

Water Security and Conflict in South Sudan: A Hydro-Political Analysis of Nile Basin Countries Relations

Jacob Dut Chol Riak, Ph.D^{1*}, Poth Johnson Matur Akech²

¹Senior Researcher and Associate Professor, Department of Political Science, School of Social and Economic Studies, Director (Dean), Institute of Japanese Studies. University of Juba. South Sudan. ORCID ID 000900340178612

²Freelance Journalist, Juba. South Sudan.

*Corresponding Author: Jacob Dut Chol Riak, Ph.D, Senior Researcher and Associate Professor, Department of Political Science, School of Social and Economic Studies, Director (Dean), Institute of Japanese Studies. University of Juba. South Sudan.

ABSTRACT

This study examines water security and conflict in South Sudan: a hydro-political analysis of Nile Basin Countries relations. The purpose of the study was to investigate the intricate relationship between water resources, particularly within the Nile Basin, and the persistent conflict and instability in South Sudan. It argues that water scarcity is exacerbated by climate change and population growth, coupled with complex hydro-political dynamics among riparian states and in particular, South Sudan. The study employs a hydro-political analysis framework to examine how water resource management, allocation, and development projects within the Nile Basin influence power relations, cooperation, and conflict in South Sudan and its neighbors, notably Sudan, Ethiopia, and Egypt. By analyzing historical water agreements, contemporary water infrastructure projects (e.g.) the Grand Ethiopian Renaissance Dam), and the socioeconomic and political implications of water access and control, this study aims to identify key drivers of water-related conflict and propose policy recommendations for enhancing water security and fostering sustainable peace in South Sudan and the broader Nile Basin countries.

The study deployed mixed research design: qualitative and quantitative data collection technique through questionnaire and interview guide. The target population for the study was government officials, civil society representatives, academics, and community leaders in South Sudan and potentially other riparian states. The study acknowledged ethical considerations and the methods for data analysis, which involve thematic analysis and discourse analysis to identify patterns, themes, and underlying power dynamics. The study found that the factors contributing to water insecurity in South Sudan include political supremacy and water ownership and internal and external actors causing local conflict in South Sudan. Indeed, the Nile river contestations is a worrying trend to people of South Sudan. Foreign interference on Nile river management and governance has not provided justice to all riparian states. The study therefore recommends that, government and other stakeholders such as some aid agencies should set up programs (including reintegration) and share of water that provide opportunities for income generation to all the riparian states. South Sudan government should ensure its investments in Nile water align with other riparian governments in the region and should be anchored on peace and justice.

Keywords: Water, Security, South Sudan, Hydro, Political, Analysis, Nile Basin Countries, Relations

ARTICLE INFORMATION

Received: 26 January 2026

Accepted: 05 February 2026

Published: 12 February 2026

Cite this article as:

Riak, JDC and Akech, PJM. (2026). Water Security and Conflict in South Sudan: A Hydro-political Analysis of Nile Basin Countries Relations. *International Journal of Innovative Studies in Humanities and Social Studies*. 2(2): 11-37

<https://doi.org/10.71123/3067-7319.020202>

Copyright:©2026. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.



Introduction

Water security and conflict in South Sudan: a hydro-political analysis of Nile Basin Relations is a critical issue in South Sudan, a country that has experienced prolonged conflict and instability since its independence in 2011. The Nile river, which is the lifeline of the country, plays a crucial role in the country's economy, politics, and social dynamics. This study aims to explore the relationship between water security and conflict in South Sudan, with a particular focus on the country's relations with other Nile Basin countries.

Background

Although South Sudan is not yet a major player in global hydro-politics, its strategic location and water resources gives it the potential to play meaningful roles in shaping peaceful water governance both regionally and, by extension, globally as the key riparian state of the Nile. South Sudan holds influence that, if harnessed wisely, can contribute to cooperative hydro-politics. Globally, water security has become one of the most pressing challenges of the 21st century, driven by rapid population growth, urbanization, industrialization, and climate change. According to Gleick (1993), water scarcity increasingly threatens global peace and stability, as demand for freshwater surpasses supply in many regions. The Nile River is a vital water resource for several countries in northeastern Africa, particularly South Sudan. As the world's longest river, it plays a crucial role in agriculture, drinking water supply, and economic development. However, the management and policies surrounding Nile water usage have significant socioeconomic implications for communities in South Sudan. The United Nations has long recognized access to safe water as a fundamental human right, yet over 2 billion people worldwide still lack it, highlighting the urgency of coordinated international water governance. The uneven distribution of water resources across continents has given rise to both intra-state and inter-state tensions, especially in arid and semi-arid regions.

Environmental scholars argue that trans-boundary water resources, especially shared rivers, are potential sources of cooperation but also conflict. Conca and Dabelko (2019) emphasize that environmental issues like water access are no longer marginal, but central to global security concerns. While water wars are rare, water-stressed regions face heightened risks of political instability, particularly where water is poorly managed or controlled by dominant powers. Zeitoun and Warner (2006) introduced the concept of hydro-hegemony to describe how powerful states shape water-sharing arrangements in their favor, often marginalizing weaker nations in shared basins. Furthermore, the growing recognition of the water-energy food nexus adds

complexity to water governance on a global scale. Hoff (2011) notes that water scarcity affects not only direct consumption but also energy production and agricultural output, creating cascading effects across economies and ecosystems. This interconnectedness underscores the need for integrated resource management strategies that go beyond national borders. As climate change exacerbates variability in rainfall and runoff, the need for adaptive and equitable transboundary water governance becomes more critical worldwide.

The Nile Basin, spanning eleven countries in northeastern Africa, is one of the most contested and politically sensitive river systems globally. The historical distribution of the Nile's waters has been shaped by colonial treaties, most notably the 1929 and 1959 agreements, which allocated the majority of Nile water to Egypt and Sudan while excluding upstream countries (Tvedt, 2004). These treaties failed to consider the needs of other riparian states such as Ethiopia, Uganda, and South Sudan. As a result, the legitimacy of these agreements has been widely challenged, especially as midstream nations seek equitable access to Nile resources to fuel their development. In recent years, the construction of the Grand Ethiopian Renaissance Dam (GERD) has intensified regional tensions. Ethiopia views the GERD as essential for energy generation and national development, while Egypt sees it as an existential threat to its water security (Casção, 2009). These differing national interests have exposed deep-seated rivalries and distrust among Nile Basin countries. Zeitoun and Warner (2006) characterize this situation as a manifestation of hydro-hegemony, where powerful downstream states assert control over shared water resources, often at the expense of upstream neighbors. The continued lack of consensus on the Cooperative Framework Agreement (CFA), which seeks to establish equitable water sharing, reflects these unresolved disputes. Despite these challenges, there have been notable efforts at regional cooperation through institutions like the Nile Basin Initiative (NBI), which provides a platform for dialogue and joint development.

However, political tensions and nationalistic agendas often hinder progress. As Conca and Dabelko (2019) point out, successful trans-boundary water governance requires trust, transparency, and mutual benefit elements that are still weak within the Nile Basin context. In this fragile hydro political environment, the prospects for cooperation or conflict will depend on how states balance national sovereignty with regional interdependence. South Sudan, as an upstream riparian state within the Nile Basin, is deeply dependent on the Nile and its tributaries for water, agriculture, transportation, and energy. However, decades of civil war have left its water infrastructure severely underdeveloped, resulting in inadequate access to clean

water, poor sanitation, and vulnerability to water-related diseases (de Waal, 2015). The country's reliance on rain-fed agriculture and traditional pastoral systems makes it highly susceptible to climate-induced shocks, such as floods and droughts. According to Nixon (2021), climate variability in South Sudan is exacerbating food insecurity, displacement, and resource-based conflict, especially in rural communities. The internal dynamics of water use in South Sudan are shaped by local-level conflicts between pastoralist and farming communities, particularly over access to rivers, wetlands, and grazing land. These tensions are intensified during dry seasons or in areas affected by prolonged drought. Santos and Rohrman (2021) observed that in regions like Jonglei and Upper Nile, access to water has become a flashpoint for ethnic and communal violence, compounding this is the lack of national water governance policies and weak institutional capacity to manage water disputes or invest in infrastructure. The result is an uneven distribution of water resources, both spatially and socially. Internationally, South Sudan's engagement in Nile Basin politics remains cautious yet strategic. After gaining independence in 2011, the country joined the Nile Basin Initiative in 2013 to position itself as an active stakeholder in regional water diplomacy (Zeray, 2019). However, the country's domestic instability and limited technical capacity restrict its ability to influence negotiations meaningfully. As Zeitoun and Warner (2006) argue, power asymmetries in shared basins often leave fragile states like South Sudan at a disadvantage in trans-boundary water politics. Yet, given its geographical location and control over key tributaries such as the Sobat and Bahr el Ghazal rivers, South Sudan remains a critical player whose future stability is closely tied to regional water cooperation.

Statement of the Problem

Water security in South Sudan presents a critical and multifaceted challenge, both internally and within the broader Nile Basin hydro political context. As a newly independent state since 2011, South Sudan entered an already contentious environment of trans-boundary water politics dominated by historical treaties most notably the 1929 and 1959 Nile Water Agreements which allocated disproportionate control of the Nile waters to Egypt and Sudan. These agreements excluded other riparian states, including Ethiopia, Uganda, and what is now South Sudan. The legacy of these treaties continues to influence water-sharing negotiations today, with South Sudan navigating complex relations with upstream and downstream neighbors while lacking the political and technical leverage to assert its needs effectively. The country formally joined the Nile Basin Initiative (NBI) in 2013, signaling its intent to participate in cooperative frameworks, but key legal instruments such as the Cooperative Framework

Agreement (CFA) remain un-ratified by powerful states, prolonging regional tensions and ambiguity over equitable water rights. The social impacts of Nile water policies are profound as they influence community dynamics and well-being access to Clean Water: Approximately 41% of South Sudan's population lacks access to clean drinking water because water policies are not prioritizing local needs and this contribute to health crises and social unrest. Competition over scarce water resources can lead to conflicts among different ethnic groups special Bahr el Ghazal areas were communal fight stage the ground within South Sudan. The grievances history of South Sudan is related to land and resource allocation exacerbate tensions. Water bodies hold cultural importance for many communities in South Sudan. Policies that disregard these cultural ties risk alienating local populations from their heritage and identity.

The political context shapes how Nile water policies are formulated and implemented, As the youngest state with a history of conflict, South Sudan's leadership must navigate complex regional dynamics involving Egypt, Sudan, and Ethiopia regarding Nile waters. Effective diplomacy is crucial for securing equitable agreements that benefit local communities. Weak governance structures hinder effective implementation of water management policies. Corruption and lack of transparency divert resources away from community needs toward elite interests. The geopolitical significance of the Nile Basin influences international aid flows into South Sudan. Engaging with international organizations can provide technical support but may also impose external agendas that do not align with local priority. The root causes of South Sudan's water insecurity are both structural and environmental. Internally, years of civil war have devastated infrastructure, leaving water systems damaged or non-existent in many areas. According to Santos and Rohrman (2021), access to safe drinking water remains alarmingly low, particularly in rural and conflict-prone regions. Additionally, the country is highly vulnerable to climate-induced extremes, such as prolonged droughts and seasonal flooding, which disrupt agricultural activities, destroy settlements, and displace communities. The seasonal variability of rainfall and increasing temperatures due to climate change have intensified water stress across the country. Meanwhile, the rapid growth of population, particularly in urban centers and refugee-hosting areas, has increased demand for limited water supplies, creating further strain on underdeveloped water infrastructure. Bridge between Upstream and Downstream States, geographically situated between upstream Ethiopia and downstream Sudan and Egypt, South Sudan can act as a diplomatic bridge. By maintaining neutral and balanced relations, it can facilitate dialogue and mutual

understanding similar to how Switzerland mediates trans-boundary water disputes in Europe.

South Sudan can strengthen regional integration efforts and advocate for equitable water sharing. Through active participation, it can push for inclusive frameworks that recognize the water rights of all riparian states, promoting regional peace, much like Tanzania has done within the NBI framework. South Sudan's potential in hydro-politics lies not in current power but in its capacity to foster dialogue, champion sustainability, and contribute to inclusive regional water governance. With the right support and strategic vision, it can become a constructive voice for peaceful hydro-politics in Africa and beyond.

The effects of water insecurity are both immediate and long-term. At the community level, disputes over access to water sources such as rivers, boreholes, and grazing areas are a major driver of inter-communal conflict, especially among pastoralist and agrarian communities in states like Jonglei, Lakes, and Upper Nile. These local tensions are often exacerbated by broader ethnic divisions and political grievances. Nationally, water scarcity impedes economic development by undermining agriculture, livestock rearing, and food security, which are the main livelihoods for the majority of South Sudanese. Public health is also significantly affected, with the lack of clean water contributing to outbreaks of waterborne diseases such as cholera and typhoid. Furthermore, the inability to sustainably manage and distribute water resources weakens public trust in government institutions and limits the effectiveness of peacebuilding and post-conflict reconstruction efforts.

