM by giving emphasis to the interrelationship between indigenous knowledge, stakeholder participation, and sustainable management of resources in the context of the Black and White Volta Basins. It calls for combining traditional ecological knowledge with modern management practices to enhance resilience and sustainability. Moreover, this adds to

theories on participatory governance by proving that active participation of local communities and equitable sharing of benefits might yield accountability and social cohesion.

6.4.2 Practical/Policy Implications

These results have very important policy and practical implications in managing water resources. It is high time that policy thinkers took a giant stride in the development of irrigation systems and promotion of sustainable fishing practices, as these are strategies that would cater to the current needs of agricultural productivity and biodiversity preservation in these production systems. This calls for participatory governance with the involvement of local communities, NGOs, and stakeholders in the decision-making processes for ownership of programs implemented and cultural relevance.

More stringent regulatory enforcement and establishment of water quality monitoring networks would help to deal with challenges like water pollution and inefficient irrigation practices. Investments in flood control infrastructure, wetland restoration, and climate resilience strategies may reduce environmental risks and increase ecosystem services. Financial and technical support for community-driven initiatives could help bridge gaps in governance, while integrating indigenous knowledge into planning and monitoring activities would help strengthen traditional practices and intergenerational knowledge transfer.





6.5 Recommendations

Based on the findings and conclusions of the study, the following recommendations are proposed for policy and practical interventions. In response to the examiner's comment that the recommendations were too general, each recommendation is presented with clear implementation pathways, responsible institutions, and realistic timelines (short-, medium-, and long-term) to enhance policy usefulness and operational feasibility.

1. Institutionalize Intergenerational Knowledge Transfer in Basin Governance

The Ministry of Sanitation and Water Resources, in collaboration with the Water Resources Commission (WRC) and the District Assemblies, should strengthen community-based participatory frameworks by institutionalizing intergenerational knowledge transfer programs. This can be achieved through the formal integration of traditional ecological knowledge holders such as elders, spiritual leaders, and experienced farmers into community water governance structures, local training sessions, and school-based environmental clubs. This approach will help bridge generational knowledge gaps and promote youth ownership of sustainable water resource governance in the Black and White Volta Basins.

Implementation pathway:

- Develop a structured Traditional Ecological Knowledge (TEK) integration policy guideline for basin communities.
- Create annual community mentorship sessions where elders and traditional leaders train youth and farmer groups.

- Integrate basin conservation topics into basic and secondary school environmental clubs, supported by the Ghana Education Service.

Timeline:

- **Short-term (0–12 months):** Develop TEK integration framework and pilot programs in selected communities.
- **Medium-term (1–3 years):** Scale up across basin communities and institutionalize annual knowledge transfer forums.
- **Long-term (3–5 years):** Evaluate impact and integrate TEK formally into WRC local basin management plans.

2. Strengthen Participatory Water Governance and Benefit-Sharing Mechanisms

The Water Resources Commission and District Assemblies should institutionalize participatory water governance frameworks that formally integrate local stakeholder groups—especially traditional authorities, community-based organizations, and water user associations—into all stages of water resource planning, implementation, and monitoring. This participatory governance should emphasize the integration of traditional ecological knowledge into environmental assessments, while ensuring that benefit-sharing mechanisms are clearly defined, documented, and equitably enforced.

Implementation pathway:

- Establish or strengthen basin-level stakeholder committees in all catchment communities.
- Develop stakeholder participation guidelines specifying roles in planning, implementation, monitoring, and benefit sharing.



- Introduce participatory monitoring tools such as community scorecards and stakeholder reporting systems.

Timeline:

- **Short-term (0–12 months):** Form/strengthen committees and define stakeholder roles through stakeholder mapping.
- **Medium-term (1–3 years):** Institutionalize stakeholder participation through Assembly by-laws and WRC operational manuals.
- **Long-term (3–5 years):** Evaluate participation effectiveness and mainstream into national IWRM governance policy.

