



**Addis Ababa University
College of Development Studies**

**Transboundary Water Resources Management Practices
Comparative Analysis of Nile and Senegal River Basins**

By

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**TRANSBOUNDARY WATER RESOURCES MANAGEMENT PRACTICES
COMPARATIVE ANALYSIS OF NILE AND SENEGAL RIVER BASINS**

by

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**A thesis report submitted in partial fulfillment of the requirements for the Degree of
Master of Art in Regional and Local Development Studies**



**Addis Ababa University
College of Development Studies
Center for Regional and Local Development Studies**

APPROVAL

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I hereby certify that I have advised the thesis by Kiram Tadesse, which is entitled: **“Transboundary Water Resources Management Practices: Comparative Analysis of Nile and Senegal River Basins.”** The paper fulfils the academic requirements and standards.

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Acronyms

AFD	Agence Francaise de Développement
AfDB	African Development Bank
BCM	Billion Cubic Meter
BOAD	West African Development Bank
CFA	Cooperative Framework Agreement
CIDA	Canadian International Development Agency
CPR	Common Pool Resource
DFID	Department for International Development
DOP	Declaration of Principles
EC	European Commission
EIB	European Investment Bank
ENBC	Eastern Nile Basin Countries
EPRDF	Ethiopian People Revolutionary Democratic Front
EU	European Union
FADES	Arab Fund for Economic and Social Development
FAO	Food and Agriculture organization of the United Nations
GDP	Gross Domestic Product
GEF	Global Environment Facility
GERD	Grand Ethiopian Renaissance Dam
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWh	Giga Watt Hour
Ha	Hectare
HDI	Human Development Index
IAAA	Identification, Authentication, Authorization, Accountability
ICON	International Consortium for Cooperation on the Nile
IDA	International Development Association
IDB	Islamic Development Bank
JMP	Joint Multipurpose Project
KfW	Kreditanstalt für Wiederaufbau
KII	Key Information Interview
MCM	Million Cubic Meter
MDG	Millennium Development Goal
MW	Mega Watt
NBC	Nile Basin Commission
NBI	Nile Basin Initiative
NBTF	Nile Basin Trust Fund
NDB	Nordic Development Bank
NELSAP-CU	Nile Equatorial Lakes Subsidiary Action Program Coordination Unit
NGOs	Non-Governmental Organizations

NRB	Nile River Basin
OERS	Organization for the Coastal States of the Senegal River
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal
QCA	Qualitative Comparative Analysis
RPCL	Rusumo Power Company Limited
RRFP	Regional Rusumo Falls Hydroelectric Project
SOGED	Diama Dam Management Company
SOGEM	Manantali Dam Management Company
SRB	Senegal River Basin
SWRA	Strategic Water Resources Analysis
TBWRM	Transboundary Water Resource Management
TECCONILE	Technical Cooperation Commission for the Promotion & Development of the Nile
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
USD	United States Dollar
WB	World Bank

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Abstract

Transboundary water resources management emerges as a difficult and explosive topic because of the conflicting interests of the involved parties known as riparians. This study examines how river basins address these conflicting interests by a closer inspection of the practices in the Nile River Basin as compared to the Senegal River Basin. The study uses a comparative study design with in-depth qualitative analysis of selected hydrological, political and socio-economic as well as developmental cases along with interviews to identify the factors that have been influencing the cooperation processes in the Nile and Senegal River basins. Upon arguing that the compound effects of hydro-ecological phenomenon, legal regimes, historical beliefs and unilateral actions of the riparians, the study has put forward some recommendations aimed at striking a ‘win-win’ solutions that could pave the way for the Nile riparians to come to a cooperative framework. These include, among others, focusing on benefits sharing than water allocations, focusing on scientific or technical issues than political, contest the legitimacy of the old-regimes through re-negotiation of Cooperative Framework Agreement (CFA) with Egypt and Sudan, and challenging power relations in the basin.

Key words: Nile River Basin, Senegal River Basin, Transboundary waters management, Water cooperation

Chapter One

Introduction

The role of water in the nature is very fundamental, which makes it to be called as the blood of the ecosystems of the planet Earth. This delineates water as an essential resource (Ayaa, 2012), interwoven in the various functions of the nature and the human society in countless ways making it one of the most complicated sources of challenges of the mankind (Varis et al., 2008). Simultaneously, the global water demands have increased with steadily growing world population and the subsequent rise of various types of human activities. Notwithstanding the importance of aqua, Abukhater (2013) claims that throughout human history, water has created a great deal of dramatic disputes between many conflicting demands and users. However, there's no denying that humankind's never-ending pursuit of better living conditions will mean that freshwater needs will only increase for the foreseeable future. Ultimately, the issue remains intense due to the fact that water transcends all political boundaries (GIZ, 2011).

As many Latin-rooted languages demystify, shared water resources have always been a potential cause of conflict. According to Tayia (2019), even the term "rival" comes from the Latin word "r̄iv̄alis," which means "rivus," and that translates as "river stream," and describes someone who uses the same river stream as another. Significant study interest has been sparked by the complexity of developing disputes, the growing importance of water resources shared across national borders, and the underlying resource management techniques. The underlying issues demand that water be viewed within a comprehensive development framework due to a combination of demographic, political, social, environmental, technical, and economic forces (Varis et al., 2008). Thus, the choice facing these conflicting interests is to work together to manage the common resource responsibly and maximize its advantages, or to continue to wriggle. Given the fact that water is needed for both essential human needs and economic development purposes, yet it is limited in nature, particularly in arid regions. Hence, the management of transboundary water resources is a complicated process which presents policy-makers with complex geopolitical, economic, and environmental as well as supranational

challenges that are being amplified by exponential population growth, uneven economic development, and environmental degradation.

Therefore, the researcher has been inspired to evaluate how river basins address conflicting interests, by a closer inspection of the SRB as compared to the NRB. Moreover, the researcher examined conflict mitigation strategies used in the SRB in order to manage the shared water resources. This enabled to formulate an insight into the phenomenon by exploring practices used in addressing challenges of transboundary water resources management in the NRB, so as to help fill the gap and serve as an input for negotiable cooperation efforts.

1.1 Background of the Study

Water that is shared across social, political, or economic frontiers is referred to as transboundary water resources (Beach et al., 2000). International water conflicts are a difficult and explosive topic because of the complexity of man-made borders and the natural demarcation of the involved parties as upstream or downstream riparians. Nations compete for their fair share of water for various reasons (Mirumachi et al., 2016). The situation is further complicated by the fact that a large portion of major freshwater basins in the world fall within the jurisdiction of more than one nation (Uitto and Duda, 2002). According to the United Nations, approximately 40% of the world's population lives in river and lake basins that comprise two or more countries, and perhaps even more significantly, over 90% lives in countries that share basins (UN-Water, 2008). Varis et al. (2008) indicate that nearly 47% of the area of the world (excluding Antarctica) falls within transboundary basins, while nearly 60% of the area i.e. 20 countries in Africa; at least 80% of their total areas are within transboundary basins.

Eventually, transboundary water conflicts are widespread globally and give rise to significant regional and international challenges in the realms of politics, economics, environment, and society. Varis et al., (2008) in their book entitled: "Management of Transboundary River and Lakes" note that transboundary freshwater resources as the most complicated challenges of the mankind today inciting the potential for conflict. According to Varis et al., the main challenges of the 21st century are the need for the sustainable and effective development and management of the various transboundary water resources in full cooperation and agreement among the basin

countries so that they produce a "win-win" situation for all the parties involved. Amid this phenomenon, the United Nations expects that management of transboundary water resources to be one of the biggest challenges facing human development over the next decades (UN-Water, 2008).