Several attempts have been made to address the issue. South Sudan's membership in the NBI and participation in basin-wide dialogues have opened channels for cooperation, technical assistance, and data sharing with neighboring countries. Nationally, development partners such as UNICEF, the World Bank, and USAID have implemented water, sanitation, and hygiene (WASH) programs to improve access to clean water in both rural and urban areas. However, these efforts have often been fragmented, donor-driven, and limited in geographic scope. Additionally, weak institutional capacity, corruption, and poor coordination among government ministries continue to hamper progress in water governance. There is a lack of a comprehensive national water policy framework that integrates water management, conflict resolution, and climate adaptation.

The major gap in existing research and policy lies in the limited understanding of the intersection between water security and conflict in South Sudan, especially in relation to regional Nile Basin dynamics. While studies

have addressed trans-boundary water politics at a macro level, few have critically examined how these dynamics impact internal water conflicts and vice versa. Moreover, the voices and needs of local communities, who are most affected by water insecurity, are rarely reflected in high-level negotiations or national planning processes. This study aims to fill that gap by offering a hydro-political analysis that connects South Sudan's internal water challenges with its external relations within the Nile Basin. It seeks to provide evidence-based insights to inform sustainable water governance and regional cooperation.

Purpose of the Study

The purpose of this study is to critically examine the interplay between water security and conflict in South Sudan within the broader context of Nile Basin relations. Specifically, the study aims to explore how internal challenges such as climate variability, underdeveloped infrastructure, and inter-communal conflicts interact with regional hydro-political dynamics shaped by historical treaties and unequal power relations among riparian states. By assessing both national and trans-boundary dimensions, the research seeks to generate a nuanced understanding of South Sudan's strategic position in the Nile Basin and the implications for sustainable water governance. Ultimately, the study intends to provide informed policy recommendations that promote equitable resource sharing, regional cooperation, and conflict sensitive water management in South Sudan and the wider Nile Basin.

Objective of the study

- a) Examine the role of trans-boundary water politics in shaping South Sudan's relations with other Nile Basin countries.
- b) Analyze the impact of climate change and environmental variability on water availability and distribution in South Sudan.

Justification of the study

Water security is increasingly recognized as both a development and security concern globally, especially in trans-boundary river basins such as the Nile. For South Sudan a country emerging from prolonged civil conflict and institutional fragility, the availability, control, and management of water resources are deeply connected to peacebuilding, socio-economic development, and regional diplomacy. Yet, existing research has largely overlooked the country's unique position and role within the Nile Basin, focusing more on dominant riparian actors like Egypt, Sudan, and Ethiopia. This study is therefore justified in its aim to fill that critical research gap by offering a South Sudan-specific hydro-political analysis. The study is further justified by the pressing

need to understand how internal governance weaknesses and environmental pressures interact with regional water politics. South Sudan’s limited infrastructure, coupled with recurring climate shocks such as floods and droughts, has left large segments of the population vulnerable to water stress. Moreover, internal competition over water access has triggered inter-communal conflicts, complicating the nation’s post-conflict recovery. Understanding the internal dynamics of water insecurity and how they align with broader Nile Basin politics is essential for designing more coherent water management and peacebuilding strategies.

Finally, this study will provide timely and practical insights to guide policymakers, development partners, and local institutions. With ongoing regional negotiations over water sharing agreements and increasing pressure on the Nile due to climate change and population growth, South Sudan must strategically position itself in both national planning and international diplomacy. The study’s findings will contribute to the formulation of informed and inclusive water governance frameworks that consider both the domestic and trans-boundary dimensions of water security.

Significance of the Study

This study is significant in advancing scholarly understanding of the link between water security and conflict, particularly from the perspective of a fragile, post-conflict state like South Sudan. Most existing academic literature tends to frame the Nile Basin hydro-politics

Conceptual Framework

Independent variables

- Climate change and environmental variability
- Transboundary water politics
- Historical water-sharing treaties
- Water governance and policy frameworks

Dependent variables

South Sudan and Nile Basin Relations



Source: Researchers, 2025

Literature Review

Trans-Boundary Water Politics Influence on South Sudan’s Relationships with Other Nile Basin Countries

Concepts and Definitions of the TWINS Framework

The trans-boundary Water Interaction Nexus (TWINS) framework seeks to critically examine trans-boundary water conflict and cooperation over shared water resources. The TWINS framework was developed by Mark Zeitoun and Naho Mirumachi in 2008 (Zeitoun, Mirumachi 2008) and has since been further developed by

in binary terms such as Ethiopia versus Egypt without adequate attention to smaller or newer riparian states. By focusing on South Sudan, this research addresses an under-explored area in hydro-political studies and contributes to the diversification of scholarly narratives surrounding water governance in the region.

In terms of practical policy impact, the study provides evidence-based insights that can inform national decision-making processes around water resource management. South Sudan’s water sector remains under-regulated, underfunded, and poorly coordinated. Findings from this research can help guide the development of a national water policy that is both climate-resilient and conflict-sensitive. It can also support the efforts of international donors and NGOs working on water, sanitation, peacebuilding, and environmental resilience in the country. At the regional level, the study has the potential to influence cooperative approaches to water sharing in the Nile Basin. By highlighting South Sudan’s interests, challenges, and contributions, the research can contribute to more inclusive and equitable dialogue within institutions like the Nile Basin Initiative (NBI). It may also inform future revisions of legal instruments such as the Cooperative Framework Agreement (CFA), ensuring that South Sudan’s voice is heard in shaping the future of shared water resources. In this way, the study serves both national and regional peace and development agenda.

various authors, the most recent version being presented by Mirumachi in 2015 (Mirumachi 2015). The framework was developed to enhance the topic of state interaction over water and broaden it by presenting water interaction as a combination of conflict and cooperation, where previously interaction was understood as either being in cooperation or conflict. The framework brings in aspects of political geography, political ecology and sociology to provide a multidimensional approach to examining riparian interaction. In this section the TWINS framework will be explained in detail to help the reader gain a basic understanding of the analytical tools used in the study.

Hydrocracy

One important concept for the TWINS framework is that of the hydrocracy, the elite power makers that influence decisions on hydro politics such as state agencies in charge of water resources. The hydrocracy is a vital part of the TWINS framework analysis and therefore this study, as it comprises the elite-decision makers with regards to water issues of the riparian states. The hydrocracy are of course not the only actors involved in trans-boundary water issues. There are also non-state actors, such as corporations, various NGO's that attempt to influence the state on water issues. How these actors influence the various processes surrounding water management gives a good reflection of the political economy of riparian states and the response of the hydrocracy to the various issues that might arise are vital to examine for a better understanding of trans-boundary water interaction (Mirumachi, 2015).

Speech Acts

Another vital concept for the study is speech acts made by elite decision makers (the hydrocracy). Speech acts can act to establish relations between actors and make up the rules of these relationships (Austin 1962; Searle 1969 as cited in: Mirumachi, 2015). Speech acts are constructivist in origin and is the constructivist way of explaining how relationships develop. Speech acts are not just confined to verbal communication between actors. Speech acts can also be non-verbal if they change the dynamics between actors by establishing or changing the rules of interaction (Frederking, 2003). Speech acts can be used as indicators for how change in actor's identities and interest occurs. It is through these speech acts that actors socially construct the structures that govern in which way shared waters are managed (Mirumachi, 2015). Duffy and Frederking puts forward the three different types of speech acts that can be used by actors to influence discourse. They are:

- Assertions are made when the actors want to express a belief with the intention that the receiver of the assertive speech act shares this belief.
- Directives are made with the intention that the speaker would like the hearer to act in a specific way.
- Commitments are speech acts that are used by the speaker to express their intention to perform an act in the future.

These categories of speech acts encompass many different aspects of world politics and provides structure for a constructivist analysis of social interaction. International agreements are examples of Commissure speech acts that binds states to it and shapes their actions. (Duffy and Frederking, 2009). Mirumachi makes some good

examples of speech acts in the context of trans-boundary water resources management that help clarify what it means for this study. An assertive speech act for example could constitute a joint declaration on water quality improvement. A directive speech acts could be the actions of the hydrocracy of an upstream country that closes dams or unilaterally constructs hydraulic infrastructure without agreement from downstream states. The signing of bilateral treaties on water sharing could be an example of a Commissive speech act (Mirumachi, 2015). Speech acts is a vital part of the analysis of this study and can be found in documents ranging from media reports to official and legal documents. Speech acts can affect the conflict or cooperation intensity that is plotted in the TWINS Matrix of riparian interaction in various ways (Mirumachi, 2015).

The TWINS matrix makes use of scales of cooperation and conflict to map out riparian state interaction. These scales are central to this study and is the primary method for analysing changes in riparian relations.

Conflict Intensity

The conflictual scale in the TWINS matrix uses the security theory developed by the Copenhagen Schools (Buzan *et al* 1998) that focuses on how threats are socially constructed by actors (Mirumachi 2015: 46). The scale varies from "non-politised" (lowest end of the conflict scale) where there is no issue of conflict, to violation (highest end of the scale) where the issues goes out of the bounds of ordinary politics and becomes subject to military action (Zeitoun, Mirumachi 2008). The water crisis in South Sudan is driven by conflict, underdevelopment, climate change, and inadequate infrastructure. Howe, Lauren. 2010. Hydro politics of the Nile River: Conflict, Policy and the Future. Insights 4 (1): 30-43, Spring. This crisis has profound implications on overall stability of the nation. Number of the population lacks access to clean and safe drinking water. Water crisis in South Sudan is characterized by a critical lack of access to safe drinking water and the seasonal variations emphasize water insecurity poses an existential threat. The impact of the water crisis is far-reaching and deeply entrenched in the daily lives of South Sudanese citizens, the insufficient water for irrigation affects crop yields, perpetuating a cycle of food scarcity and economic hardship. The lack of access to clean water lead to competition for scarce resources, potentially fueling violence and instability.

This scale is used to reflect how politicized an issue is and to what degree actors will resort to military action to solve it. Issues that are not prioritized by or not included in the public domain are considered non-politized. Once an issue enters the political arena it becomes *polities*

“part of public policy, requiring government decision and resource allocation” (Buzan *et al* 1998). The next level of conflict intensity is *opportunised* where actions outside of the realm of normal politics may be justified. At the same level of conflict intensity an issue may also be *securitised*. At this level the issue may require emergency actions. At the most extreme levels of conflict, intensity issues may be *violised*, where violent confrontation seems imminent. Speech acts have the ability to transform an issue into a securitized one and this can be viewed as positive or negative depending on the perspective of the actor. This relates to opportunitization, that state actors can ignore public discussion if an issue is securitized as emergency acts and can then be justified in relation to this (Mirumachi 2015). Simply put, conflict intensity increases as more speech acts or an especially powerful one is made that make an issue out to be a threat (Mirumachi, Warner 2008).

Cooperation Intensity

Cooperation in the case of transboundary water interaction is understood by Mirumachi to be a reflexive process in which riparian states share norms and ideas on water resources management and governance. Cooperation is viewed from a constructivist point of view where it is assumed that states can develop a collective identity that fosters collective action (Mirumachi, 2015). In a study by Warner and Mirumachi the existence of cooperative speech acts is argued for. Cooperative speech acts have the ability to create common goals and coordinate interests. This is to show the ways in which states can increase levels of cooperation (Mirumachi and Warner 2008). Cooperation intensity in the TWINS matrix is measured on what level of intention states have to form common goals and take collective action. This is identified through various norms and ideas. In the TWINS matrix intention to undertake collective actions is derived from water management norms and public ideas. The norms and ideas that are collectively formed make up the tools that shape state action (Mirumachi, 2015). These five scales of cooperation make up the indicators of the cooperation intensity in the TWINS matrix. Mirumachi makes it clear that cooperation is difficult to define and argues that the scale used is only one interpretation of looking at relationships between state actors and how they are socially constructed. In the case of bilateral riparian relations, trans-boundary water resources management is usually of concern for both states involved (Mirumachi, 2015). The first indicator of cooperation is therefore when states acknowledge that there is an issue, and consequently frame it as a problem. This is plotted as *confrontation of the issue*. Actions by states at this level is individual and compromises domestic public policy. There is no common goal formation and any potential actions does not necessarily represent one of collective action.