3. Enforce Integrated Watershed Protection and Pollution Control Measures

The Ministry of Sanitation and Water Resources, in collaboration with WRC and District Assemblies, should prioritize the development and enforcement of integrated watershed protection policies that address water pollution and soil erosion in the Black and White Volta Basins. This should include supporting community-led monitoring initiatives, reforestation of riparian zones, and stricter regulation of agricultural runoff and waste disposal into water bodies.

Implementation pathway:

- Implement riparian buffer restoration programs with community labour participation.
- Strengthen enforcement of EPA and WRC water pollution regulations through joint task forces.
- Provide incentives (seedlings, tools, extension support) for riparian tree planting and erosion control.





Timeline:

- **Short-term (0–12 months):** Identify degraded riparian zones and initiate pilot restoration projects.
- **Medium-term (1–3 years):** Expand buffer restoration and enforce community by-laws on pollution control.
- **Long-term (3–5 years):** Establish permanent basin ecological monitoring units and maintain reforested zones.

4. Build Stakeholder Capacity and Establish Formal Conflict Resolution Systems

The Water Resources Commission, in collaboration with District Assemblies and basin committees, should implement targeted capacity-building programs aimed at strengthening stakeholders' attitudes, confidence, and perceived effectiveness in basin management. These interventions should include participatory training, public awareness campaigns, and logistical support for stakeholder groups. In addition, structured conflict resolution mechanisms should be institutionalized, led by traditional authorities and community mediators who possess legitimacy and contextual authority.

Implementation pathway:

- Conduct annual training workshops for water user associations, chiefs, and community groups.
- Provide logistical resources such as community monitoring kits and communication tools.

- Establish Basin Conflict Resolution Committees composed of traditional leaders, local mediators, and Assembly representatives.

Timeline:

- **Short-term (0–12 months):** Train key stakeholders and form conflict resolution committees.
- **Medium-term (1–3 years):** Institutionalize mediation procedures and integrate them into Assembly governance systems.
- **Long-term (3–5 years):** Develop a basin-level arbitration framework linked to WRC and national dispute resolution systems.

5. Improve Water Allocation Systems and Promote Efficient Water Use Technologies

To address conflicts over water allocation and inefficiencies in water use, the WRC, in collaboration with the Ministry of Food and Agriculture (MoFA) and irrigation user associations, should implement a comprehensive water-use efficiency program. This program should promote climate-smart irrigation technologies such as drip and sprinkler systems, supported by farmer training on efficient water use. Additionally, stricter water abstraction regulations should be enforced, and a transparent allocation framework should be established to ensure equity, ecological sustainability, and conflict reduction during scarcity periods.

Implementation pathway:

- Develop basin water allocation schedules and water abstraction permits for key user groups.



- Train farmers and irrigation associations on climate-smart irrigation practices.
- Introduce demonstration farms and subsidized irrigation technology schemes through MoFA.

Timeline:

- **Short-term (0–12 months):** Conduct stakeholder consultations and design allocation framework.
- **Medium-term (1–3 years):** Implement irrigation technology adoption programs and enforce abstraction permits.
- **Long-term (3–5 years):** Evaluate water allocation compliance and integrate allocation framework into basin governance structures.

6. Develop Community-Managed Irrigation Systems through Public–Private Partnerships

The Ministry of Sanitation and Water Resources, in collaboration with WRC and District Assemblies, should prioritize the development of community-managed irrigation systems tailored to the ecological conditions of the Black and White Volta Basins. This should be implemented through a Public–Private Partnership (PPP) model involving local farmers, traditional authorities, NGOs, and private irrigation service providers. Such systems will improve food security, enhance dry-season farming, reduce pressure on natural water bodies, and promote local ownership of water infrastructure.

Implementation pathway:

- Identify suitable irrigation sites based on hydrological feasibility studies.



- Mobilize private sector and NGO partners for funding and technical support.
- Establish irrigation management committees responsible for maintenance, cost recovery, and equitable access.

Timeline:

- **Short-term (0–12 months):** Conduct feasibility assessments and stakeholder consultations.
- **Medium-term (1–3 years):** Construct pilot irrigation schemes and train local management committees.
- **Long-term (3–5 years):** Scale up successful irrigation schemes and integrate them into district agricultural development plans.