Petrella (2001) as cited by Rahaman (2009) puts examples of transboundary water conflicts including Nile basin in Africa, Tigris and Euphrates in the Middle East, Aral Sea basin in Central Asia, Parana basin in South America and Ganges basin in Asia. However, water also acted as a deterrent to achieving peace and cooperation in contexts such as the Israeli–Syrian relationship over the Yarmouk, the relationship between China and Thailand apropos the Salween River, and the relationships among the newly independent states of the former Soviet Union over the Aral Sea (Postel, 1997). Similarly, there are many other examples that demonstrate the fact that water can be a catalyst for peace and stability, such as the 1960 Indus Waters Treaty between India and Pakistan and the Lesotho Highlands Water Project Treaty between Lesotho and South Africa (Abukhater, 2013), as well as the Senegal River Basin among four west African countries. In these cases, not only did water act as an incentive to achieving peace, but it also helped in avoiding tensions, building trust and confidence, and fostering mutual social and economic development.

Motivated by the vision of “pan-African unity”, Senegal, Mauritania, Mali, and Guinea realized that by working together to develop the Senegal River, they might benefit from it more than if they went unilaterally and at a lower cost to each nation. The Organization for the Development of the Senegal River (French: Organisation pour la Mise en Valeur du Fleuve Senegal (OMVS)) was then founded in 1972 by the three nations, except Guinea. It was also referred to as *l'espace OMVS*, or “a space within nations could cooperate.” The "Clé de repartition," which upholds the values of "solidarity," or support for one another in sharing development expenses, and "equity," or the requirements of the nation, serves as the foundation for decision-making (Dione, 2004). Contrary to the many unfolding transboundary water resource management issue, the Senegal River Basin (SRB) in West Africa has been a unique exception. The four West African governments of Mali, Mauritania, Guinea and Senegal are engaged in an experiment in international organization that is not only following the most advanced concepts of integrated river basin development, which may also afford a lesson in cooperation on a broad scale,

implying their joint organization as a text book example of an international river basin organization (Parnall and Utton, 1976).

Nevertheless, the Nile River, often described as the world's longest river spreading over 3.35 million km² basin wide, has been the source of life as well as of conflict for centuries (Wiebe, 2001). The basin connects 11 riparian countries, namely, Ethiopia, South Sudan, Burundi, Eritrea, Kenya, Democratic Republic of Congo, Rwanda, Tanzania and Uganda (upper riparians), Egypt and Sudan (lower riparians). Kinfu Abreham, who states the principal occupation of the people in the basin is agriculture, while pastoralism is a supplementary activity, in his article titled "Imbalance in Water Allocation Stability and Collaboration within the Nile Basin," argued that, the upper riparians have made little use of the river and confined to hydroelectric power generation (Abraham, 2006). However, hinged on bigoted old treaties the two lower riparians (Egypt more so) have exploited the Nile waters extensively both for irrigation and hydro-power (ibid). He ruled that the upper riparians have been the suppliers and the lower riparian the users of the Nile water. Aron T. Wolf, who is an expert on water resource management at the Oregon State University, says the Nile region is running out of water. And the people who have built their lives and livelihoods on a reliable source of fresh water are seeing the shortage of this vital resource impinge on all aspects of the tenuous relations that have developed over the years between nations (Wolf, 1996).

In contrast to this continuous transboundary problem in managing water resources in the Nile River Basin (NRB), the Senegal River Basin (SRB) has shown to be a unique case. In an international organization experiment that follows the most recent concepts of integrated river basin development, the governments of Mali, Mauritania, Guinea, and Senegal have joined forces. This could be a major cooperative learning experience, as their combined organization is a prime example of an international river basin organization (Parnall and Utton, 1976).

Given the fact that water is scarce in nature, especially in arid areas, it is required for both basic human needs and economic growth, nevertheless, Abukhater (2013) contends that there are more factors at play than only water scarcity that contribute to the persistence of water disputes in many regions. In order to lessen the negative effects of animosity and anger, he says it is more

about the absence of equitable agreements that control the distribution of contested water resources. Iyob (2011) therefore, concludes that policy decision processes are increasingly prioritizing the pragmatic, efficient, and equitable management of water resources.

1.2 Problem Statement

Due to the detrimental effects of climate change, industrial expansion, growing urbanization, and exponential population increase, it is anticipated that conflicts involving water would intensify (UN-Water, 2008). To address these intricate disputes over shared water resources, many riparian countries chose to negotiate to jointly manage river basins (Merrill, 2008). Therefore, an approach known as Integrated Water Resource Management (IWRS) has been used with varying degrees of success in several regions of the world, including the SRB countries that show regional cooperation for equitable utilization rather than conflicting over the shared resource. The NRB on the other hand, has historically served as an example of several transboundary water resources management issues, as demonstrated by inter-basin conflict, catastrophic floods, excruciating droughts, unstable political and economic development, and diplomatic disputes (Merrill, 2008).

The NRB countries have been involved in protracted, turbulent conflicts as "upstream" and "downstream" due to a variety of circumstances. Ethiopia and Uganda, two upstream countries, have long argued that they have a natural right to use the waters of the Nile River, using the concepts of "absolute sovereignty" or "limited territorial sovereignty" and calling for "reasonable and equitable utilization." Conversely, the downstream, Egypt and Sudan, argue in favor of the "limited territorial integrity" theory and insisted on their right to have the water resource protected by referring to the "do no harm" concept (Brady, 2015).

Interactions between the Nile riparian countries are also characterized by mutual distrust, intimidation, and competition. As Ethiopia and other upstream countries push for a cooperative institutional framework, Egypt opposed by maintains its hypersensitivity to any reduction or diversion of Nile's flow (Hefny and Amer, 2005). Egypt sees Nile as a life-sustaining umbilical cord mainly because 96% of its freshwater supply comes from the river (ibid). Yacob Arsano, in a paper titled, "Toward Conflict Prevention in the Nile Basin," presented at the "Fifth Nile 2002

Conference”, writes, “the development initiatives and the enormous potential of the water resources in upstream countries have been frustrated, among other things, by fear of strategically untimely conflicts with downstream riparians” (Abraham, 2006). The unsolvable “tragedy of the commons” has persisted in the basin because to Egypt's unwavering resistance to any alteration in the status quo regarding the Nile waters (Azarva, 2010). Similarly, Tesfaye Tafesse, in a keynote paper titled, “Cooperation Endeavors and Institution Building in the Nile River Basin: Opportunities and Constraints,” presented at the 1st Nile Basin Discourse Summit (NBDS) 2017, writes; “non-cooperation has remained the Nile modus operandi for too long due to the divergent interests of upstream and downstream states” (Tesfaye, 2017). As to him, in the NRB there have neither been commonly agreed views on how the Nile waters should be equitably and reasonably used nor had there been attempts to develop common views and come up with collaborative solutions on sharing the resource. Thus, Yacob (2007), observes possibility of conflict, where every riparian may experience increased demand as well as a duty to make the most use of its water resources.

When the SRB experience is beyond a political success, in conflict resolution aligned with cooperative approach in water negotiation in general, but according to Dione (2004), it also success in contributing to poverty reduction. While the basin sets good example in crafting and developing institutional framework of cooperation the countries further move towards a closer regional integration. Eventually, to address the potential for conflict the SRB riparian countries employed a number of methods towards practical cooperation concepts in water negotiation in general. However, as Brady (2015) notes in the context of the NRB, historically, the competing interests of nations upstream and downstream have polarized ties and created inter-regional friction, which has hampered cooperation efforts. Azarva adds that despite decades of work, there has been no progress in building stronger confidence and collaboration among Nile riparians with the ultimate goal of completing a fair and all-encompassing treaty regime, which has left the basin unreachable. The NRB's turbulent hydro-political environment presents significant obstacles to achieving cooperative effort.