The second indicator is *ad hoc joint action*. At this level there is joint action by riparian states, however the goals of the actors are different. At this level cooperation intention is considered weak but it represents the first step in towards collective actions. The third level of cooperation is *common goal formation*. At this level actors do share a common goal regarding the issue, however, there is disagreement on what joint action is needed to solve the problem. Both states have different views on how common goals are best achieved and take differing actions in this case. The next level of cooperation intensity is *common norm formation*. At this level there is both common goal formation and norms as well as agreed upon joint action. This level is often represented by treaties and agreements on water resource management where interaction is based on institutionalized norms. Here common goals are achieved by joint action that is guided by common norms (Mirumachi, 2015). At the last level of cooperation intensity is *collective identity formation*. Here a full collective identity is formed where state domestic and collective international interest align perfectly (Wendt 1994).

Political Interaction

Political interaction on shared watersheds are divided into three various categories in the TWINS framework:

- *Negative Interaction* defined as resentment between actors is considered significant and affects inter-state interaction negatively and influences the broader political context.
- *Neutral Interaction* defined as the transboundary water interaction between state actors having no apparent effect on the political sphere.
- *Positive Interaction* is when the needs and interests of the actors are met, and this in turn affects political relations between state actors in a positive way.

The TWINS framework places transboundary water interaction within this context and helps determine what possible drives actors under these diverse circumstances (Zeitoun, Mirumachi 2008: 309-310).

Material Capability and Discursive Power

The TWINS framework places much weight on power asymmetry and how it affects riparian interaction. Power analysis is an important part of understanding why cooperation may not always bring equitable outcomes for all the basin states involved. Analyzing power is also needed to understand the effects of cooperative mechanisms that may exclude specific issues or basins states. Analyzing this can also show how conflict can bring forward new issues in negotiation processes that affect trans-boundary water interaction (Mirumachi, 2015). The TWINS framework makes use of the Framework of Hydro-Hegemony (FHH) developed by Zeitoun and Warner (2006). FHH identifies

three key pillars that enables hydro-hegemony to decide the direction taken over shared waters. These indicators are: riparian position, power and exploitation potential. Riparian position is simply if the basin state is located upstream or downstream. Power is viewed as three dimensional where the first is military and economic power, second is active stalling incentives and the third is securitization. The last pillar is exploitation potential defined as infrastructure and technological capacity (Zeitoun and Warner, 2006).

In the TWINS framework, riparian position and exploitation potential is combined to represent material capacity, and power is specified as discursive power. These two explanatory factors can then be joined to assist in analyzing the different ways that contention, negotiation and agreement can affect access and control over water resources (Mirumachi, 2015). Exploitation potential is defined as material capacity in the TWINS framework. Material capacity is the technological level and knowledge of a riparian state. There are many good indicators for material capacity and among them are: how developed hydraulic infrastructure is in the basin, the number of plans for development and how advanced they are, the availability and level of professional knowledge and human resources, and the access to funding. Riparian position can also reinforce material capacity (Mirumachi, 2015).

Soft Power

Soft power in the FHH framework is defined as non-material power, specifically bargaining power, that can influence agendas and ideational power, meaning power in relation to ideas that can bring about compliance without contestations (Zeitoun and Warner, 2006). Power is tied together with interests and complacency. There is usually a dominant actor that is able to push its interests on a weaker part and the weaker actor has to adapt to this relationship. According to Zeitoun soft power can be exercised for distributive or integrative ends. Distributive power can be exemplified with a conflict of interest, where the aim is that the compliance of the weaker actor can only be achieved through their resignation of the issue. The use of integrative soft power relates to when actor's interests align and there are good relations between them. Compliance here takes the form of consent and actors are using collective capacity to achieve their common and individual goals (Zeitoun *et al*, 2010).

Climate Change and Environmental Variability Affect Water Availability and Distribution

Climate Change Aspects

The cognizance of the level to which the society, environment and economy can be affected by the change

of climate has increased. Increasing greenhouse gases concentration mainly carbon dioxide has led to the observed long-term climate change globally, regionally and also at local scales. These encompass changes in timings and amounts of precipitation, temperatures, extreme weather like droughts and heavy precipitation, wind patterns and heat waves (IPCC, 2014). Precipitation patterns are influenced by moisture availability and circulation patterns of the atmosphere and are unevenly distributed across the globe. These patterns of precipitation are anticipated to change since the temperature is changing and it influences the moisture availability and the atmospheric circulation patterns.

The changes comprise of the amount, frequency intensity and nature of precipitation. In most parts of Northern Europe, North America and South America, precipitation has increased and decreased in most of Africa, the Mediterranean and southern Asia (Trenberth & Shea 2006; IPCC 2014). The world leading international organizations in climate change research associate climate change to human causes through activities that increases emissions of heat absorbing GHGs (IPCC, 2014). These emissions change the composition of atmosphere and vary the natural climate witnessed over a relatively longer time period. Climate change is the state variation of the climate that can be predictable by mean fluctuations or the inconsistency of its characteristics and that takes longer period, normally decades or longer (IPCC, 2014).

Source and Emission of Greenhouse Gases

The anthropogenic activities that contribute to climate change mostly encompass the emissions of greenhouse gases (GHGs) which trap heat. These GHGs include methane (CH₄), carbon dioxide (CO₂) and nitrous oxide (NO₂). GHGs such as CO₂ and CH₄ absorb energy emitted on earth's surface, and this prevents or reduces the loss of heat to space. Therefore, these gases form a blanket near earth's surface rising the average temperature of the earth's climate system. The CO₂ concentration in the atmosphere has increased by roughly 35 percent since the beginning of industrial revolution (IPCC, 2014). During the biological carbon cycle, plants take up the CO₂ from the atmosphere which helps in the process of CO₂ sequestration. CH₄ results from production and transport of natural gas, coal, oil. Another factor that contributes to the emission of methane to a greater extent is waste decay in municipal solid waste landfills and agricultural practices such as livestock farming (IPCC, 2014). Another GHG is NO₂ which is emitted during industrial activities, fossil fuels combustion and solid waste as well as in agricultural related activities such as raising livestock (IPCC, 2014).

Naturally Driven Climate Change Aspects

The volcanic eruptions and the sun are among the major

natural factors contributing to global climate change (IPCC, 2014). The energy output of the sun has followed its historical cycle of 11- years of small ups and downs without any significant increment. This is as was measured by satellites since 1979 several decades ago. Though the above stated natural influences cannot substantially give details on the global warming in latest decades, there has existed a minor cooling influence over this period as a result of their net effect on climate (Hansen *et al.*, 2006; IPCC, 2014). On thousands of year's timescales, the unhurried variations in the earth's orbit around the Sun and its tilt in the direction of or away from the Sun are also a natural influence on climate, (Kaufmann *et al.*, 2011; Burck *et al.*, 2014; Mach & Mastrandrea, 2014).

Climate Change Indicators

Climate, generally defined by the temperature and precipitation characterizes an enduring average condition of the weather in a given place. Weather can change within a few minutes or hours, but development of changes in climate is over longer time periods, i.e., decades to centuries). The warming of the climate system is undisputable, a statement from the Fifth Assessment Report of IPCC (2014). This is a claim deduced from observations of rising average sea level, prevalent melting of snow and ice and rise in overall average air and ocean temperatures.

Impacts on Water Quantity

For human survival and sustenance, water as a natural resource is very crucial. Water is also important for energy production, agricultural science, manufacturing, recreation and navigation (Karl *et al.*, 2009; Melillo *et al.*, 2014). These natural water resources include ocean, seas, lakes, underground aquifers and rivers (Furniss, 2010). The hydrological cycles and regimes within watersheds are altered by the climate change at global scale and also local scale which undesirably impacts forests, water resources, sustainable agriculture, environment and ecosystems (Poff *et al.*, 2002; Karl *et al.*, 2009; Chien *et al.*, 2013; Rwigy, 2014). Runoff is one of the significant components of water resources and will be affected by changes in the climate in terms altering of precipitation and temperature. Quite several researches are steered towards evaluation of climate change effects on runoff due to the importance of runoff for water supply (Githui *et al.*, 2009; Faramarzi *et al.*, 2010; Mango *et al.*, 2011). Demand for water could likely be increased by change in climate while the supply is being reduced (IPCC 2014; Melillo *et al.*, 2014). The amount of water that is available for recharge will also be affected by reduced precipitation or increased evaporation and runoff which are as result of changes in the water cycle (Mach & Mastrandrea, 2014). Temperature changes, fire or pest outbreaks that lead to changes in soils and vegetation

which in turn leads to changes in the rates evaporation and infiltration are also likely to affect recharge (Bates *et al.*, 2008). More frequent and larger floods in semi-arid and arid areas may likely increase the groundwater recharge (Bates *et al.*, 2008). Lastly, extreme weather conditions for instance drought caused by the stretched imbalance between precipitation and evaporation, is another resulting impact of climate change (Melillo *et al.*, 2014). Increasing demand for drinking water which accompanies the more rates of urbanization will put stress on the existing water sources (Bates *et al.*, 2008).

Impacts on Human Health

When considering the human health, ecosystems and their survival, the quality of water becomes a very important issue (Quansah *et al.*, 2008; Melillo *et al.*, 2014). Regions expected experience increased rainfall intensity due to climate change, the water quality could depreciate. The increased runoff in rivers could lead to washing human and animal waste, sediment, trash, nutrients, pollutants and other materials into water supplies, making them insecure or requiring water treatment process before use (Parry *et al.*, 2007; Ebi *et al.*, 2008). The same could cause problems in water treatment plants and sewer systems as these infrastructures can be overwhelmed by the increased volumes of water and materials (Mimikou *et al.*, 2000; Karl *et al.*, 2009; EPA, 2011). Sea level upsurge caused by climate change may also affect freshwater resources along the coasts (Karl *et al.*, 2009; Mach & Mastrandrea 2014). Availability of dissolved oxygen in water is an indispensable resource for various living things, and also for self-purification abilities of rivers. However, increased temperatures in the water could compromise its availability (Mimikou *et al.*, 2000; Karl *et al.*, 2009).

The Upper Tana Catchment experiences a substantial threat of point and non-point pollution emanating from human activities, (Maingi & Marsh, 2002; Dijkshoorn *et al.*, 2011; Knoop *et al.*, 2012). Nation's largest water quality deprivation is the non-point source pollution and is linked to why the apportioned water quality principles for various activities like recreational activities or fishing are not met by a greater percentage of rivers, lakes etc. (Maingi & Marsh, 2002; Kauffman *et al.*, 2014). The principal source of non-point source pollution is agriculture (Hunink, *et al.*, 2012; Melillo *et al.*, 2014).

Impacts on Agriculture

Climate change has adverse impacts on the agricultural sector. Warmer temperatures may decrease crop yields and also could favor a quick growth of some crops (Mach & Mastrandrea, 2014). Like in the case of crops like grains, there is decline in the quantity of crop produced in a farm because of reductions in the extent of time the seed have

to develop and mature, (EPA, 2011; Mach & Mastrandrea, 2014). Water availability, soil nutrients and optimal temperature of the crop for reproduction and growth, controls the effects as a result of increased temperature (Mogaka, 2006; Kauffman *et al.*, 2014). Agricultural activities largely depend on water resources. Farming in the upper Tana will become altered due to climate change and this will affect economic growth of the country. Crop yield is also affected by higher atmospheric concentrations and extreme weather conditions e.g. flood and drought (Funk & Brown, 2009). Human health and livestock can also be negatively impacted by increased temperatures in the form of heat waves (Githeko & Woodward, 2003; Nardone *et al.*, 2010; Ouma, 2015).

Current National and Regional Policies and Agreements in Addressing Water Governance and Cooperation

Institutional Components of Water Governance Systems: Water Laws, Policies and Administration

The adopted definition of water governance suggests that different types of arrangements are found between state and non-state actors in water sectors. In this section, the overall institutional framework within which actors involved in water governance interact will be examined by focusing on three main components: water laws, water policies, and water management. Looking at these three elements and exploring the interplay dynamics among them is an important step to understand how water governance systems work and what factors may affect their performance. Added to this, the amalgamation of these three factors form what is called ‘water governance capacity’, which refers to ‘a society’s level of competence to implement effective water arrangements through policies, laws, institutions, regulations, and compliance mechanisms’ (Iza and Stein, 2009). The lack of any of these three components will affect the overall effectiveness of water governance systems and arrangements. Water laws are needed in the first place to empower water policies. At the same time, sound water policies require an overarching legal and regulatory framework to guide the process of policy formulation and implementation. Effective water governance is also a function of the way in which water resources are manipulated and controlled by water management institutions and the capabilities of these institutions to achieve their intended policy goals and to enforce water policies and regulations.