These recommendations provide actionable strategies that move beyond general proposals by specifying implementation steps, responsible actors, and phased timelines. This ensures that stakeholder participation becomes operationalized through institutional reforms, capacity development, ecological restoration, and conflict-sensitive water governance, thereby strengthening sustainability outcomes in the Black and White Volta Basins.

5.6 Recommendations for Future Research

Future research should be oriented toward the appropriateness and effectiveness of incorporating indigenous ecological knowledge into formal water management strategies in view of climate change adaptation.

5.7 Limitation of the Study

This research was carried out in the Central Gonja District of Ghana's Savannah Region and offers relevant evidence in terms of indigenous community engagement



in water resource management in this particular context. While the findings inform indigenous community participation, these cannot be transferred directly to other districts or regions within the wider Black and White Volta Basins. The research is mainly based on attitudes and perception, which are susceptible to individual biases, which might impact the coverage scope of representation of participation by the community. Resource shortages, both financial and human resources, may also determine the level and range of study, although all efforts at hand were utilized to ensure the study was comprehensive and sound in the analysis of the subject.



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APPENDICES

APPENDIX A: STRUCTURED INTERVIEW SCHEDULE FOR RESPONDENTS

STAKEHOLDERS PARTICIPATION IN THE MANAGEMENT OF THE BLACK AND WHITE VOLTA BASINS IN THE CENTRAL DISTRICT OF THE SAVANNAH REGION OF GHANA

My name is Saaka Takora, a post graduate student of the University for Development Studies; I am currently conducting a study on the topic Stakeholders Participation in the Management of the Black and White Volta Basins in the Central District of the Savannah Region of Ghana: The Role of Traditional Authorities and Indigenous Communities. The study is purely for academic purposes alone and any information released will be treated with all the confidentiality it deserves. Your participation in the data collection is optional and you have the right to decline in participating in this exercise. However, your very kind participation will bring to light your massive contributions to management of natural resources in the Region.



Name of EnumeratorCommunity.....

Contact number of respondents

Kindly tick or write on the appropriate response

Section A. Demographic data of respondents

1. Sex of respondent? 1 = Male [] 2 = Female []
2. Age of respondent? (Number of years)
3. Marital status. 1= Married [] 2 = Never Married [] 3= Divorced [] 4=
Widowed [] 5= Others (Specify).....
4. Educational level of respondent? 1= No education [] 2= Primary school []
3= Junior high school [] 4 = Secondary/Vocational institute [] 5 = Tertiary [].
5. Occupation of respondent? 1= Farming only [] 2= Trading only [] 3= Farming/
Trading [] 4= Fishing [] 5= Formal employment [] 6= Others,
specify.....
6. Status of respondent 1= Indigene [] 2= Migrant [] 3= Transferee [] 4 = Settler []
] 5= Others, specify.....
7. How long have you stayed in this community? 1= Less than 1 year [] 2= 1-5 years
[] 3= 6-10 years [] 4 = More than 10 years [].



Section B: 1. Examine indigenous communities perceive knowledge and attitude towards management in the Black and White Volta Basins.

8. Kindly indicate the indigenous communities perceive knowledge and attitude towards management in the Black and White Volta Basins?

Perceptive statements	Level of agreement				
	SA	A	NS	D	SD
Knowledge					
I am aware of the integrated water resource management principles that involve participatory approaches at the local level in the Black and White Volta Basins.					
I know that the government is taking actions to help my community adapt to climate change and manage water resources in the Black and White Volta Basins.					
I am aware that international agencies like the United Nations are taking actions to help my community adapt to climate change and manage water resources in the Black and White Volta Basins.					
I understand how droughts, flooding, and other climate change effects have impacted water resources in the Black and White Volta Basins,					





and I have made adaptations to my farming and housing practices.					
I am knowledgeable about the traditional water management practices used by my community in the Black and White Volta Basins.					
I am familiar with the diverse habitat mosaic and its role in effective water resource management in the Black and White Volta Basins.					
I understand the importance of traditional ecological knowledge in sustainable water resource management in the Black and White Volta Basins					
Attitudes					
Lack of transparency or community involvement in decision-making processes could lead to mistrust or dissatisfaction					
Community-led initiatives can harness local knowledge and resources to implement sustainable practices					
Traditional practices can be sustainable and adapted to local environmental conditions.					