Hence, the researcher assumes a vacant room for the NRB countries, governments, existing institutions and policy makers to grab a workable path from the cooperative successes achieved in the SRB, in moving the West African countries toward closer regional integration. Moreover,

from the researcher's reading comparative researches of such kind between the two river basins have not been widely addressed, and with this study the researcher intends to contribute on ways to make positive progress towards lowering the impasse among the NRB riparian countries through important practical lessons driven from the SRB.

1.3 Objectives of the Study

The major objective of this study is to draw lessons in building effective cooperation on transboundary water resources management, and the methods used in conflict resolution with reference to the NRB and the SRB.

More specifically the study has the following objectives:

1. To discuss key drivers of changes towards cooperation in both NRB and SRB.
2. To analyze methods used in conflict resolution lessons and parallels that can be extrapolated to benefit the practice of cooperation in the NRB's water negotiation in general.
3. To examine the experience of crafting and developing institutional framework of cooperation on both basins.

1.4 Research Questions

To serve its purpose the study in essence, seeks to explicate three key questions:

RQ1: What are the key drivers of changes towards cooperation in NRB and SRB?

RQ2: What are the lessons and parallels that can be extrapolated to benefit the practice of cooperation in water negotiation in SRB, and their policy implications?

RQ3: What are the experiences of crafting and developing institutional framework of cooperation on both basins?

1.5 Scope of the Study

The overall research agenda and scope of this study are delineated on trends of cooperation among NRB and SRB countries in general. More specifically, geographically this study aims to engage with methods and approaches from the planning and implementation of cooperation and their control factors among the two river basin countries while incorporating concepts and debates from other disciplinary approaches. SRB is selected to serve the comparison with NRB on the basis successful cooperation model for transboundary water resources management. Methodologically, to be able to select adequate cases that are not only relevant to the scope of this study, but also representative of other important cases in different contexts around the world, a number of methods will be utilized systematically. By relying on a systematic review of the available published documents such as empirical studies, treaties, online databases, along with water expert interviews, and other secondary sources of data, the first-cut selection has been used in identifying and reviewing candidate cases, five of which are selected for more in-depth analysis.

1.6 Limitation of the Study

The scope and approach used in this study has its own limitations that need to be highlighted. Given that it is outside the scope of this study to investigate every potential objective and subjective arguments offered for each phenomenon, and its players in the analysis, the researcher analyzed only relevant documents and notes related to the topic in the NRB and the SRB, and there are certain limitations attached to this methodology.

First, although both river basins flow within the African continent, however comparing the two river basins, which have distinct hydrological, geographical, social, and political characteristics, has its own limitations to multilateral water negotiations. Second, given the significant number of riparian states involved among the two river basins, selection and identification of cases made SRB as the most successful, whereas NRB to be the least successful in terms of cooperation and equitable utilization. For that matter the selection of specific cases may be exceptional and may not be entirely representative of another context. Third, interviews were time consuming,

especially among key officials from both basin institutions identified or assigned, while there was also limitation in getting adequate empirical data from SRB.

1.7 Significance of the Study

This study has been conducted in 2022 and 2023 during which time the issues relating to water management and cooperation in the NRB was evolving mainly in connection with Ethiopia's mega hydropower project on Abbay (Blue Nile) river – the GERD. Given the shift towards unilateral water resources development among the NRB countries due to rising socio-economic factors such as population growth and demand for economic development this study is of considerable significance. By examining existing transboundary water resources management practices this study tried to provide evidence to support the claim of cooperation through critical assessment of cases from the SRB.

Accordingly, this study would have key significance suggesting that the essential practices employed in SRB can be used as a platform to induce cooperation over multiple geopolitical issues, to address budding conflicts, and eventually commissioning the development win-win and sustainable cooperation among NRB countries; whereby it can help policymakers in all basin countries seek and draft more acceptable water agreements by tying local concerns with overall national and international policies. Thus, the main premise of the study is that water could be used as a catalyst for peace and cooperation as well as for economic development rather than conflict among NRB countries.

Eventually, this study could help to contribute to the many endeavors to break the vicious cycle of non-cooperation and poverty among NRB countries. Overall, the immediacy and evolving nature of this study helps policymakers and national governments understand the range of future cooperation for the NRB countries, and point to reasons why these states are making unilateral movements right now. Findings could help lobby policy makers, governments and organizations as well as offer insights on how to maximize win-win cooperation in NRB. Moreover, this study can be used to aid research on determinants of cooperation and conflict in the NRB that currently remain largely inconclusive.

1.8 Organization of the Study

The research report is organized in to five chapters as follows:

The first chapter provides a general introductory overview of the research problem and the basic questions under investigation, objectives, hypothesis, significance and scope of the study. The second chapter presents detailed literature reviews of contextual analysis of the relevant publications and discusses the implications for transboundary water resources management. Under the third chapter, the study has composed the methodology used to conduct the research in the form of research design, participants, and sources of data, tools and instruments employed in the data collection, procedures of data collection and methods of data analysis. The fourth chapter focuses mainly on a detailed descriptive analysis of the views and attitudes of the participants and cases solicited influencing negotiable cooperation to bring successful shared water resources management. This section uses extensively an analysis of literatures reviewed in the two river basins covered by this study and views of experts. A summary of the study's findings, conclusions, recommendations, and limitations is given in the fifth and final chapter, with an emphasis on what the NRB should do to encourage a cooperative resolution of current conflicts among Nile riparians. The part ends with a consideration of the likelihood of a shift toward cooperation in the near future, as well as the main obstacles and opportunities for communication and cooperation, based on the findings.

Chapter Two

Literature Review

This chapter serves as a theoretical and epistemological underpinning for the study by outlining the scholarly contribution in light of a critical evaluation of relevant literature. By focusing on what has been written about transboundary waters in relation to cooperation, conflict, power and perception, and equitable utilization, the researcher provides an overview and analysis of the different bodies of literature that tackle the issue of transboundary water resources management and conflict resolution in general, and equitable allocation concepts and measurements in particular. Moreover, by describing and analyzing relevant previous studies, the researcher draws conclusions about the effectiveness of each approach introduced by different literature in order to formulate a rigorous research agenda that avoids their shortcomings and drawbacks and further builds on their foundation. Although far from an all-encompassing review, this chapter nonetheless provides an anecdotal review and critique of selected publications that has attempted to discuss the issues of transboundary water resources management.

2.1 Conceptual Framework

The enquiries and analysis of this study is guided by a number of theories and concepts related to the overall topic of striking cooperation in the context of transboundary water resources management. Getting to understand the position of cases and respondents in relation to this theme helps in framing the underlying motivations, beliefs and values that will justify a certain position – either favorable or unfavorable – with regards to dialogue and negotiations over transboundary water resources management. Therefore, this section helps to identify factors for success, principles, and essential qualities in practical contexts and evaluates lessons learned from cases in the SRB to make inferences about appropriate processes of cooperation. Ultimately, this section aims to develop a conceptual framework for investigating this issue, monitoring implications, and recommending a transformative approach to conflict resolution, applicable to the context of the NRB.

The framework for analyzing key cooperation outcomes adopted in this study has been grounded in three elements, namely; (1) Potential for conflict or cooperation; (2) “Agreement” (institutions and regime); and (3) Implementation and its effects or outcomes (Mostert, 2010). In this context conflict and cooperation can be analyzed as a cyclical process (Figure 1); starting with the potential for conflict or cooperation, which is determined by the hydrological, socioeconomic, institutional, political and historical contexts. The next will be the initiation of negotiations, which can be analyzed in terms of the contexts, mentioned above, the parties involved – including influential “observers” – and the strategies they employ (Shamir, 1997). When successful, negotiations result in an agreement, which can take a number of forms, including a treaty, or a shared cultural practice. It can be analyzed in terms of the “institutions” or “rules of the game” that the negotiating parties or river basin states establish (Ostrom, 1990). Finally, as negotiations may fail to produce agreement, the potential for conflict or cooperation does not always result in negotiations.