Water laws

Water laws and regulations provide the legal framework for water policies and represent the underlying foundations for water management and administration. The main idea behind central governments designing and issuing these laws is to keep water resources under control and to

provide the pillars for sound water policies and practices (Barreira, 2006). As stated by Iza *et al.*, (2009). Water laws provide a legal framework, which ‘levels the playing field, clarifies the rules, and sets a country on the route to good management’. In this perspective, water laws represent the cornerstone and the main foundation in any water governance system. They put in place the ground rules for all state and non-state actors and identify their roles and responsibilities in addition to accountability mechanisms. Consequently, a good starting point for analyzing water governance arrangements in any given context is to examine water laws and regulations. Water laws take different shapes in different contexts; therefore, it is expected that different water laws will be found in different countries. Nevertheless, in spite of such a diversity of water laws, there are some similarities among them all. For example, Saleth and Dinar (1999) have noted that water laws in different countries focus on issues such as the legal status of water conflict resolution mechanisms, water rights and regulations plus enforcement mechanisms. This observation has led scholars such as Gupta *et al.* (2013) to conclude that water laws in different countries provide water managers with the same menu. That means the options available for water managers to select from are more or less similar despite the difference in water laws and regulations (Gupta, 2011). For instance, when it comes to types and forms of ownership as well as rights and responsibilities, a great deal of similarity can be noticed. The quality of water laws influences the effectiveness of the overall water governance systems. Generally speaking, well drafted and designed water laws should offer ‘predictability, and a precise yet flexible structure through which obligations are laid down, with rights which can be enforced and protected’ (Iza and Stein, 2009). To this end, and in order to avoid any form of overlapping and confusion, coordination mechanisms have to be set out clearly in water laws. These mechanisms help in dividing roles and responsibilities among state and non-state actors at all water governance levels (global, regional, national, and sub-national) (Gupta and Pahl-Wostl, 2013).

Water Policies

Water laws and policies are normally in the background of any water governance discussion. They provide ‘the skeleton that is fleshed out by institutions and management practices’ (Iza *et al.*, 2009). In that sense, water laws and regulations are usually translated into more concrete objectives and goals in water policies. Water policy is defined as ‘all efforts to define the rules, intent, and instruments with which governments manage human uses of water, control water pollution, and meet environmental water needs. It considers not only the legal and regulatory framework, but also the planning around water resource allocation and

the implementation practices by water managers and other stakeholders in support of this framework' (Morrison et al., 2010). Accordingly, water policies cover 'usage priorities, water tariffs, decentralisation or centralisation of competencies, participation, and coordination with other policies' (Saleth and Dinar, 1999).

In addition to this, the scope of water policies may also extend to cover different water governance issues including: water supply and infrastructure development; water resource protection; water rights and allocation among sectors; water quality management; water pricing and economic instruments; operations and maintenance of water management systems; public participation in water governance and decision-making and environmental regulation, planning, and protected area management (Anokye, 2013). These policy issues and the general directions regarding how to deal with them are most likely to be defined at the central governmental levels. Nonetheless, the implementation of these directions takes place at regional and local levels (Morrison et al., 2010). In all cases, water policies should have strategic orientations that are built upon a vision of water sectors in the near future and in the long term. In this context, '[A] written water policy might contain a background section explaining the need for the policy, a statement of purpose, a vision statement, a statement of scope, a set of definitions, an effective date, one or more statements of policy, and a section on responsibilities regarding who will carry out the policies' (Iza and Stein, 2009). This vision as well as the long-term policy goals set the directions for governance reforms in water sectors.

Water management

Managing water wisely and effectively is the essence of any water governance system. The way in which water resources in a given country are managed determines greatly how healthy the people in this country are, how successful its economy is, how sustainable its natural resources are, and how good its relationship with neighbouring countries is. As noted by Iza et al. (2009):

Good water management can provide clean drinking water and sanitation, the basics of good health, while poor water management can increase disease and suffering. Good water management can bring hydroelectric power to homes and industry, irrigation for agriculture, and improve the economy, while poor management can mean lack of power, desiccated crops, floods and famine. Good water management allows water for wildlife to maintain biodiversity, and provides opportunities for recreation and tourism, while poor management can result in parched ground, driedup lakes and silted harbours. Good water management can result in harmonious and mutually

beneficial water agreements with neighbouring countries, while bad management can trigger tensions and conflict (Iza et al., 2009).

In this context, it is imperative to understand what water management is and how it affects the water governance arrangements. Water management is defined by Carrey (2011) as 'the activity of planning, developing, distributing, managing an optimum use of water resources defined under water polices and regulations'. The scope and the way in which these activities are supposed to be undertaken are determined by water laws and policies. As noted by Iza and Stein (2009), 'good water laws provide a structure for effective water management'. Ideally speaking, all the activities involved in water management are supposed to guarantee the efficient utilization of water resources, equitable access and distribution of water among the different members of the society and the sustainability of the existing water resources. As Iza and Stein (2009) state, 'a modern legal regime for water is comprehensive and includes efficiency, equity and sustainability considerations'. In practice, however, these aims are hard to achieve. Growing populations, increasing demands from industries and the agricultural sector, as well as the uncertainty of water availability caused by the climate change effects are typical challenges facing water managers worldwide and call for more innovative solutions to water issues and problems (El-Rae 2009; Iza et al., 2009).

To further explicate the difficulty of achieving efficiency, equity and sustainability in water governance we need to underscore the fact that water management and administration processes take place at two different levels: policy making and policy implementation. At the policy level, the main concern for water management activities is to effectively manage water resources. At the implementation level, the preoccupation for water managers is to direct and control the delivery processes. Some organizational actors may play more than one role in the water management system at both levels. In this case, it is crucial to separate functions in order to avoid any form of conflict of interests. For example, those who are heavily involved in policy making should not be responsible at the same time for policy implementation and water delivery. The reason for this is that if one policy actor is responsible for policymaking and policy implementation at the same time this actor will most likely design policies in accordance with its own directions and competencies regardless of the benefit these policies may bring to the wider community (Iza and Stein, 2009).

The productivity committee in Australia (2003) has emphasized the importance of enforcement and monitoring mechanisms as core elements of effective water

management. Another important managerial function in water management systems is to administer water rights in terms of issuing, modifying and approving water rights, which gives right-holder(s) a priority of access to water resources (Holland and Moore, 2003). Taken together, these institutional components are essential for understanding the notion of water governance. The general understanding of governance as presented in earlier need to be anchored in the context of water crisis (see Bevir, 2013). As further explained in chapter 4, those institutions provide the water 'structures' which limit or expand the ability of water agents to make water policy decisions.

Relationships Between the Institutional Components of Water

Saleth and Dinar (2004) have explained the link between these three institutional components of water governance systems. According to their view, the overall performance of water governance systems depends not only on the functionality of their individual single components but also on the way these components are put together and integrated. From an inter-institutional perspective, the linkage between water policies, law, and administration is quite important for understanding the way in which these components interact and the impact of this on the overall performance of water governance systems (Saleth and Dinar, 2005). In an ideal situation, water laws should guide and empower water policymaking. This is not to say that water laws always precede water policies as they may come as a part of an overall reform initiative in water sectors. Regardless of which comes first, water laws or water policies, the link between these two elements is obvious. On the one hand, water laws provide overarching guidance for water policies. On the other hand, water policies represent a translation of water laws from a political economy perspective (Saleth and Dinar, 2000). Both water policies and laws determine the scope and duties for water administration. In this sense, water policies and laws represent what Saleth and Dinar (2004) call the 'software component' of water governance while water administration provides the 'hardware component'.

At the outset, the performance of water governance systems can be affected by several factors. From an economic point of view, the performance of a water governance system is affected by the transaction costs involved in interactions among participating actors (Saravia and Chen, 2008). The higher the transaction costs, the less efficient the performance of a water governance system is. The performance of water governance systems can also be influenced by the clarity of the implemented rules as well as the enforcement mechanisms (Barrett et al., 2005). The clearer the ground rules governing actors' interaction,

behavior, and the stronger the enforcement and monitoring mechanisms, the more efficient the performance of the governance systems. The level of formality of the rules in place is also an important factor as we need to bear in mind both formal and informal rules as particularly in many developing countries, informal rules may become more important than formal ones. The linkage between the different institutional components (water law, policy and management) and the way in which these components influence each other represents another important factor, which may interfere with the ability of water governance systems to achieve high performance (Bandaragoda, 2006).

Strategic Issues in Water Governance

Water resources can be regarded as a critical enabler, or constraint, for achieving economic development and meeting social needs (Muller, 2012). Hence, developing an effective water governance system is not an end in itself; it is a means to effectively handle and wisely manage different strategic policy issues in water sectors. In other words, the development of water governance systems is meant to address resilient water issues such as sustainability, climate change, poverty reduction and development in general. Dealing with such issues, which are described in this section as 'strategic', in the sense that any decision in these areas may have implications for the development of water sectors and the well being of the people, is not an easy task. Decision and policymakers as well as water managers and practitioners are required to come up with new approaches and to use new tools in order to achieve the designed policy goals for water sectors. This task is even more complicated with two main features of water sectors: uncertainty and complexity. These two characteristics render the traditional policy responses to water issues obsolete or at the best not effective enough to solve water problems. In the words of Head (2008), many of the water issues have become 'wicked' in the sense that they have become complex and intractable with no final solutions (Head, 2008). Therefore, the complex water governance issues call for new ways to address them and new tools for steering interactions among involved actors.

Water Governance and Sustainability

Water is always regarded as a renewable source and therefore many people believe they should not worry about how much water they use. This misconception of water as a natural resource has led to the conclusion that sustainability has not been and will never be an issue when it comes to water usage. This section argues against this perception of water as a renewable source as well as de-linking water and sustainability. Conversely, in accordance with the conclusion of Knight et al. (2009), this section

argues that water and in particular, fresh water should be regarded as a scarce resource and therefore it requires effective governance systems to ensure its sustainability. From this angle, the sustainability of water is regarded as a function of the way in which water is perceived as a natural resource and the way in which this natural source is managed and controlled. In other words, 'the nexus of water sustainability lies at the intersection of water availability in the physical sense and water governance' (Knight et al., 2009).

In general terms, the concept of sustainability is normally used to refer to the current generation's commitment to take into account future generations' rights to enjoy the same amount of natural resources, if not a greater amount, when deciding upon the way in which these resources are deployed for the purpose of achieving economic development. The old resource intensive model of development based on the abundance of natural resources and the downplay of social and environmental costs in production processes has particularly resulted in the depletion of many natural resources in addition to the degradation of the environment in general. The need has become quite clear for a new model of development which is socially responsible and environmentally friendly; a model that 'takes into account the adverse side effects of modernization and fundamentally redefines its own dynamics and workings' (Loorbach, 2010). The United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 was a manifestation of the internationally growing awareness that the old model of development was no longer acceptable and that environmental as well as social costs had to be correctly accounted for and reflected in the calculations of economic development decisions. The notion of sustainability has now become a paramount concern for the international community and sustainable development has become a framework of governance for national states at the national level. As Dernbach (1998) states, sustainability and sustainable development represent 'an internationally recognized normative framework for guiding and evaluating the behaviour of national governments and other actors'.

In water sectors, sustainability has been perceived as 'the use of water that supports the ability of human society to endure and flourish into the indefinite future without undermining the integrity of the hydrological cycle or the ecological systems that depend on it' (Gleick,

1998). This conceptualisation includes a commitment that 'we leave as many choices about fresh water to future generations as possible, making as few permanent, irretrievable commitments as possible' (Knight et al., 2009). In this context, the notion of sustainability has been adopted by water managers and policymakers at

national levels in order to reflect their commitment to the internationally developed and agreed upon model of sustainable development. Sustainable water has become a cornerstone in water governance systems and a widely mentioned goal for water policies. Knight et al. (2009), for instance, regard sustainable fresh water as reflecting the 'long-term maintenance of adequate volumes of fresh water and commitments of fresh water to vital human uses, including recognition of water's place in the basket of fundamental goods and services that should be attainable by all humans as a right'.

In that sense, water sustainability is first and foremost an issue of good long-term planning and utilization of water resources in order to meet the basic human needs. Nonetheless, this simple notion of water sustainability is challenged in reality by the very fact that some water resources such as the ground water are not themselves sustainable. Furthermore, there are competing demands for water including the demands for economic and business activities which may result in distortions in the ways in which water is allocated and may divert water resources to these areas before meeting the fundamental human needs. As Karar et al. (2012) put it, 'water resource allocation for a range of productive purposes, from agriculture to industry to ecosystem services, is typically inequitable. Often it is the comparatively powerless groups which are shut out not just to water itself but also to the processes where allocation decisions are made'. Climate change, and its impact on the predictions of future water availability, represents another factor that should be added to the equation of water sustainability as it adds to the uncertainty surrounding this scarce resource (El-Rae, 2009). In the words of Gleick et al. (1995), to address the issue of sustainability in water sectors is to answer fundamental questions including how are all competing values to be prioritized? What is to be sustained? For how long? What are the benefits? Who are the beneficiaries?