Indigenous communities often have deep-rooted knowledge of local ecosystems and traditional water management practices.					
Education and awareness programs can lead to behavior changes that benefit the environment.					
They may involve community-driven initiatives that enhance local ownership and stewardship of natural resources					
Practices					
Some community members might resist adopting new water conservation practices due to traditional habits or skepticism about their effectiveness.					
Local authorities or stakeholders may have conflicting priorities or political agendas that hinder collaborative efforts towards effective water resource management					
Many community members may appreciate and actively participate in initiatives like cleaning public drainage systems or building green spaces, recognizing the benefits to local health and aesthetics					

Effective collaboration between local authorities, community members, and stakeholders can lead to more resilient and adaptive water management strategies in response to changing conditions.					
Sharing traditional ecological knowledge about water management can empower younger generations to become stewards of their environment, ensuring sustainable practices are preserved.					
Traditional water management practices, when respected and integrated with modern approaches, can foster a sense of cultural pride and continuity among younger generations					



Section C: Analyze how communities' influences the planning, implementation, monitoring and benefit sharing of the Black and White Volta Basins.

Stakeholders' participation planning of the Black and White Volta Basins

9. Do you participate in meetings regarding decision-making and management of the Black Volta Basin? 1 = Yes [] 2 = No []

10. If yes, how often do you participate? 1 = Always [] 2 = Often [] 3 = Occasionally [] 4 = Rarely [] 5 = Never []

11. Do you participate in meetings regarding decision-making and management of the White Volta Basin? 1 = Yes [] 2 = No []

12. If yes, how often do you participate? 1 = Always [] 2 = Often [] 3 = Occasionally [] 4 = Rarely [] 5 = Never []

13. Do you participate in the planning process regarding the Black Volta Basin? 1 = Yes [] 2 = No []

14. If yes, how regularly do you participate? 1 = Always [] 2 = Often [] 3 = Occasionally [] 4 = Rarely [] 5 = Never []

15. Do you participate in the planning process regarding the White Volta Basin? 1 = Yes [] 2 = No []

16. If yes, how regularly do you participate? 1 = Always [] 2 = Often [] 3 = Occasionally [] 4 = Rarely [] 5 = Never []

17. If you participate in the planning process for either basin, what are your roles?
(Select all that apply)

Providing information on water use, local knowledge, and environmental conditions []





Identifying water-related needs, challenges, and priorities []

Contributing to setting goals and objectives for water resource management []

Providing feedback on plans and policies for water resource use and conservation []

Advocating for sustainable water use and conservation []

Other (Please specify).....

Stakeholders' participation monitoring of the Black and White Volta Basins

18. Do you participate in the Volta Lake monitoring process regarding the Black and White Volta Basins? 1= Yes [] 2= No []

19. If yes, how regular do you participate in monitoring process? 1= Always [] 2= Often [] 3= Occasionally [] 4 = Rarely [] 5 = Never []

20. If yes, Q14, what are your roles in the monitoring process? (Tick as many as necessary or as many as applicable)

A) Take part in decision regarding monitoring activities []

B) Enforcement of by-laws []

C) Monitoring of implementation of river projects []

D) Part of reinforcement surveillance team []

Stakeholders' participation benefit sharing of the Black and White Volta Basins

21. Do you participate in the Volta Lake benefit sharing regarding the Black and White Volta Basins? 1= Yes [] 2= No []

22. If no, why?.....

.....
.....

23. If yes, Q22, how regular do participate in benefit sharing? 1= Always [] 2= Often [] 3= Occasionally [] 4 = Rarely [] 5 = Never []

24. If yes, Q17, what are the benefits you drive from the river?

- a) Water supply for domestic use []
- b) Agricultural irrigation []
- c) Livestock watering []
- d) Supporting fisheries, providing a source of livelihood for fishing communities []
- e) Tourism and Recreation []
- f) Cultural and Spiritual Significance



Section D: Examine how stakeholder participation influences the sustainability of the Black and White Volta Basins.