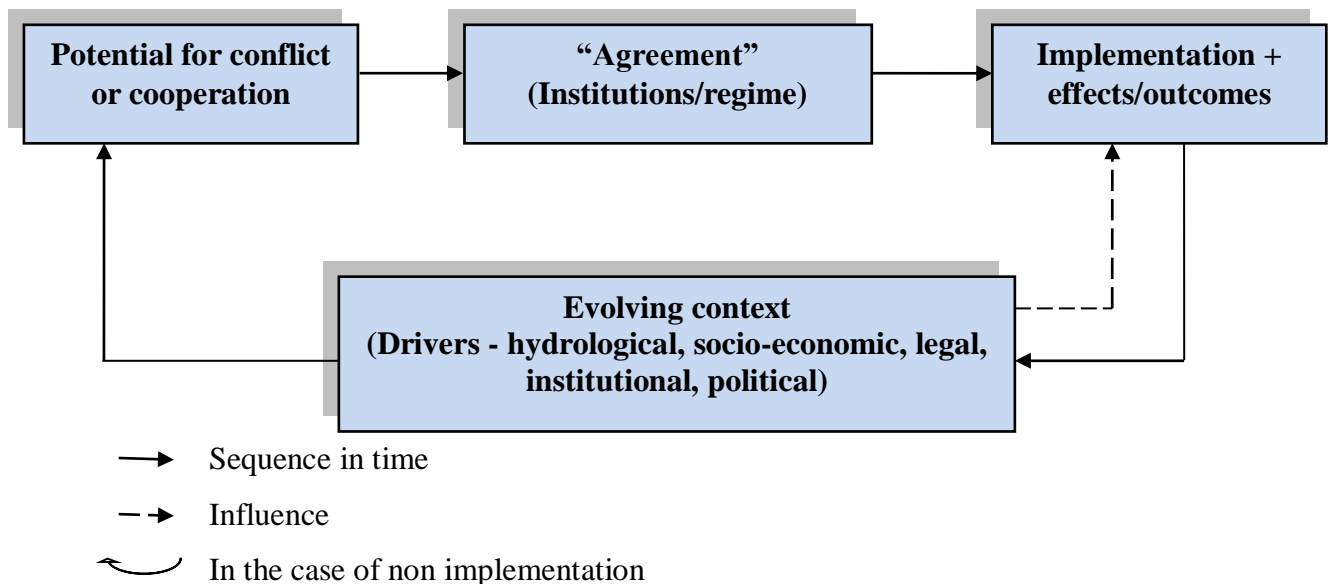


Figure 1: The conflict prevention and cooperation process/logic model (excluding serious escalation); adapted from (Mostert, 2010).

Each of the key elements are analyzed based on the extent to which they conform to the overall parameters of cooperation outlined in the conflict prevention and cooperation process or logic model, and on how well they support hydro-stability for all parties involved in the diplomatic

efforts. This helps to provide a comprehensive analysis of each river basin cases and their major implications for the theories of negotiated cooperation. By drawing lessons and parallels that help break logjams created by intransigent position-based negotiations, according to Innes and Booher (1999), cited by (Abukhater, 2013); the resultant agreements are more likely not only to be fair from a distributive justice standpoint, but also to be regarded as fair from a perceptual standpoint. It will be shown that the two cases differ in how the shared waters negotiation processes have been going, and by which outcomes were reached and implemented, or are unable to be implemented.

It has shown that the two river basins differ in how cooperation was dealt and in the negotiation process by which outcomes were reached and implemented. Although the two cases have similarities and differences with regards to the influence of colonialism and the existence of hostility at the time the states entered into negotiation, the SRB management was successful in focusing on the benefits of water rather than on volumetric water allocation itself. Moreover, unlike the NRB, the SRB involves key stakeholders together in a multinational effort to reach a comprehensive management of the basin water resources. The case study comparison will also show how important it is that riparian states consider extreme hydro-events, proactive public involvement, and third-party mediation, for example to ensure success in acceptance of outcome, implementation, and therefore hydro-stability. These and other lessons learned from the cases set the stage for the development of a set of critical elements that are deemed essential in transforming transboundary water resources management from a non-cooperative to a cooperative state, which is outlined in this study and referred to as a “transformative approach to cooperation.

2.1.1 Tranboundary waters and related core concepts

Tranboundary waters or international water systems are often used interchangeably with similar meaning of their nature. The 1997 UN Convention puts “international watercourse” as a watercourse, parts of which are situated in different countries (UN, 1997). Similarly, the 2008 UN law of transboundary aquifers defines “transboundary aquifer” or “transboundary aquifer system” as an aquifer or aquifer system, parts of which are situated in different States (UN, 2008).

Wolf (2007) also defines “international watercourse” as a water course, parts of which are situated in different states or nations, whereas; “watercourse” are a system of surface and underground waters constituting by virtue of their physical relationship a unitary whole and flowing into a common terminus. To this end it is important to understand that nearly half of the global available surface water is found in 263 international river basins, and groundwater resources, which account for more than one hundred times the amount of surface water, cross under at least 273 international borders eventually making them transboundary waters (Jägerskog et al., 2009).

2.1.1.1 Hydropolitics

The term hydropolitics was first coined by John Waterbury in his book “Hydropolitics of the Nile Valley” (Waterbury, 1979). He implicitly defines hydropolitics as the study of inter-state politics regarding the management of shared water resources, in order to respond to a question “how can sovereign states, pursuing national self-interest cope with the challenge of bi- or multinational coordination in the use of a common resource?” In a broader and more comprehensive interpretation (Meissner, 1998) portrays hydropolitics as the “systematic investigation with respect to the interaction between states, non-state actors and a host of other participants, like individuals within and outside the state, regarding the authoritative allocation and/or use of international and national water resources”. From Meissner’s perspective, hydropolitics is not limited to certain actors but entangles both state and non state actors, both internal and external to the basin. Furthermore, hydropolitics is not limited to water resources crossing (or forming) the border between states; it also includes those flowing within national boundaries (Geneva, 2021). Thus, the comprehensive definition of hydropolitics is more than the conflict or cooperation dichotomy: it is an analysis of the many ways heterogeneous actors interact over water.

2.1.1.2 Power shifts

Marit Brochmann in her paper titled: “Signing River Treaties – Does It Improve River Cooperation?”, argues that state power has an effect on cooperation among riparian states (Brochmann, 2002). Anna Cascão supports this theory, specifically with regards to the Nile River (Brady, 2015). Cascão argues that Ethiopia’s challenge to the Egyptian hegemony with counter hydro-hegemony is due to shifting power dynamics (Cascão, 2008). According to Cascão, power relations represent the cornerstone of the analysis of hydro-political relations.

2.1.1.3 Water Stress

Falkenmark (1989) takes the attribution to have coined the term “water stress” through the “Falkenmark Water Stress Index” that measures the scarcity of renewable freshwater in an arid and semi-arid environment, a situation that leads to intense socio-political pressures. According to Falkenmark (1989) threshold, a country is said to be experiencing water stress when water availability is below 1,700 m³ per person per year; below 1,000 m³ is considered water scarcity; and below 500 m³ is absolute or severe water scarcity. Water stress occurs when water demand exceeds the available amount during a certain period (Roy, 2022), and areas with low rainfall, high population density or intense agricultural or industrial activities exhibit high frequency to water stress. Seasonal variations in the availability of freshwater may also cause stress despite sufficient long-term freshwater resources (ibid). Kristin Wiebe states that as water stress becomes water scarcity, more water projects will be planned and constructed, increasing discord between riparian countries (Wiebe, 2001). Many scholars theorize that increasing water scarcity density creates conflict in transnational basins (Bernauer and Böhmelt, 2014).