The challenges facing water sustainability call for developing new pathways and sustainability criteria to guide policymakers, water managers and the other participating actors in water governance regimes. Gleick (1998) has identified seven criteria for sustainable water utilization:

- A basic water requirement will be guaranteed to all humans to maintain human health;
- A basic water requirement will be guaranteed to restore and maintain the health of ecosystems;
- Water quality will be maintained to meet certain minimum standards. These standards will vary depending on location and how the water is to be used;

- Human actions will not impair the long-term renewability of freshwater stocks and flows;
- Data on water resources availability, use, and quality will be collected and made accessible to all parties;
- Institutional mechanisms will be set up to prevent and resolve conflicts over water;
- Water planning and decision-making will be democratic, ensuring representation of all affected parties and fostering direct participation of affected interests.

Following on from these criteria, any decision concerning water usage and allocation should take account of the basic human needs and health as well as the needs of the surrounding environments and ecological systems. Water managers and decisions-makers also need to make sure that the quality of utilized water meets a minimum standard that maintains human health and well-being. The issue of renewability of water resources should also be considered to make sure that today's decisions do not impact negatively on the long-term availability of water stocks and flows. Water decisions must be taken based on accurate, timely and up-date data. The quality of the decisions taken in this area depends to a great extent on the quality of the data used by decisionmakers. From an institutional point of view, a sustainable water governance system should develop adjudication and conflict resolution mechanisms, which facilitate the solving of disputes among actors involved in governance processes.

As noted by Karar et al., (2012), people's participation and representation 'come at the centre of any biophysical-ecological intervention aimed at the use and sustainability of water resources'. The issues of participation and transparency are quite important to ensure the accountability of decision-makers and to enhance the legitimacy of water decisions. As eloquently summarized by Barbara Schreiner, Chair of the Board of the Water Research Commission (WRC) in the opening address of the International Conference on Fresh Water Governance for Sustainable Development, '[W]e cannot save the world as water managers, researchers and specialists alone' (Schreiner et al., 2011). In other words, water should be brought into the centre of the development debate and all types of societal actors must be involved in such a debate in order to come up with innovative solutions to water issues. Addressing the above-mentioned issues in water management and governance should eventually lead to the creation of a good water governance system which reflects the criteria for good governance discussed in chapter two. Such a system would ultimately produce more efficient strategies for managing water resources, which in turn will lead to the attainment of the intended water policy goals,

and outcomes in an open, transparent and accountable environment.

Gaps in the Literature

Here are several key gaps (some overlapping) that the current literature seems to exhibit, especially when synthesizing water security + conflict + South Sudan + Nile Basin + hydro political analysis. Many studies focus on macro-level riparian states, treaties, dams, hegemonic relations. There is less empirical research on how these macro dynamics filter down to local communities in South Sudan (e.g., how local water access, local conflict dynamics, livelihood changes respond to hydro-politics). For example, recent study notes: "micro-level studies to better understand the pathways from climate stress to conflict" are needed. There is limited qualitative/quantitative data on community perceptions, local coping strategies, traditional institutions and how they interact with national/regional water governance.

South Sudan is not only part of a trans-boundary basin, but also has internal conflict (civil war, ethnic violence, displacement). There is a gap in fully integrating how external hydro political tensions (with Nile Basin states) interact with internal conflict dynamics (e.g., competition over water among pastoralists, seasonal migration, flooding in the Sudd wetlands, displacement). In other words: the literature is stronger on upstream/downstream state dynamics, weaker on how those combine with internal fragility and conflict in South Sudan. While there is work on institutional weaknesses in South Sudan, the literature lacks in-depth comparative analyses of how different governance levels (national, sub-national, community) function with respect to water security and how they interplay with hydro politics. For example, overlapping agencies, institutional fragments, weak enforcement, and how these create "governance vacuums" are acknowledged but not deeply analysed with data. Moreover, traditional/local water institutions (customary systems) and how they interact with formal trans-boundary water governance frameworks are under-explored.

There is a strong theoretical link made between water stress and conflict (e.g., studies that show water stress raises conflict risk). But the literature lacks fine-grained empirical measurement in the Nile Basin / South Sudan context (e.g., temporal-spatial data on water stress, conflict incidents, migration, hydrological changes). Recent note: reliance on aggregate water-stress indicators overlooks local disparities. Also modelling the future risk (under climate change) of water-security-driven conflict in South Sudan is thin. South Sudan's role in the Nile Basin is relatively marginalised in the literature: many studies focus on Egypt, Sudan, Ethiopia. But South Sudan is both upstream

(White Nile tributaries) and has huge wetlands (the Sudd) and is in a unique position. The literature describes the upstream/downstream asymmetries but less so how South Sudan may leverage its position or how it is vulnerable as a riparian state. There is work on climate change and water, but less detailing of how changes in the Sudd wetlands (evaporation, water loss, shifts in ecology) feed into hydro-politics and conflict. For example: wetlands governance and large development projects (canal, dredging) in the Sudd are under-explored. So, the intersection of ecology (wetlands/evaporation), hydropolitics and conflict is not rich in data.

Many studies focus on conflict potential, risks, power asymmetries. Less on how cooperation or benefit-sharing might be achieved in this fragile context (especially with South Sudan) and what institutional models would work given fragility. There's a gap in normative/practical frameworks for inclusive water governance in a post conflict state like South Sudan within the basin.

How to Fill the Gaps

Design empirical study at the community/sub-national level in South Sudan: e.g., in a particular county or state such as around the Sudd wetlands or along the White Nile tributary. Collect interviews with local stakeholders (pastoralists, farmers, local officials, traditional authorities) about water access, seasonal migration, conflict/competition, perceptions of engagement with bigger river basin politics. Use household surveys and geospatial mapping of water access, conflict incidents, migration flows. Integrate local traditional institutions' role in water governance and dispute resolution. Develop case-studies of how external hydro-political tensions (e.g., with upstream/downstream neighbours) feed into internal conflict drivers (resource competition, displacement, ethnic tensions) in South Sudan. Use conflict-event datasets (if available) and water-stress/hydrological data to correlate temporal spikes in water scarcity or infrastructure decisions (canal/dredging) with local conflict incidents.

Map all water governance institutions operating in South Sudan – national ministry, river basin authorities (if any), state and county level, customary/traditional water institutions, civil society and international actors (donors). Analyse overlaps, gaps, capacity constraints, incentives, accountability mechanisms. Compare with “successful” basin governance models (e.g., the Nile Basin Initiative or other transboundary basins) to derive lessons. Investigate how South Sudan can integrate into or leverage regional frameworks (treaties, frameworks) and what barriers exist (political, institutional, technical). Collect and compile hydrological data (river flows, wetlands water loss, evaporation, rainfall, floods/droughts) for the South Sudan

section of the basin. Collect conflict event data (localised, over time) and migration/displacement data. Use statistical methods (time-series, spatial econometrics) to assess relationships: e.g., does water stress correlate with conflict/migration? What thresholds exist? Use scenario modelling of future climate change + infrastructure development (canal/dredging) to project risk of conflict or displacement. Analyse South Sudan's legal and diplomatic status in Nile Basin agreements, its negotiation power, how its water rights are framed, and how recent politics (independence, civil war) affect this. Conduct research on the Sudd wetland's hydrological and ecological functions, the potential impacts of water-diversion or dredging projects, and how these impact livelihoods, ecology and regional water flows. Explore how South Sudan might move from vulnerability to strategic actor in the Basin: what infrastructure, what diplomatic moves, what institutional reforms could position it better. Study the Sudd wetland's role: water loss through evaporation/transpiration, seasonal flooding patterns, implications for downstream water flows and for local communities in South Sudan. Explore how wetlands change (due to climate/land use) might shift hydro political bargaining power and conflict potential. Incorporate ecological science with political/human dimensions: how do changes in wetlands/hydrology trigger migration, competition for pasture/fish, or new water infrastructure debates.

The study potential for benefit-sharing models in the Nile Basin that are tailored to fragile states like South Sudan: e.g., hydropower export, ecosystem service payments, joint waterinfrastructure governance. Explore inclusive governance design: how to integrate local communities, customary authorities, cross-border cooperation with neighbouring states (Ethiopia, Uganda) etc. Focus on policy recommendations grounded in South Sudan's context: what institutional reforms, what legal frameworks, what capacity-building are required.

Research Methodology

Research design

The study employs a mixed-methods research design, combining qualitative and quantitative approaches to provide a comprehensive understanding of the complex hydro-political landscape. A case study approach will be central, focusing specifically on South Sudan within the broader Nile Basin context. This design allows for in-depth exploration of the nuances of water security and conflict, while also enabling the identification of broader patterns and relationships.

The study is primarily explanatory and descriptive, seeking to explain the causes and consequences of water-related

conflicts and describe the existing water security situation. Investigation of South Sudan's specific situation within the broader Nile Basin, provide detailed insights into its unique challenges and opportunities. A qualitative approach allows for the nuanced exploration of perceptions, experiences, and power dynamics related to water resources, water conflict and nature of hydro-political relations, a qualitative design facilitates the collection of rich, descriptive data that can reveal underlying patterns and causal mechanisms not easily captured by quantitative methods.

Area of Study/ Research Site

The primary area of study is South Sudan, with a specific focus on its internal water dynamics and its interactions with other Nile Basin riparian states. This includes examining the White Nile sub-basin within South Sudan, as well as the broader implications of agreements and disputes concerning the entire Nile River system. The study considered key regions within South Sudan that are particularly vulnerable to water scarcity or conflict, such as Jonglei, Unity, and Upper Nile states, due to their reliance on the Nile and its tributaries, and their history of inter-communal and political conflicts often exacerbated by resource competition. This research will serve as the hub for national decision-making regarding water resource management and international relations within the Nile Basin.

Source of Information

Information was gathered from a variety of sources to ensure comprehensiveness and triangulation. These include. Primary sources: Interviews with key stakeholders (government officials, community leaders, NGOs, academics, international organizations), focus group discussions with affected communities, and direct observations where feasible. Secondary sources: Academic journals, books, reports from international organizations (e.g., UN, World Bank, African Union), government documents, policy briefs, news archives, and geospatial data (e.g., satellite imagery for water levels, land use changes). Archival data: Historical treaties, agreements, and diplomatic correspondence related to Nile water allocation.

Population and Sampling Techniques

The study targeted the population of 135 includes Government officials (Ministry of Water Resources and Irrigation, Ministry of Environment, Ministry of Foreign Affairs). Representatives from international and local non-governmental organizations working on water, peacebuilding, and development. Community leaders and elders in water-stressed or conflict-affected areas. Academics and researchers specializing in water resources,

conflict studies, and African politics. Representatives from regional bodies like the Nile Basin Initiative (NBI) and IGAD as well as United Nations agencies, African Union, Local community leaders and elders from areas affected by water scarcity or water-related conflicts. Academics and researchers specializing in water resources, environmental studies, and peace and conflict studies. Representatives from civil society organizations and NGOs working on water sanitation and hygiene (WASH) initiatives or peacebuilding. Sampling techniques used was purposive and snowball sampling for qualitative data collection. Purposive sampling will be used to select key informants who possess specific knowledge and experience relevant to the research questions. Snowball sampling will be employed to identify additional relevant individuals or groups through referrals from initial contacts, particularly for hard-to-reach populations or those with specialized knowledge.

The study conducted approximately 20-30 in-depth interviews with key informants, supplemented by focus group discussions. This range is considered sufficient to achieve data saturation in qualitative studies of this nature. The selection of participants employed a purposive sampling strategy, ensuring that individuals with relevant knowledge and experience are included.

Determination of Study Sample

The sample size for qualitative interviews was determined by the principle of saturation, where data collection continues until no new significant themes or information emerge from the interviews. This typically ranges from 15-30 in-depth interviews for a focused qualitative study, but could be higher depending on the diversity of perspectives required. For focus group discussions, 3-5 groups, each comprising 6-10 participants, would be ideal to capture diverse community perspectives. The specific number of participants will be flexible and adjusted based on the richness of data obtained.

The researcher used Yamane's theory, representative sample of the respondents from the target population was determined as shown below formula:

$$n = N / (1 + Ne^2)$$

Where N= Total number of employees from target population

n= Estimated sample size

e= error of prediction/ detection

$$n = 100$$

The sample used for this study was 100 Respondents.

Variables Definitions and Measurements

The interplay of Variables Definitions and Measurements at the level of water security and the potential for conflict or cooperation in the Nile Basin, with South Sudan's internal

stability and development heavily relied on equitable access to and management of its water resources. key variables for this study include: Water Security: Defined as the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

Measurement: Qualitative indicators (perceptions of access, quality, reliability, vulnerability) and quantitative indicators (water availability per capita, rainfall patterns, incidence of water related diseases, infrastructure development, water-related displacement).

Conflict: Defined as overt or latent disputes, violence, or tensions arising from competition over water resources, or where water acts as a trigger or exacerbating factor for broader political, ethnic, or inter-communal conflicts.

Measurement: Incidence of water-related disputes (local and transboundary), reported casualties, displacement figures, types of conflict (e.g., inter-communal, state-level, regional), and perceptions of water as a conflict driver.