Economic Sustainability Implications

25. What economic activities in the Basins? (Tick as many as necessary or as many as applicable)

Agriculture (crop cultivation and livestock rearing) []

Fishing []

Manufacturing and Processing (related to agriculture and forestry) []

Services (tourism) []

Transportation and Trade []

Other (please specify).....

26. Do you think economic activities in the Black and White Volta Basins are conducted sustainably? 1= Yes [] 2= No []

27. Which of the following unsustainable economic activities do you observe in the basins?



Unsustainable economic activities	Response	
	Yes	No
Unsustainable agricultural practices (e.g., excessive use of chemical fertilizers and pesticides, monoculture farming)		
Illegal logging or timber extraction		
Uncontrolled mining activities causing environmental damage		
Pollution from industrial activities (e.g., factories discharging waste into water bodies)		
Unsustainable fishing practices (e.g., use of illegal fishing methods, overfishing)		
Inefficient water use practices (e.g., water wastage in irrigation, inefficient irrigation methods)		

Social Sustainability Implications

28. Which of these describe the social dynamics within the Black and White Volta Basins? 1= Relationships between different communities [] 2= Access to resources [] 3= Conflicts among users [] 4= Other (please specify).....

29. Are there any social inequalities or conflicts you have observed in the basins? 1= Yes [] 2= No [] Kindly give reasons to your answer?





30. Do you believe there is equitable access to resources and decision-making power among stakeholders in the basins? 1= Yes [] 2= No [] Kindly give reasons to your answer?.....
.....
.....

Environmental Sustainability Implications

31. Have you observed any sources of water pollution in the basins? 1= Yes [] 2= No []

32. If yes, please specify the sources of water pollution you have observed? 1 = Industrial discharge [] 2 = Agricultural runoff [] 3 = Domestic sewage [] 4 = Mining activities [] 5 = Other (please specify).....

33. Are you aware of any soil erosion issues in the Black and White Volta Basins? 1= Yes [] 2= No []

34. If yes, where have you observed soil erosion occurring? 1= Slopes [] 2 = Farmlands [] 3 = Riverbanks 4 = Construction sites [] 5 = Other (please specify).....

35. Have you observed any areas of deforestation in the basins? 1= Yes [] 2= No []

36. If yes, please specify where you have observed deforestation? 1= Forested areas cleared for agriculture [] 2 = Logging activities [] 3= Urban expansion [] 4= Wildfires [] 5 = Other (please specify)

37. Has deforestation affect biodiversity and ecosystem health in the basins? 1= Yes [] 2= No []

Section E: Establish the factors that influence stakeholders’ participation and management of the Black and White Volta Basins

38. Please indicate your level of agreement with the following statements regarding basin management on a five-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree/1 = Very Ineffective, 2 = Ineffective, 3 = Neutral, 4 = Effective, 5 = Very Effective/1 = Very Low, 2 = Low, 3 = Neutral, 4 = High, 5 = Very High/1 = Never, 2 = Rarely, 3 = Sometimes, 4 = Often, 5 = Always).



Perceptive statements	Level of agreement				
Attitudes towards Basin Management	SA	A	NS	D	SD
Belief in the necessity of stakeholder participation for effective management.					
Recognition of basin management’s role in sustainability.					
Willingness to collaborate with others.					
Support for inclusive, multi-stakeholder involvement.					
Endorsement of participatory decision-making processes					
Perceptions of Stakeholder Effectiveness	VI	I	N	E	VE



Perceived Stakeholder Influence					
Decision-Making Efficacy					
Access to Resources	VL	L	N	H	VH
Financial Accessibility for Participation.					
Time Availability for Participation.					
Access to Basin-Related Information.					
Communication Infrastructure					
Transportation Infrastructure					
Collaboration and Networking					
Networking with other stakeholders involved in basin management.					
Participating in collaborative projects or initiatives related to basin management.					
Sharing resources or knowledge with other stakeholders involved in basin management.					
Regularly attending meetings in relation to the management of the basins					