2.1.1.4 Economic factors

As to Kalbhenn (2011) argument of liberal theory of cooperation that economic linkages between states lead to cooperative water relations. However, Brady (2015) takes fact that there is no data suggesting an increase or decline in economic linkages between Nile River Basin states that correlates with changes in the level of cooperation among them. Rather economic incentives were influential in the basin. Yet Brady says the changing landscape of international financial

structures, particularly the rise of China as a ready donor for large-scale development projects such as dam creation, created economic incentives for upstream states to develop the Nile.

2.1.1.5 Relations among basin states

According to the Gravity Model utilized by Brochmann and Gleditsch (2012), it suggests that state proximity is positively correlated with conflict. However, Brady (2015) rules in the case of the NRB, and water conflicts in general, that this model proves false. Different researchers have also say that general conflict tends to increase between states with higher levels of proximity, but the inverse tends to be true for water-driven conflict (Yoffe et al., 2003). Therefore, Yoffe et al., state that geographic proximity actually increases instances of friendly behavior for cooperation over freshwater.

2.1.2 Water conflict and cooperation

A global review on conflict and cooperation in international freshwater management by Mostert (2010) puts water to play a number of different roles in international conflict and cooperation. Frank Marty, who pointed freshwater as the most valuable and fragile of the earth's life-supporting substances, identified three types of international water issues in the 2001 book titled; *Managing International Rivers. Problems, Politics and Institutions*, (Mostert, 2010) namely;

- (a) **Collective problems:** Issues in which all countries concerned have similar interests, such as the ecological restoration of an international lake and the joint development of a boundary river.
- (b) **Negative externality problems:** Actual or proposed activities in a country that have negative effects on another country, such as upstream water diversions and water pollution.
- (c) **Positive externality problems:** Activities in a country that would benefit another country, such as the construction of a dam that would reduce flooding downstream.

Water issues become so much more complex and political due to national boundaries (Jägerskog et al., 2009). In this regard Mostert (2010) concluded that conflict is most likely with respect to negative externality problems and cooperation is most probable in the case of collective problems. And yet for him even in the context of pure negative externality problems, cooperation may develop if the countries concerned wish to develop or maintain good relations. With respect to pure collective problems Mostert indicated that conflicts may develop because of poor international relations, mistrust or factual controversies.

Moreover, people cooperate within multiple, overlapping, and occasionally conflicting scales of social interaction, and they often do so in ways that are inconsistent with canonical models of rationality and self-interest (Carballo, 2012). The structure of cooperative undertakings, however, is segmentary, nested, and fluid, with the result that individuals who cooperate as groups in certain settings may be adversarial in others. Hence, Carballo acknowledged that this segmentary structure and the tensions inherent in reconciling individual and group interests pose dilemmas for sustaining cooperation, which has been analyzed within domains as diverse as treaties between sovereign nation-states, ethical codes established by enemies engaged in trench warfare, community managed irrigation systems, and household recycling.

In the sense of ultimate causality, the developmental and comparative psychologist Michael Tomasello (2009), argues that mutualism among early human ancestors was the primary selective pressure affecting the evolution of our faculties promoting cooperation (Carballo, 2012). Tomasello defines collaboration for mutual benefits as a phenomenon of cooperation, of which altruism is another. Accordingly, Carballo summed up definitions of cooperation involving mutualism find wide support within many disciplines, but definitions of altruism vary greatly, with some researchers questioning whether “pure” altruism, involving a cost with no payoff, actually exists.

2.1.2.1 Cooperation

For the purpose of this study, a broad definition of “cooperation” is used within the framework of existing UN Convention and treaties. Accordingly, the UN Convention on the Law of

Transboundary Aquifers, cooperation is implied as providing notice of potential projects which may have impacts, exchanging information and conducting dialogue with the “view to arrive” at a negotiated compromise or agreement mutually satisfactory for all parties (UN, 2008).

The UN framework says that transboundary cooperation is meant to enable member states to improve their institutions, strengthen professional capacities and develop regulations for the sustainable management and environmentally sound protection of transboundary aquifers. The UN law also abides transboundary river basin member countries to cooperate on the basis of sovereign equality, territorial integrity, sustainable development, mutual benefit and good faith in order to attain equitable and reasonable utilization and appropriate protection of their transboundary aquifers or aquifer systems, (UN, 2008).

It is assumed that shared water resources can actually provide the basis for cooperation and sharing of benefits, rather than conflict, provided that the threats to the international waters are objectively recognized and institutional structures for collaboration are created. Wolf (2007) noted that shared water provides compelling inducements to dialogue and cooperation, even while hostilities rage over other issues. Nevertheless, Wolf pointed out that noncooperation costs result primarily in inefficient water management, leading to decreasing water quantity, quality, and environmental health, while at the same time political tensions can also be impacted, leading to years or even decades of efficient, cooperative futures lost.

For the fact that water is the only scarce resource for which there is no substitute, however it ignores political boundaries, fluctuates in both space and time, and has multiple and conflicting demands on its use. Thomas et al. (2016) in their study indicated that cooperative interactions over international rivers require engaging in a complex network of environmental, economic, political and security interdependencies. Therefore, Uitto and Duda (2002) saw the essence of the argument in terms of transboundary water cooperation among countries and between the various actors within each need to be based on solid science and a factual analysis of the problems and opportunities, their potential solutions and shared benefits arising from the alternative solutions.

2.1.3 Dogmas of water wars

Wolf (1998) saw "water" and "war" to be the two topics being assessed together with increasing frequency. However, to his argument the problems of transboundary water management are compounded in the international realm by the fact that the international law that governs it is poorly developed, contradictory, and unenforceable. More explicitly, Tvedt (2010), categorized the general 'theory' of 'water war' on two grounds – first, as a mechanical misunderstanding of the relations between resource scarcity and conflict, and between climatic change or predictions and the form of social and political adaptations on one hand and, secondly, for the matter that very few examples can substantiate the hypothesis and quite a number of cases can falsify it. Yet, although the alarmist 'water war' dogma must be rejected, argues Tvedt that there have indeed been water wars in the past.

Although many people fear that the wars of the 21st century will be over water, a competing theory of Wolf (1989) has however recently become popular which casts optimism that instead of leading to war, water will fuel greater interdependence among states. Wolf backed his argument on a later publication, saying that shared water does lead to tensions, threats, and even to some localized violence let alone to war (Wolf, 2007). These tense situations which Wolf (2007) dubbed as "flashpoints" rather induce the parties to enter negotiations, often resulting in dialogue and, occasionally, to especially creative and resilient working arrangements. Even though Wolf, indicated that few historical examples of such water related wars exist, but those conflicts falling short of a war have occurred frequently, and that 'water and river basins are [rather] pathways to peace'. Tvedt (2010) supported this point where coming together to manage shared water resources will prevent conflict and build trust even in otherwise conflict-ridden areas. This reassuring argument refers to 'historical lessons' that interstate war is unlikely, it is said, because for thousands of years there have in fact been no wars specifically over water resources, and the evidence shows that water interdependence does not lead to war. The real problem, according to this way of reasoning, is that the provocative rhetoric that politicians aim at their own constituencies can antagonize their neighbors (ibid).

2.1.4 Equitable and reasonable utilization

Zeitoun and Jägerskog (2011) see equitability in transboundary water management as a key to effective cooperation. However, operationalization of the concept of cooperation for equitable utilization, which is seemingly context specific, presents a definitional challenge. To that end, it is necessary to formulate concrete yet flexible and adaptable parameters of cooperation process in terms of parameters of treaty formation, which are a moving target themselves, to be able to evaluate the impact of a cooperation policy-development approach, or lack thereof.