Nile Basin Relations: Defined as the diplomatic, economic, and social interactions among Nile riparian states concerning the management and utilization of the Nile River.

Measurement: Participation in Nile Basin initiatives (e.g., NBI), adherence to international water laws, existence and effectiveness of bilateral/multilateral agreements, frequency of diplomatic engagements, and perceptions of cooperation or competition.

Hydro-political Dynamics: The interplay of water resources, power, and politics.

Measurement: Analysis of policy documents, power asymmetries among riparian states, historical grievances, and the role of external actors.

Data Collection Instruments

The procedure for this data collections are in multi-method approach that employed comprehensive and triangulated data collection, enhancing the robustness of the findings. The primary data collection methods include interviews that were conducted with key informants from the identified target populations. Semi-structured interviews allow for flexibility, enabling the researcher to explore emerging themes while ensuring coverage of core research questions.

Data collection proceeded will proceed in several phases such as Literature Review and Document Analysis for systematic review of academic literature, policy

documents, and reports. Key Informant Interviews (KIIs) for an anonymity assured where requested. Focus Group Discussions (FGDs): Conducted with community members in selected areas to gather collective perspectives on water access, challenges, and conflict experiences. Facilitators will ensure all voices are heard. Quantitative Data Collection (if applicable): Collection of statistical data from official sources (e.g., national statistics bureaus, UN agencies, World

Bank databases) on rainfall, population, conflict incidents, and water infrastructure.

Geospatial Analysis: Utilizing GIS tools to analyze satellite imagery for changes in water bodies, land use, and population distribution in relation to water resources.

This involves the systematic review of relevant policy documents, legal frameworks, reports from governmental and non-governmental organizations, academic literature, and media reports related to water resources, conflict, and Nile Basin relations in South Sudan. Document analysis provides contextual information, historical perspectives, and insights into official narratives and existing interventions. It was based on Surveys and Questionnaires, Interviews, Observation, Tests and Assessments, Experiments Diaries, Administrative Data Archival Documents/Secondary Data Analysis. Interview Guides: Semistructured questionnaires with open-ended questions tailored for different stakeholder groups (e.g., government officials, community leaders, NGO representatives). A set of guiding questions to facilitate discussion on specific themes related to water security and conflict within communities. Document Analysis Protocol: A systematic framework for extracting relevant information from reports, policies, and academic papers, including themes, arguments, and data points. Observation Checklists: If direct observation is possible, a checklist to record relevant environmental conditions, water infrastructure, and community interactions. GIS Software and Databases: For analyzing spatial data (e.g., ArcGIS, QGIS, open-source satellite imagery platforms like Google Earth Engine).

Piloting the Study

A pilot study was conducted with a small subset of the target population (e.g., 2-3 key informants, one focus group) to test the clarity of interview and FGD guides, assess the feasibility of data collection procedures, and identify any unforeseen challenges. This study allowed for refinement of instruments and procedures before full-scale data collection commences, ensuring the questions are understood and elicit the desired information.

Quality/Error Control

This quality/error control is to ensure the quality and

minimize errors in data collection and analysis, that includes triangulation, researcher reflexivity, Peer debriefing, detailed documentation and data verification. As in details Triangulation, using multiple data sources (interviews, documents, quantitative data) and methods (qualitative, quantitative) to corroborate findings and enhance validity. Researcher reflexivity, acknowledging and reflecting on the researcher's own biases and assumptions throughout the research process.

Peer Debriefing: Discussing findings and interpretations with colleagues to gain alternative perspectives and identify potential biases. Detailed Documentation: Maintaining meticulous records of all data collection activities, interview transcripts, and analytical decisions. Data Verification: Cross-checking information from different sources to ensure accuracy.

Reliability

The Reliability of this research title "Water Security and conflict in South Sudan: A Hydro Political Analysis of the Nile Basin Countries Relations" is based on print encyclopedia, nonfiction books, academic journals, dictionaries, questionnaire and interview. This study used the test-retest essential for qualitative data coding e.g interviews and Reports using Cohen's Kappa (for two raters) Fleiss' for three or more or Krippendorff's alpha Highly versatile for various data types raters. intra-rater of single research codes, testretest for quantitative survey, internal consistency, coding manuals and training to minimize ambiguity and enhancing overall reliability. The rigorous sources for reliability that provide empirical theoretical foundation and the crucial historical context and depth that ensure precise and consistent understanding of Water Security and Conflict in South Sudan the hydro-political terms and analysis are clearly and credibility based on print encyclopedia, nonfiction books, academic journals, dictionaries, questionnaires' and interview. The exclusive use of these of sources guarantee this research in-depth and intellectual rigorous examination of the complex hydro-political dynamic

Validity

Validity refers to the extent to which the research accurately measures the validity of a hydro-political analysis of water security and conflict in South Sudan hinges on understanding the historical geographical legal and political complexities of the Nile Basin. The Validity of this research includes the historical context of Nile management, the absence of a comprehensive legal framework for water allocations and South Sudan's internal political instability and socio-economic vulnerabilities. This study used multi-faced approach, water security measurement, conflict measurement and validation technique for both objective and subjective.

This study account for the power dynamic and strategic interests of all Nile Basin Countries, particularly the upstream-downstream relationships and competing development aspirations. This study explores both the potential for conflict arising from water scarcity and competing interests as well as opportunities for cooperation through joint management and diplomatic engagement.

Data Processing and Analysis

The collected qualitative data was analyzed using thematic analysis, a widely used method for identifying, analyzing, and reporting patterns (themes) within qualitative data.

Data analysis, transcription: All interviews and focus group discussions was transcribed verbatim. Thematic Analysis: Using a systematic approach to identify patterns, themes, and categories within the qualitative data. This involved: Familiarization: Reading and rereading transcripts. Initial Coding: Generating initial codes from the data. This involves looking for patterns and relationships among the codes. Reviewing Themes, Refining and defining the themes, ensuring they are distinct and accurately represent the underlying patterns in the data. This may involve collapsing or splitting themes. Defining and Naming Themes, Developing clear and concise names and definitions for each theme, along with illustrative quotes from the data. Writing up the analysis, Presenting the findings in a coherent narrative, supported by evidence from the data, and linking them back to the research questions and existing literature.

Ethical Consideration

The study adhere to strict ethical guidelines throughout the research process such as informed consent, anonymity and confidentiality, minimizing harm, beneficence, data security and transparency.

Informed consent: all participants were informed about the purpose of the study, their rights (including the right to withdraw at any time), and how their data will be used.

Written or verbal consent will be obtained before any data collection.

Anonymity and confidentiality: participants' identities were protected, and their responses will be kept confidential. Data was anonymized where appropriate, and pseudonyms will be used in reporting findings to prevent identification. Minimizing harm: researchers ensure that participation does not cause any physical, psychological, or social harm to participants. Sensitivity to cultural norms and local contexts will be paramount.

Data Security: all collected data was stored securely, with access limited to the research team. Digital data will be encrypted, and physical data stored in locked cabinets.

Transparency: the research process and findings were transparently reported.

Results and Discussions

Demographic Information

Table 4.1. *Response Rate*

Questionnaires	Frequency	Percentage
Sample Size	100	100%
Returned Questionnaires	100	100%
Missing Questionnaires	0	0.0%

Table 4.1 above show the rate of return of questionnaires from the data collection. The total number of questionnaires distributed to the respondents were 100. The total number of questionnaires received by the researcher from the respondents were 100 (100.0%), the number of questionnaires the researcher did not get back from the

respondents were 0 (00.0%). The researchers concluded that, most of the respondents managed to answer their questionnaires and were collected back. The reason given by those who did not respond to their questionnaires was that they were too busy and therefore, did not get ample time to answer their questionnaires.

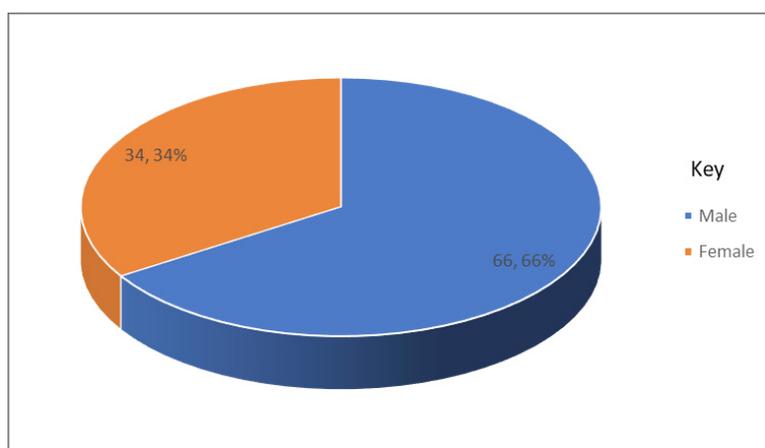


Figure 4.1. *Gender of Respondents*

Figure 4.1 above showed the gender of the respondents been tallied together, the male respondents were (66%), the female respondents were (34%), The total numbers of respondents were (100). The researchers concluded that, most of the youths who participated in the data collection

were male meanwhile the female respondents were few, hence, the researcher considered gender during the data collection by allocating some questionnaires to the female respondents.

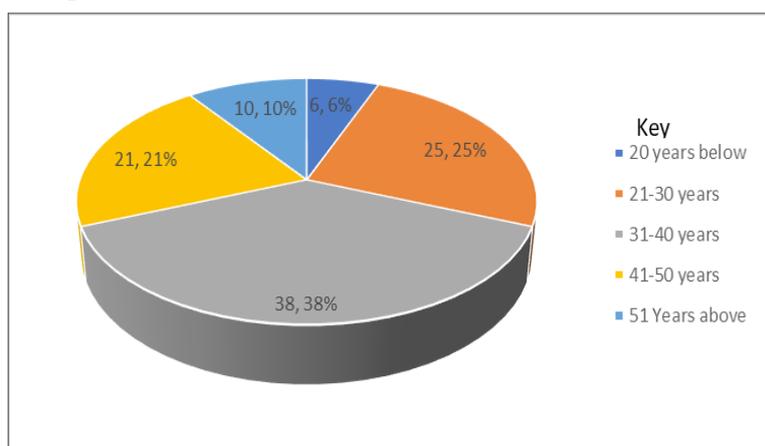


Figure 4.2 *Age group*

Figure 4.2 show age of the respondents. The respondents who are 20 years below were (6%), The respondents who are between 21-30 years were (16%), The respondents who are between 31 -40 years were (38%), The respondents who are between 41-50 years were (21%), The and the respondents who are over 51 years were (10%).

The researcher concluded that, majority of the respondents were between the age of 21 years to 50 years. These was the correct age group for the studies because it was the age of the youths.

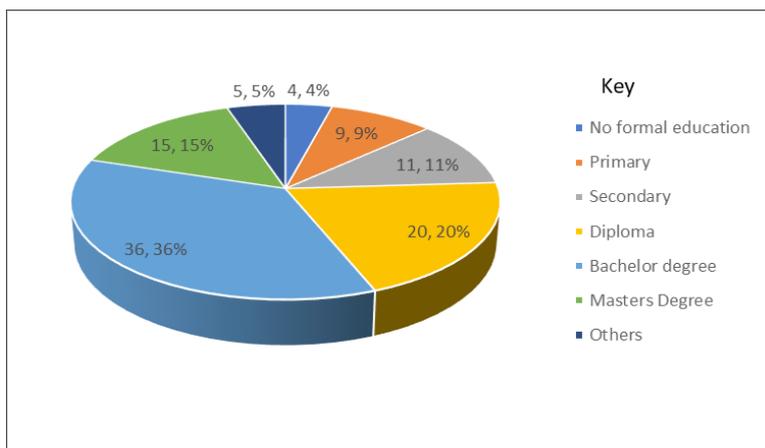


Figure 4.3 Highest education level

Figure 4.3 above show the various educational levels of the respondents who participated in answering the questionnaires. The respondents were as follows; those respondents who are not educated were (4%), those respondents who are primary school leavers were (9%), those respondents who are secondary school leavers were (11%), Diploma had 20%, and those respondents who are bachelor degree graduates were (36%), master degree were 15% meanwhile any others were 5%.

The researchers concluded that, majority of the respondents are Diploma and bachelor degree graduates whereas few were master degree graduates, researcher ensured that, respondents chosen for the study were able to read and write whereas those who cannot read and write were translated the questionnaire in a way that, they can easily understand and interpret

Internal Factors Contribute to Water Insecurity and Local Conflict of Water in South Sudan

Table 4.2. Do you have any experience of water security and conflict in South Sudan

Response	Frequency	Percentage
Yes	90	90
No	10	10
Total	100	100

The respondents who agreed that, they have experience of water security and conflict in South Sudan were 90% meanwhile the respondents who disagreed that they don't

have experience of water security and conflict in South Sudan were 10%.