Section F: Identifying challenges and opportunities for improving the management of the Black and White Volta Basins, with a focus on stakeholder participation

39. Kindly rank the challenges in improving the management of the Black and White Volta Basins (rank in order of severity)

Challenges statements	Ranking
Water pollution	
Deforestation and land degradation	
Changing weather patterns, including irregular rainfall and prolonged droughts	
Insufficient data and monitoring systems for effective planning and decision-making for water resource management	
Inefficient irrigation practices and lack of water-saving technologies	
Conflicts over water allocation	
The lack of proper infrastructure for water storage, distribution and flood control	
Insufficient involvement of local communities and other stakeholders in decision-making processes	
Weak enforcement of water management regulations and illegal activities on the water	



Limited financial resources and human capacity on the implementation of comprehensive water management plans and projects	
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40. Kindly rank opportunities available for improving the management of the Black and White Volta Basins (rank in order of importance)

Opportunities available statements	Ranking
Developing irrigation systems enhance agricultural productivity, enabling farmers to utilize water resources effectively and increase crop yields	
Implementing sustainable fishing practices and promoting responsible fishing can help preserve aquatic biodiversity and support local fishing communities	
Establishing a comprehensive water quality monitoring network helps identify pollution sources and ensures the provision of safe drinking water	
Protecting and restoring critical wetlands and natural habitats in the basins promote biodiversity and enhance ecosystem services	
Investing in flood control infrastructure, early warning systems, and floodplain mapping reduce the impact of floods on communities along the river	



Incorporating climate change considerations into water management strategies allows for resilience and adaptation to potential future challenges	
Involving local communities, NGOs, and other stakeholders in decision-making processes fosters ownership and support for sustainable water management practices	

Thank You



**APPENDIX B: INTERVIEW GUIDE FOR KEY INFORMANTS
STAKEHOLDERS PARTICIPATION IN THE MANAGEMENT OF THE
BLACK AND WHITE-VOLTA BASINS IN THE CENTRAL DISTRICT OF
THE SAVANNAH REGION OF GHANA: THE ROLE OF TRADITIONAL
AUTHORITIES AND INDIGENOUS COMMUNITIES**

My name is Saaka Takora, a post graduate student of the University for Development Studies; I am currently conducting a study on the topic Stakeholders Participation in the Management of the Black and White Volta Basins in the Central District of the Savannah Region of Ghana. The study is purely for academic purposes alone and any information released will be treated with all the confidentiality it deserves. Your participation in the data collection is optional and you have the right to decline in participating in this exercise. However, your very kind participation will bring to light your massive contributions to management of natural resources in the Region.

Planning

1. How does your community participate in the planning of water resource management in the Black and White Volta Basins?
2. Can you provide an example of how your community's input has influenced the planning of water resource projects?
3. What challenges does your community face in contributing to the planning phase?
4. In your opinion, how important is it for water management policies to reflect the needs and ways of life of your community?



5. Perceived effectiveness of current policies in addressing community needs?

Implementation

1. In what ways does your community participate in the implementation of water management projects?
2. How does active participation in project implementation affect the outcomes of water management initiatives?
3. Can you describe a specific project where your community played a key role in its implementation?
4. What are the main challenges your community faces during the implementation of these projects?

Monitoring

1. How does your community contribute to the monitoring of water resource management projects in the Black and White Volta Basins?
2. Can you share an example of how community monitoring has led to adjustments or improvements in a project?
3. What motivates your community to engage in monitoring activities?
4. What are the challenges your community encounters in monitoring water resources?



Benefit Sharing

1. How is your community involved in the discussions and decisions about benefit sharing from water resources?
2. Can you provide an example of how benefits from water resources have been shared within your community?
3. What are your thoughts on the current benefit-sharing mechanisms?
4. What challenges does your community face in securing equitable access to benefits from water resources?
5. In your opinion, how has the participation of your community in planning, implementation, monitoring, and benefit-sharing processes affected the management of the Black and White Volta Basins?

Thank You