Mandating river basin states to establish joint mechanisms of cooperation, the UN Convention (2008), sets a number of factors to be taken into account so as to ensure utilization of a transboundary aquifer or aquifer system in an equitable and reasonable manner; such as, the population, the social, economic and other needs, present and future, the natural characteristics, the contribution to the formation and recharge, the existing and potential utilization, and its effects of the aquifer or aquifer system in one aquifer State on other aquifer States concerned, the availability of alternatives to a particular existing and planned utilization; the development, protection and conservation of the aquifer or aquifer system; and the role of the aquifer or aquifer system in the related ecosystem.

Despite the weight to be given to each factor is to be determined by its importance with regard to a specific transboundary water system in comparison with that of other relevant factors, states the law that it puts that all relevant factors are to be considered together and a conclusion reached on the basis of all the factors in determining what is equitable and reasonable utilization. However, the law also stipulates that in weighing different kinds of utilization of a transboundary waters, special regard shall be given to vital human needs.

2.1.5 Obligation not to cause significant harm

The UN Convention urges river basin member countries take all appropriate measures to prevent the causing of significant harm among each other in utilizing transboundary water resources in their territories, while taking, all appropriate response measures to eliminate or mitigate such harm in consultation with the affected member country (UN, 2008)

2.2 Theoretical Framework

This theoretical framework intends to support a theory of the study mainly by addressing why the research problem exists. One of the most vexing questions surrounding this topic involves different dimensions of cooperation that extend across a wide continuum of disciplines including economic, political, environmental, technical, cultural, and social aspects. Therefore, drawing upon a greater number of disciplines and investigating prior and contemporary theoretical frameworks that are applicable to the topic is critical to enhance the applicability of the findings and inferences to a vast spectrum of fields.

2.2.1 Collective action theories

Researchers discussing “collective action” tend to emphasize more proximate, historically contingent causes, rather than cost-benefit matrices. They think in terms of large human groups with marked differences in power, wealth, and hierarchy; and favor the compilation of case based surveys as an analytical method, argues (Carballo, 2012). Tved, who have seen the limitations of the theory of collective action tried to incorporate the idea which holds that when rational individual behavior and companies’ profit-seeking fail to provide public goods, the common or shared interest of a group might enable collective action. Mancur Ohlson, in his famous model of the ‘rational’ individual questioned this willingness to cooperate, and put that for all types of social activity, when people can benefit from cooperation without contributing to it, they will do so (Tvedt, 2010).

Therefore, when analyzing collective action in river basins in general, Tvedt, puts these abstract and generalized models to have shown their limitations due to that throughout history, transboundary rivers physical character has continually created widely different possibilities for human adaptation and action along its course. Therefore, Tvedt says the physical context cannot and should not be compared to the abstract context or idea of a market. He further pointed out that if the riparian states are regarded as a group, the issue of the ‘free rider’ does not arise since benefits and costs are not allocated by market forces, but are partially affected by factors that individuals can neither create nor control, including the physical character of the river, the

history of the river and river control works in each country, and the existence and relative importance of other water resources that can be exploited by the same actors.

Garrett Hardin's influential article "The tragedy of the commons," Hardin (1968), puts institutions, or the apparent lack thereof, at the center of academic and policy debates on the management of common pool resources. Common pool resources are defined as "natural or humanly constructed systems that generate a finite flow of benefits, in which: (1) exclusion of beneficiaries through physical and institutional means is especially costly; and (2) exploitation by one user reduces resources availability for others," (Suhardiman et al., 2018). Thus, theoretically, the latter characteristic is often referred to as "subtractability" or the "zero-sum principle." For Suhardiman et al., (2018) managing water as a common pool resource is predicated on the process of rule-shaping. Because that is how various actors negotiate the rules on paper and in use, what Swyngedouw (2009) highlights as part of the socio-political construction of nature. Whether it is for irrigation, hydropower, fisheries, and/or watershed protection, water governance is shaped by myriad actors with diverse interests, strategies, and access to resources.

2.2.2 Theory of power asymmetry and hegemony in transboundary relations

The transboundary water management literatures have identified the role of asymmetric power. Politics, power structure, and relationships have been identified as important factors by water governance scholars in shaping common pool resources, primarily in the context of irrigation system management hydropower development (Suhardiman et al., 2018). Scholars like Zeitoun and Warner (2006), in particular, clarified the structural role of power in a basin. They posit that relative power differences can cause various forms of hydro-hegemony. According to their "Framework of Hydro-Hegemony," if a basin state with superior power acts for the collective good of the basin, there is leadership in this form of hydro-hegemony (Mirumachi et al., 2016). On other hand, if the hegemon captures and controls the water resources or coerces other states to produce situations that are beneficial to it only, there may be skewed water allocation outcomes. Zeitoun and Jägerskog (2011) see that in regions where the basin hegemon has enabled 'positive' interaction between the actors, approaches to both influencing and challenging power asymmetry show to have some degree of success. According to them, this eventually

indicates basins where the hegemon is leading ‘negative’ transboundary interactions; neither the influence nor challenge approach has proven effective. They pointed that failure to engage the basin hegemon constructively will hamper effective cooperation on transboundary waters.

Zeitoun and Jägerskog suggest an analytical method to help transboundary water initiatives respond to power asymmetry (Jägerskog et al., 2009). They note that the most powerful riparian is often able to determine the outcome of the transboundary water interaction, either for unilateral gain or the collective good. There are two options: either find ways to strengthen the weaker players, or level the playing field. Similarly, Zeitoun and Warner (2006) came up with what looks favorable from a hegemonic perspective may not always be perceived in the same manner from the weaker state’s vantage point. Mirumachi thus noted the importance of understanding that transboundary water relations evolve under circumstances of asymmetric power. For Mirumachi effective international adaptive management or integrated water resource management is not possible without taking into account the dynamics of power.

Zeitoun and Jägerskog say existing power asymmetries that prevent equitable outcomes or processes can be confronted through strategies to either ‘influence’ or ‘challenge’ them. Approaches to influence powerful actors include matching interests or encouraging transformation. Accordingly, they put options to challenge power centered on strategies by building capacity in weaker actors to ‘level the players’ or through ‘leveling of the playing field’ through emphasizing international water law. Thomas et al., (2016) see the challenges of power asymmetries to impede cooperation through competing factors. This, they say it depend on decision makers perception with the risks associated with their actions as well as the risks associated with the actions of neighboring states in an ever-changing context.

Other studies have also affirmed that imbalances in power relations impede cooperation (Thomas et al., 2016). This may be the case when an upstream country is also the most powerful. Meanwhile, in a case where the most powerful country is located downstream, the power asymmetry may force a less powerful upstream country to avoid a resource-capture strategy; such as building dams and diverting water without discussions with and compensations for downstream countries, and engage in negotiations to avoid sanctions. Whereas, Lautze et al. (2005) note the significance of a basin’s geostrategic importance, global paradigms in water and

environmental management, a perceived religious or cultural affiliation, for recognition of the potentially conflictive nature of transboundary waters. Ho (2017) sees that large infrastructure can shift power asymmetries at the basin level in complex ways, modifying incentives to participate in river basin institutions, as well as opportunities for cooperation. It is indicated that new cooperative institutions and approaches to benefit sharing may become viable as a result of infrastructure development.