Table 4.3 The Internal factors contribute to water insecurity in South Sudan

Statements	Strongly agree		Agree		Strongly disagree		Disagree		Neutral		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Political supremacy and water ownership cause local conflict in South Sudan.	75	75	9	9	7	7	5	5	4	4	100	100
Nile River is cause of threat to people of South Sudan	79	79	6	6	3	3	5	5	7	7	100	100
Foreign interference on Nile Water impended water security and conflict in South Sudan	74	74	12	12	3	3	6	6	5	5	100	100
Mismanagement of water and lack of law to governance Nile River water result to security threat in South Sudan.	78	78	11	11	4	4	3	3	4	4	100	100
Internal conflicts among community are always caused by a lack of water for the people and animals	75	75	13	13	5	5	4	4	3	3	100	100
laws regulating water managment in South Sudan are not implemented.	74	74	11	11	6	6	5	5	4	4	100	100

The findings from the statement that; political supremacy and water ownership cause local conflict in South Sudan; 75% strongly agreed, 9% agreed, 7% strongly disagreed, 7% disagreed and 4% were neutral. The findings from the statement that; Nile River is cause of threat to people of South Sudan; 79% strongly agreed, 6% agreed, 3% strongly disagreed, 5% disagreed and 7% were neutral. The findings from the statement that; Foreign interference on Nile Water impended water security and conflict in South Sudan; 74% strongly agreed, 12% agreed, 3% strongly disagreed, 6% disagreed and 5% were neutral.

The findings from the statement that; mismanagement of water and lack of law to governance Nile River water result to security threat in South Sudan; 78% strongly agreed, 11% agreed, 4% strongly disagreed, 3% disagreed and 4% were neutral. The findings from the statement that; Internal Conflicts among community are always cause by a lack of water for the people and animals; 75% strongly

agreed, 11% agreed, 4% strongly disagreed, 3% disagreed and 4% were neutral. The findings from the statement that; Law to regulating water management in South Sudan are not implemented; 74% strongly agreed, 11% agreed, 6% strongly disagreed, 5% disagreed and 4% were neutral.

The findings from the statement that; trans-boundary politics on Nile Water can exacerbate tensions among differences communities; 73% strongly agreed, 10% agreed, 7% strongly disagreed, 6% disagreed and 4% were neutral. The findings from the statement that; South Sudan government can have used the trans-boundary politics as tool governance water at it territory; 77% strongly agreed, 6% agreed, 3% strongly disagreed, 7% disagreed and 7% were neutral. The findings from the statement that; The implication of water trans-boundary politics to South Sudan water policies; 72% strongly agreed, 12% agreed, 3% strongly disagreed, 8% disagreed and 5% were neutral.

Table 4.4 South Sudan opens avenues for foreign influence in domestic affairs that governing water is it to strengthening relationships with other Nile Basin countries.

Statements	Strongly agree		Agree		Strongly Disagree		Disagree		Neutral		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Transboundary politics on Nile Water can exacerbate tensions among differences communities.	73	73	10	10	7	7	6	6	4	4	100	100
South Sudan government can use the transboundary politics as tool governance water at it territory	77	77	6	6	3	3	7	7	7	7	100	100
The implication of water transboundary politics to South Sudan water policies	72	72	12	12	3	3	8	8	5	5	100	100
Water transboundary politics is genuine discourse stifled, further complicating efforts toward national reconciliation among communities.	76	76	11	11	4	4	5	5	4	4	100	100
Water transboundary spread ethnic based insecurity and deepening divisions within society.	74	74	13	13	5	5	4	4	4	4	100	100
Water transboundary policies reduced access to pasture and agricultural land in Sudan Conflict	71	71	11	11	6	6	5	5	7	7	100	100
Transboundary Politics address both opportunities and challenges to South Sudan.	75	75	10	10	7	7	3	3	5	5	100	100
Transboundary politics explore more barriers to Upstream Countries	76	76	14	14	4	4	4	4	2	2	100	100

The findings from the statement that; Water trans-boundary politics is genuine discourse stifled, further complicating efforts toward national reconciliation among communities;

76% strongly agreed, 11% agreed, 4% strongly disagreed, 5% disagreed and 4% were neutral.

Table 4.5 *In what ways does climate change and environmental variability affect water availability and distribution in South Sudan.*

Statements	Strongly agree		Agree		Strongly disagree		Disagree		Neutral		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
climate change and environmental variability affect water availability and water distribution in South Sudan	71	71	13	13	7	7	5	5	4	4	100	100
Climate change and environmental variability affect water availability and water distribution in South Sudan but government need to engage non-state actors to directly contributes in water management.	78	78	7	7	3	3	5	5	7	7	100	100
Can government of South Sudan mitigate measures to manage effect of climate change and environmental?	78	78	7	7	3	3	5	5	7	7	100	100
Foreign interference on Nile water tend to security threat in South Sudan	79	79	8	8	3	3	6	6	4	4	100	100
water insecurity and resultant conflicts amongst local population in South Sudan	75	75	11	11	5	5	5	5	4	4	100	100
Water security and conflict instantaneous sharing among Nile Basin Countries through governments and regional responses.	77	77	10	10	7	7	3	3	3	3	100	100
Water Management Act to regulate water usage and management in South Sudan and other countries of the Nile	72	72	16	16	6	6	4	4	2	2	100	100
The threat of Water security and conflict to South Sudan and the regions	77	77	11	11	5	5	3	3	4	4	100	100

The findings from the statement that; climate change and environmental variability affect water availability and water distribution in South Sudan; 71% strongly agreed, 13% agreed, 7% strongly disagreed, 5% disagreed and 4% were neutral. The findings from the statement that; Climate change and environmental variability affect water availability and water distribution in South Sudan but government need to engage non-state actors to directly contributes in water management; 78% strongly agreed, 17% agreed, 3% strongly disagreed, 5% disagreed and 7% were neutral.

The findings from the statement that; Can government of South Sudan mitigate measures to manage effect of climate change and environmental deserts; 78% strongly agreed, 17% agreed, 3% strongly disagreed, 5% disagreed and 7% were neutral. The findings from the statement foreign Water Security and Conflict in South Sudan the national Security of South Sudan; 79% strongly agreed,

8% agreed, 3% strongly disagreed, 6% disagreed and 4% were neutral.

The findings from the statement Water Security and Conflict in South Sudan result to a security threat in South Sudan; 75% strongly agreed, 11% agreed, 5% strongly disagreed, 5% disagreed and 4% were neutral. The findings from the statement that Water Security and Conflict in South Sudan allows for instantaneous sharing of water among the Nile Basin Countries and the governments and regional responses; 75% strongly agreed, 11% agreed, 5% strongly disagreed, 5% disagreed and 4% were neutral.

The findings from the statement that Water Security and Conflict in South Sudan are not implemented; 72% strongly agreed, 16% agreed, 6% strongly disagreed, 4% disagreed and 2% were neutral. The findings from the statement that Water Security and Conflict in South Sudan 77% strongly agreed, 11% agreed, 5% strongly disagreed, 3% disagreed and 4% were neutral.

Table 4.6. *Effective of national and regional policies agreements addressing water governance and cooperation.*

Statements	Strongly agree		Agree		Strongly disagree		Disagree		Neutral		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
To ensure development in the county, what do the South Sudan need to ensure investments and complements in Nile Water to align with other government in the Regions	65	65	23	23	6	6	4	4	2	2	100	100
To ensure development in the county, the community should be assisted to access social welfare and rights of all the communities along the Nile	63	63	22	22	8	8	4	4	3	3	100	100
To ensure safety security along the Nile and in the county, the government and other stakeholders should set up programs (including reintegration) and share of water that provide opportunities for income generation	48	48	37	37	5	5	4	4	6	6	100	100
Citizen involvement causes the timely implementation of policies at the Parliamentary Service Commission	69	69	20	20	4	4	3	3	4	4	100	100
To ensure water development in the county, the government should enhance border control and manning.	56	56	29	29	5	5	6	6	4	4	100	100
To ensure development in the county, the government should foster and create a conducive environment to preevent climate change impact in collaboration with IOM and INGOs working for.	63	63	25	25	4	4	6	6	2	2	100	100
To ensure development along the Nile, there should be enhancement of security agencies presence within all water site to help and prevent insecurity.	45	45	38	38	7	7	5	5	5	5	100	100
Regulation of water sharing and information between administrators and security agencies from riparian countries to ensure water safety in the Region.	54	54	32	32	4	4	6	6	4	4	100	100

The findings from the statement that to ensure development in the county, what do the South Sudan need to ensure investments and complements in Nile Water to align with other government in the Regions; 65% strongly agreed, 23% agreed, 6% strongly disagreed, 4% disagreed and 2% were neutral. The findings from the statement that to ensure development in the county, the community should be assisted to access social welfare and rights of all the communities along the Nile; 63% strongly agreed, 22% agreed, 8% strongly disagreed, 4% disagreed and 3% were neutral. The findings from the statement that to ensure safety security along the Nile and in the county, the government and other stakeholders should set up programs (including reintegration) and share of water that provide opportunities for income generation; 48% strongly agreed, 37% agreed, 5% strongly disagreed, 4% disagreed and 6% were neutral.

The findings from the statement that citizen involvement causes the timely implementation of policies at the Parliamentary Service Commission; 69% strongly agreed, 20% agreed, 4% strongly disagreed, 3% disagreed and 4% were neutral. The findings from the statement that to ensure water development in the county, the government should enhance border control and manning; 56% strongly agreed, 29% agreed, 5% strongly disagreed, 6% disagreed and 4% were neutral. The findings from the statement that to ensure development in the county, the government should foster and create a conducive environment prevent climate change impact in collaboration with UN and INGOs working for. 63% strongly agreed, 25% agreed, 4% strongly disagreed, 6% disagreed and 2% were neutral.

The findings from the statement that to ensure development along the Nile, there should be enhancement of security agencies presence within all water site to help and prevent

insecurity; 45% strongly agreed, 38% agreed, 7% strongly disagreed, 5% disagreed and 5% were neutral. The findings from the statement that regulation of water sharing and information between administrators and security agencies from both countries to ensure water safety in the Region; 54% strongly agreed, 32% agreed, 4% strongly disagreed, 6% disagreed and 4% were neutral.

Conclusions

The study concludes that, the internal factors contributing to water insecurity in South Sudan which majority of the respondents strongly agreed are as follows; political supremacy and water ownership, internal and external actors caused local conflict in South Sudan, Nile River is cause of threat to people of South Sudan, foreign interference on Nile water impeded water security and conflict in South Sudan, mismanagement of water and lack of law to governance Nile river water result to security threat in South Sudan, internal conflicts among community are always caused by a lack of water for the people and animals, and law to regulating water management in South Sudan are not implemented. Water insecurity is a critical, yet often underestimated, factor in perpetuating conflict and instability in South Sudan. It would have emphasized that the country's vulnerability to climate change impacts, such as droughts and floods, further complicates water management and intensifies competition over dwindling resources. The study therefore concluded that without effective and equitable water governance mechanisms, both domestically and regionally, South Sudan will continue to face significant challenges to its peace and development. The study underscored the urgent need for a paradigm shift from a conflict-prone approach to one that prioritizes cooperative water diplomacy and integrated water resource management.

South Sudan opens avenues for foreign influence in domestic affairs that governing water is to strengthening relationships with other Nile Basin countries. Trans-boundary politics on Nile Water can exacerbate tensions among differences communities, South Sudan government can used the trans-boundary politics as tool governance water at it territory; water trans-boundary politics to South Sudan water policies and water trans-boundary politics is genuine discourse stifled, further complicating efforts toward national reconciliation among communities. The ways climate change and environmental variability affect water availability and distribution in South Sudan, majority of the respondents strongly agreed that, climate change and environmental variability affect water availability and water distribution in South Sudan, Climate change and environmental variability affect water availability and water distribution in South Sudan but government

need to engage non-state actors to directly contributes in water management, can government of South Sudan mitigate measures to manage effect of climate change and environmental desertsers.

Effective of national and regional policies agreements addressing water governance and cooperation include; ensuring development in the county, what do the South Sudan need to ensure investments and complements in Nile Water to align with other government in the Regions, to ensure development in the county, the community should be assisted to access social welfare and rights of all the communities along the Nile, to ensure security along the Nile and in the county, the government and other stakeholders should set up programs (including reintegration) and share of water that provide opportunities for income generation. Citizens involvement causes the timely implementation of policies at the Parliamentary Service Commission. To ensure water development in the county, the government should enhance border control and manning, to ensure development in the county, the government should foster and create a conducive environment prevent climate change impact in collaboration with the government and agencies working, to ensure development along the Nile, there should be enhancement of security agencies presence within all water site to help and prevent insecurity and regulation of water sharing and information amongst administrators and security agencies from riparian countries to ensure water safety in the Region.