2.2.3 Theory of power and poverty in transboundary water management

Hinged on the preceding discussion of power asymmetry transboundary water management has strong relationship with power and poverty. Zeitoun and Jägerskog (2011) see the contribution of effective transboundary water management to poverty reduction. They recognized that transboundary water management efforts undertaken to meet traditional transboundary water management objectives may indirectly benefit poorer segments of society, where cooperation over shared rivers can, for example, result in more sustainable river use and may lead to higher agricultural yields over the long-term, perhaps, thus contributing to the farmers livelihood and their families income. While much of the support to transboundary water management is not intended to directly alleviate poverty, Zeitoun and Jägerskog suggested that its effect within the broader political context can contribute indirectly to it.

Amid stiff competition for control of water growing demands for goods, services and economic growth are also increasing the pressure and competition for water resources at the regional, national and local levels. In regions where water is shared, transboundary water issues become even more critical to development (Jägerskog et al., 2009), and therefore UN Water (2016) note that targeted water investments may contribute towards reaching growth and poverty alleviation goals more effectively. The management and development of shared water resources is an issue of immediate urgency for basin states which requires adequate investments in water management, infrastructure and services. That can yield a high economic return (UN Water, 2009).

Economic development, infrastructural capacity, or political orientation disparities between riparian nations add further complications to water resources development, institutions, and management (Wolf, 2007). Whereas, according to Jägerskog et al., (2009), limited access to

water can constrain development, particularly with the forces of climate change, population growth and prevailing economic conditions converging to add pressure on limited water resources. As a consequence, Wolf says development, treaties, and institutions are regularly seen as, at best, inefficient, often ineffective, and, occasionally, as a new source of tensions themselves. While, Jägerskog et al., (2009) note that effective water resources management and development can promote sustainable growth and poverty reduction.

2.3 Empirical Review

Although there are 263 international rivers which have been documented to affect about 40% of the world's population (Wolf, 1998), covering almost one half of the total land surface of the globe, and untold numbers of transboundary waters have been a cause of political tensions between Arabs and Israelis; Indians and Bangladeshis; Americans and Mexicans; as well as all riparian states of the Nile River Basin. This scenario makes the seriousness of growing demand on global freshwater resources (Brady, 2015), where, 2.7 billion people face water scarcity for at least one month out of every year, whereby 2025, more than two-thirds of the global population could suffer from water shortages. Africa is a land of transboundary waters, with international river basins covering fully 62% of the continent's land mass (Lautze et al., 2005).

2.3.1 Drivers and treaties in Africa

Agreements regarding governance of international waters serve not only to protect and promote sustainable development, but also affect security throughout an entire area (Paisley and Henshaw, 2013). These international agreements tend to stabilize and enhance security at the regional level, independent of the concrete ecological and economic benefits produced by such agreements (ibid). In many comparative instances, transboundary river management are similar among African states, which have a clear basin hegemon, and a majority of the states experience low levels of Gross Domestic Product (GDP) per capita (Lautze et al., 2005). The continent has a long history of transboundary water management and a voluminous body of transboundary water law, which at least partially regulates the use of many of its basins (ibid).

Lautze et al. (2005) define drivers as the goals and interests which lead to the formation of transboundary water accords; however they distinguish drivers from the actors who attempt to realize these goals or interests. Agreements relating to African transboundary water law are generally brought about through a combination of drivers rather than one single force. These drivers are divided as; internal and external. According to Lautze et al., internal drivers are those goals or objectives contained in transboundary water agreements; e.g., extension of basic water supplies, hydropower development to facilitate economic growth, or dam construction for irrigation projects. External drivers on the other hand are defined as those which are not explicitly contained in agreements but nevertheless wield substantial influence on the formation and orientation of treaties (ibid).

In Africa's transboundary water law treaties approximately two-thirds of African agreements concluded between or among colonial powers were in fact precipitated by non-water factors such as territorial division and recognition of traditional land use customs (Lautze et al., 2005). In this regard water-related interests constitute primary drivers in almost all transboundary water treaties involving at least one independent African state. Because of this fundamental differences, and more importantly because drivers of colonial treaties were primarily related to the concerns of now defunct colonial governments (ibid). Among a range of internal and external factors that have driven transboundary water law in Africa in the post-colonial period; internal factors include joint management, water development, and water sharing and division. Whereas; externally, they have included a range of factors emanating largely outside the African continent including geopolitics, the concept of hydraulic mission, cultural ties, international environment agendas, and global concern with water conflicts. Lautze et al. (2005) found out an evolutionary change in the way these external factors have influenced African transboundary water law. More importantly, both internal and external drivers must be considered by basin states and the outside actors if either is to achieve their objectives (ibid).

2.3.2 Key transboundary water management challenges in the NRB

Over 300 million people spreading across 10% of Africa's landmass, rely on the waters of the Nile, and population growth rates in the region are projected to soar (Salman, 2013). 70% of this population resides in the Nile basin, while much of them rely almost exclusively on the Nile

River as a source of fresh water, and Egypt, the most downstream country, has been the traditional user of the Nile, exploiting its waters almost exclusively (Khorbotly, 2003). Whereas, with significant increase in the demand for water among the Nile River Basin states – due not only to rapid population growth but also to expansion of economic activities and significant improvements in the ability of many of these states to utilize the Nile waters for productive activities, Knobelsdorf (2006) indicated that existing methods of exploitation and allocation of the Nile is leading to an escalation of tensions among the river's various stakeholders with the likelihood of open and widespread conflict.

Although the vast Nile basin represents one of the critical, and perhaps the most important, shared water basins in Africa (Khorbotly, 2003); however the absence of common ground led of many of the river basin states to argue that they should not be bound by what are essentially colonial impositions. As to Mbaku and Mukum (2010) the main bone of contention in NRB is that Egypt wants to bind the upstream riparian states to agreements that were concluded without their full and effective participation and which did not take the interests of these upstream riparian states into account. Since the vast majority of Egypt's rapidly expanding population lives in the Nile Valley; the Nile is essentially Egypt's only source of water (Eckstein, 2009), and the agricultural sector, which constitutes a significant portion of its economy. However, on other hand Ethiopia's population is growing at an even faster rate than Egypt's population, establishing a compelling need for increased food production and more extensive use of the Nile waters for hydro-electricity generation and agricultural purposes (Brunnée and Toope, 2002).

Far from being resolved, as to Azarva (2010), the myriad challenges that have plagued cooperation among the countries of the NRB for decades, and which have rendered the region a flashpoint for potential conflict, are today perhaps more pronounced than ever. Tadesse (2008) also note that many researchers had given little attention to or have no knowledge of the Nile as a source of conflict in the region, including the geopolitics and hydropolitics of the river that have exacerbated the conflict. He reiterates the confrontation between Ethiopia, Egypt and Sudan, in particular, has taken its toll in recent years. At its core, according to Azarva, the dispute centers on the competing narratives and needs of the river's upstream and downstream riparian states, and the struggle to bring management of the river in line with the principle of equitable

utilization, a lodestar of international watercourse law. Generally, the history of water rights at the Nile River can be investigated through three main periods of Egyptian history; the pre-colonial, colonial, and post-colonial periods (Abteu and Dessu, 2019).

i. The Nile River Treaties

Throughout historical events there were a number of protocols that sought to govern the utilization of the Nile waters either directly or indirectly. Before the enactment of the current Nile River Water Agreements the earlier agreements were made primarily between the colonial powers that had laid claim to different African territories (Mbaku and Mukum, 2010). Some of these colonial agreements include the 1891 Anglo-Italian protocol signed between Britain and Italy for the demarcation of their respective spheres of influence in Eastern Africa region. The former was representing Egypt and Sudan, while the later was representing Eritrea. Article III of this protocol sought to protect the Egyptian interest in the Nile waters contributed by the Atbara River, in which Italy committed not to “construct on the Atbara, in view of irrigation, any work which might sensibly modify its flow into the Nile” (Okoth-Owiro, 2004). Similarly, in 1902 Anglo-Ethiopian Agreement was signed in Addis Ababa between Britain and Ethiopia to settle the boundary between Ethiopia and Sudan. Article III of the agreement (Addis Ababa, 1902) stipulated that Ethiopia should not undertake any activities on the Blue Nile, Lake Tana or the Sobat that would interfere with the flow of water to the Nile which would negatively affect Britain’s cotton-growing interests in Egypt.