The internal factors that contributed to water insecurity and local conflict of water in South Sudan include; the government lacks strong institutions to manage water resources effectively. Limited enforcement of water laws and policies allows uncontrolled use, mismanagement, and inequitable access to water. Water sources are often contested among ethnic or tribal groups, particularly in regions where pastoralism is prevalent. Competition for water during dry seasons can escalate into violent clashes, especially in areas like Jonglei, Lakes, and Unity states. Lack of investment in water infrastructure (e.g., boreholes, reservoirs, irrigation systems) contributes to physical scarcity. Many rural communities rely on natural water bodies that are seasonal or unreliable. The internal displacement caused by conflict has created pressure on already scarce water resources in host communities or IDP (Internally Displaced Persons) camps. Urban areas like Juba face increased water demand due to population influx, straining limited infrastructure. Marginalized communities often have less access to water sources, which fuels grievances and perceived injustice. Women and girls, who are primary water collectors, face increased burdens and risk of violence during water collection.

It was also concluded that, experiences of Water Security and Conflict in South Sudan, South Sudan's water security issues are closely tied to its history of conflict, underdevelopment, and environmental variability include; Season migration by pastoralists often brings communities into competition over water points and grazing lands. In some cases, these disputes have escalated into armed violence, especially in the dry season when resources are limited. During the civil war (2013–2018), water points were deliberately targeted or blocked to displace populations. In some instances, humanitarian agencies had to truck in water due to the destruction of local sources. Water access in refugee and IDP camps remains a challenge, with many people relying on UN agencies for clean water delivery. Poor sanitation and water contamination have led to outbreaks of waterborne diseases like cholera. There have been efforts to establish community-based water management systems. Some success have been achieved through projects promoting cooperation among rival ethnic groups, but sustainability is a major challenge due to ongoing insecurity. Climate change and environmental variability significantly affect water availability in the following ways: prolonged dry spells reduce water levels in rivers and boreholes, leading to shortages. On the other hand, intense floods (like those from 2019–2023) destroy infrastructure, contaminate water sources, and displace communities. The rainy season has become less predictable, disrupting traditional water usage and agricultural cycles. Communities struggle to plan migration or farming, leading to increased competition and tension. Overgrazing, deforestation, and land degradation affect water retention in the soil and caused siltation of water bodies. In areas like Upper Nile and Bahr el Ghazal, wetlands and river systems are under stress. Livestock and farming depend heavily on water availability. Loss of livestock due to drought or flood-induced disease worsens food insecurity that continued to trigger conflict over inadequate water.

Recommendations

Based on the findings and conclusion, this research put forth several key recommendations that are into two: the main and sub-dimensional recommendations:

- Strengthening National Water Governance. South Sudan needs to develop and implement robust national water policies and legal frameworks that ensure equitable access, sustainable use, and efficient management of water resources. This includes investing in water infrastructure, improving data collection on water availability and demand, and building institutional capacity for water management.
- Promoting Regional Water Cooperation. South Sudan should actively engage in and advocate for cooperative frameworks within the Nile Basin Initiative (NBI) and

other regional platforms. This involves fostering dialogue, sharing data, and jointly developing projects that benefit all riparian states, moving away from unilateral actions that could exacerbate tensions. The study might have suggested exploring benefit-sharing mechanisms as a way to de-escalate hydro-political disputes

- Integrating Water Security into Peacebuilding Efforts. Peacebuilding and conflict resolution initiatives in South Sudan must explicitly incorporate water security considerations. This means addressing water-related grievances at the community level, promoting transboundary water cooperation as a peace dividend, and ensuring that water resource development projects are conflict-sensitive.

- Investing in Climate Change Adaptation. Given the increasing impacts of climate change on water availability, South Sudan needs to prioritize investments in climate change adaptation strategies. This includes developing early warning systems for droughts and floods, promoting water-efficient agricultural practices, and exploring alternative water sources.

- Enhancing International Support and Diplomacy. The international community has a crucial role to play in supporting South Sudan's efforts to achieve water security and mitigate hydropolitical conflicts. This includes providing financial and technical assistance for water infrastructure, facilitating regional dialogue, and supporting peacebuilding initiatives that integrate water management.

Areas for further Studies

- The impact of climate change on water availability and conflict dynamics in South Sudan
- The effectiveness of existing water governance frameworks and institutions in South Sudan
- The role of external actors and international cooperation in shaping water security and conflict in South Sudan requires more detailed examination
- The socio-economic dimensions of water insecurity and their link to conflict in South Sudan need more granular investigation

References

1. Aboul-Enein, Y. (2011). Nile Basin Conflict: Perspectives on Water Sharing, Food Shortages, Civil Wars and Terrorism. *Small Wars Journal* 5 (4): 11-35
2. Alebachew, H. (2011). *International Legal Perspectives on the Utilization of Trans-boundary rivers: The case of the Ethiopian Renaissance (Nile) Dam*. Mekelle: College of Law and Governance, Mekelle University.
3. Allan, J. (1999). *The Nile Basin Evolving Approaches*

- to the Nile Management Program; *Environmental Challenges of the Next Millennium*. Jerusalem: Israel Society for Ecology and Environmental Quality Science.
4. Ameri, M. (1997). *The Nile Dispute, Inventory for Conflict and Environmental Cases*. Washington. U.S.
 5. Ayebare, A. (2013). *A Political Storm over the Nile*. New York. International Peace Institute. (Issues Brief).
 6. Braun, V., & Clarke, V. (2006). Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3(2), 77-101. [Taylor & Francis Online]
 7. Brunnee, J, and Toope (2002). The Changing Nile Basin Regime: Does Law Matter? *Harvard International* 43 (1): 122-131.
 8. Carlson, A. (2013). Who owns the Nile? Egypt, Sudan and Ethiopia's history-changing dam, Origins, Current events in historical perspective, vol. 6(6), The Ohio State University, College of Arts and Sciences. Cascão, A. E. (2009). Ethiopia–Egypt relations: The Grand Ethiopian Renaissance Dam and the future of the Nile Basin. *African Affairs*, 108(433), 533–552.
 9. Conca, K., & Dabelko, G. D. (2019). *Environmental Peacemaking*. Woodrow Wilson Center Press.
 10. Creswell, J. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed.)*. Princeton
 11. Denzin, N. K., & Lincoln, Y. S. (2018). *The SAGE Handbook of Qualitative Research (5th ed.)*. Stake, R. E. The Art of Case Study Research.
 12. De Waal, A. (2015). *The Real Politics of the Horn of Africa: Money, War and the Business of Power*. Polity Press.
 13. Elbagir, Nima, and Faith Karimi. (2011). South Sudanese Celebrate the Birth of their Nation, CNN 10 July.
 14. Frederking, R. (2003). *Water Security and Disputes in the World*. Realtime Publishers.
 15. Gleick, P. H. (1993). Water and conflict: Fresh water resources and international security. *International Security*, 18(1), 79–112.
 16. Green Cross International (2000). National Sovereignty and International Watercourses. Geneva: Green Cross International.
 17. Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? An Experiment with Data Saturation and Variability. *Field Methods*, 18(1), 59-82. [SAGE Journals]
 21. Hoff, H. (2011). *Understanding the Nexus*. Stockholm Environment Institute.
 22. Howe, L. (2010). *Hydropolitics of the Nile River: Conflict, Policy and the Future*. Insights 4 (1): 30-43, Spring.
 23. International Organization for Migration (IOM). (2024). *South Sudan Displacement Tracking Matrix (DTM) Reports*.
 24. Kameri-Mbote, P. (2007). Water, Conflict and Cooperation: Lessons from the Nile River Basin. *Navigating Peace No. 4*. Woodrow Wilson International Center for Scholars.
 25. Keith, et al., (2014). *Estimating the Effect of Climate Change on the Hydrology of the Nile River in the 21st Century*, *International System Dynamics Conference*. Delft, Netherlands 24 July.
 26. Korwa, G. (2013). Ripples in the Nile Waters. *African Review*. 26 March, Nation Media Group.
 27. Lewis, W. (2013). *Egyptian Protests, Ethiopian Dams and the Hydro-Politics of the Nile Basin*. GeoCurrents.
 28. Loveluck, L. (2013). Egypt and Ethiopia Try to Roll Back Threats Over War. *CBS News*.
 29. Madani, K, and Jay, L. (2011). A Monte Carlo theoretic approach for multi criteria decision Making Under Uncertainty. *Advances in Water Resources (Elsevier Ltd)*, 34 (5): 607-616.
 30. Mekonnen, D. (2010). The Nile Basin cooperative framework agreement negotiations and the adoption of a water security paradigm: Flight into obscurity or a logical Cul-de Sac? *European Journal of International Law*, 21 (2): 421-440.
 31. Mekonnen, K. (1999). *The Defects and the Effects of Past Treaties and Agreements on the Nile River waters: Whose faults were they?*. Claremont: The Blue Nile Resource Center, Pitzer College.
 32. Ministry of Water Resources and Irrigation, Republic of South Sudan. *Various Publications*. [Republic of South Sudan Government Portal]
 33. Mirumachi, N. (2015). *Trans-boundary Water Politics in the Developing World*. Routledge, London.
 34. Moustafa, M., and Gichuki, F. (2005). *The Nile Basin profile: Strategic Research for Enhancing Agricultural Water Productivity: Baseline Studies*. Colombo: CGIAR Challenge Program on Water and Food.
 35. Naluyaga, R. (2013). *Saving the Nile by a Drop of Blood: Egyptian President's Only Option*. Daily Nation.
 36. Nile Basin Initiative (NBI). *Various Reports*. Nile Basin Initiative
 37. Nixon, R. (2021). South Sudan: Climate change, displacement, and instability. *Journal of Environmental Migration*, 12(1), 15–28.
 38. Nile Basin Initiative Secretariat (2013). Nile Basin

- Initiative Climate Change Strategy, Entebbe Uganda.
39. Patton, M. Q. (2015). *Qualitative Research & Evaluation Methods* (4th Ed.). SAGE Publications
40. Santos, C. A., & Rohrman, H. (2021). Water scarcity and local conflict in South Sudan. *Conflict, Security & Development*, 21(2), 199–218.
41. Sudan Tribune (2011). *South Sudan Tells Egypt It Will Respect Existing Nile Water Treaties*. 28 March.
42. Swain, A. (2013). *Ethiopia's Dam Project Reflects Shifting Balance of Power in the Nile Basin: Challenges of the Unilateral Approach Towards Shared Nile Water Resources*. Addis Ababa: African News.
43. Tedla, N. (2013). *Analysis of Past Agreements on the Nile in View of the Law of Treaties and the Comprehensive Framework Agreement (CFA)*. Cairo Printers
44. Turton, A.R. (2000). *A Cryptic Hydro-Political History of the Nile Basin for Students of Hydro-Politics*. Study Guide for Pretoria University, Pretoria, South Africa.
45. Tvedt, T. (2004). *The River Nile in the Age of the British: Political Ecology and the Quest for Economic Power*. Oxford University Press.
46. Ufulle, K. (2011). Water Security and Hydro-Politics of the Nile River: South Sudan's National Security in the 21st Century. *Master's Thesis*. Fort Leavenworth: Brookes University.
47. United States Institute of Peace (USIP). (2022). *Community-Based Approaches to Conflict Resolution in South Sudan*.]
48. United Nations Development Programme (UNDP). (2023). *South Sudan Human Development Report*. Juba, South Sudan.
49. Waako, T. (2009). *The Impact of Climate Change on the Nile River Basin*. Frankfurt Maine. DLG Verlag.
50. Wagena, et al., (2016). Climate Change in the Blue Nile Basin Ethiopia: Implications for Water Resources and Sediment Transport. *Climatic Change*, 139 (2): 229-243.
51. Waterbury, J. (1979). *Hydro-Politics of the Nile Valley*. Syracuse: University of Syracuse Press.
52. Wolf, A. T., Yoffe, S. B., & Giordano, M. (2003). International waters: Identifying basins at risk. *Water Policy*, 5(1), 29–60.
53. World Bank. (2023). *South Sudan: Water Sector Overview Report*. Juba
54. Yeo, S. (2014). *Climate Impacts Fuelling South Sudan War, Says Minister*. Cancun: Climate Home.
55. Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th Ed.). London Printers.
56. Zeitoun, M, and Warner, J. (2006). Hydro-Hegemony: A Framework for Analysis for Trans-boundary Water Conflicts. *Water Policy*. 8 (5): 435-460.
57. Zeitoun, M., & Warner, J. (2006). Hydro-hegemony: A framework for analysis of transboundary water conflicts. *Water Policy*, 8(5), 435–460.
58. Zeray, Y. (2019). South Sudan's Engagement in Nile Basin Hydropolitics: Opportunities and constraints. *African Journal of International Affairs*, 21(2), 65–84.