On the same track in 1906 a Tripartite Treaty was signed between France, Britain and Italy in London. This agreement specifically dealt with the allocation of water in the Ethiopian sub-basin with an article that called to preserve the integrity of Ethiopia and safeguard the interests of Britain or and Egypt (Okoth-Owiro, 2004). Then, in 1925, there was an exchange of Notes between Italy and Britain which delivered the Anglo-Italian Agreement signed in Rome. This agreement was purported to provide a structure for the allocation of the waters of the Nile, and eventually Italy recognized the prior water rights of Egypt and the Sudan in the headwaters of the Blue Nile and White Nile rivers and their tributaries and engaged not to construct on the head waters any work which might sensibly modify their flow into the main river. Had Italy not

agreed Mbaku and Mukum (2010) says Britain feared construction of any structures on the various rivers that fed into the Nile could severely constrain the flow of water into the Nile and, hence, negatively impact its agricultural interests in Egypt. Researchers observe that regardless of whether these agreements were concluded between colonial powers seeking to establish a sphere of influence, or with Ethiopia, (Okoth-Owiro, 2004) they had the common objective of securing recognition of the principle that no upstream state had the right to interfere with the flow of the Nile, in particular to the detriment of Egypt.

ii. The 1929 and 1959 Nile Waters Agreements

Two widely known agreements have been in place regarding the regulation of the Nile waters even today. These agreements are the 1929 Anglo-Egyptian Agreement and the 1959 Agreement between Egypt and Sudan, often referred to as the Nile River Waters Agreements. While the 1929 agreement has been the most controversial and quite influential in the management of the Nile River Basin (Okoth-Owiro, 2004), today's governance of the Nile River Basin was set by the 1959 agreement between Sudan and Egypt (Mbaku and Mukum, 2010). Therefore, these two protocols together formed the basis of the legal framework currently in place to regulate any activities related to the exploitation and allocation of the Nile waters.

Since the agreement was based on the outcome of political negotiations between Egypt and Britain in 1920s, and in particular on the report of the 1925 Nile Waters Commission, the interests of Sudan were put aside despite the fact that it was represented by Britain (Okoth-Owiro, 2004, Mbaku, 2010). Hence, the final agreement granted Egypt virtually unlimited control over the Nile waters to guarantee and facilitate an increase in the volume of water reaching its territory. Eventually, Egypt claimed the entire timely flow of the Nile waters river, and actually limited the ability of Sudan to access the river.

More specifically, the agreement (Treaty, 1929) gave Egypt the right to have full control of the river flow by monitoring Nile-related activities by upstream riparian states so as to ensure that they did not negatively affect availability of water to Egypt's agricultural projects, while allowed Egypt to veto any construction projects by other riparian states considered harmful to Egypt's

interests on the Nile. It required Egyptian oversight and approval of any irrigation, power or other water diversion project along the Nile. The agreement also assured Egypt that the government of Britain would not engage in any activities that would interfere with Egypt’s “historic rights” to the waters of the Nile. Nile’s average production of water was estimated to be roughly 84 BCM per year, and based on that, the 1929 agreement allocated 48 BCM per year to Egypt and 4 BCM per year to Sudan (Treaty, 1959). Even though the precise content of the rights indicated in the 1929 agreement was not elaborated, according to Okoth-Owiro (2004), the agreement expressed recognition by Britain, of Egypt’s “natural and historic rights in the waters of the Nile”. Although some Egyptian writers took the 1929 agreement as Egypt’s established rights over the Nile since antiquity; majority however, share the view that the agreement was a political matter that cannot be used as a precedent in international law.

Despite Egypt’s allotment with the bulk of the Nile waters in 1929, yet, the 1959 agreement stated shortcomings of the former agreement which it said provided only for the partial use of the Nile waters and did not extend to include a complete control of the Nile River waters. Accordingly, with the 1959 agreement Egypt increased its allotment to 55.5 BCM per year, while Sudan’s share was raised to 18.5 BCM per year. That allocation left only 10 BCM unallocated, primarily to account for seepage and evaporation (Treaty, 1959).

Position	Egypt (BCM/year)	Sudan (BCM/year)
Egyptian ¹	62.0	8.0
Sudanese ²	59.0	15.0
Nile Waters Treaty (1959) ³	55.5	18.5

Table 1: Nile Water allocations between Egypt and Sudan, (Wolf and Newton, n.d.)

¹ Egyptians assumed an average flow of 80 BCM/year and divided approximately 10 BCM/year in evaporation losses equally.

² Sudanese assumed an average flow of 84 BCM/year and deducted evaporation from the Egyptian allocations.

³ The 1959 Treaty allowed for an average flow of 84 BCM/year and divided evaporation losses equally.

While the 1959 agreement on “the full utilization of the Nile waters” between Egypt and Sudan remains the most comprehensive treaty that addresses sharing the Nile’s waters, (Khorbotly, 2003), it did not specifically mention the upstream riparian states. In order to effectively abrogate the rights of upstream riparian states; the two signatory states agreed to further strengthen their ability to control the river, by acting with one voice in facing any challenges posed by other riparian states to the allocation of the Nile waters. Another important component of the 1959 agreement was the formation of a Joint Technical Commission, which according to the agreement was tasked to make sure that if any upstream riparian state wanted to construct any structures on the Nile River, it had to obtain the permission of the two countries, as well as subject the project to mandatory oversight and supervision by the Commission set to be staffed with equal numbers of experts from the two states (Treaty, 1959).

iii. The Nile River Dilemma

The Nile Basin has witnessed several changes in territorial sovereignty over the years due to European occupation and decolonization as well as state succession, (Okoth-Owiro, 2004), where all the Nile Basin states, except Egypt and Ethiopia, were dependencies of various European powers. Accordingly, the Nile Water agreements concluded during the colonial era are not binding on the successor states of the Nile basin; therefore, Okoth-Owiro says that it is the position in international law as buttressed by the practice of the states. Ushered by continuous arguments several historical bilateral and trilateral treaties dating from the colonial era that addressed water allocation in the Nile River continue to be politically relevant to contemporary negotiations (Paisley and Henshaw, 2013). The colonial era treaties have been advocated by the most downstream countries, Sudan and Egypt, because those treaties predominantly benefited them. Bulto (2009) says without much benefit to the now nine upstream states the effect of these treaties is to generally try to freeze upstream projects to secure a continuous and undiminished flow of water to Sudan and Egypt. Mbaku and Mukum (2010) underscored that the 1929 and 1959 agreements were purported to bound upstream riparian states even though they were neither signatories nor participants in its development.

In order to maintain the status quo, Bulto says Egypt, and to a lesser extent Sudan, have adopted a view consistent with those treaties that they have an “historical” and “natural” right to the full volume of the Nile waters and that upstream states may not disturb that right by impeding or otherwise affecting that flow. However, for Ayaa (2012) there were still tensions between Egypt and Sudan as allocation of the Nile waters between the two states did not seem to work. Because Sudan felt it was being cheated. Since it has not been in Egypt’s best interest to enter into agreements that might adversely impact its access to Nile waters, (Mbaku and Mukum, 2010) concludes that the country’s leaders have been unwilling to revisit the Nile River Agreements or engage the upper riparian states in a more inclusive, participatory and competitive negotiation process to produce a legal arrangement that enhances the ability of all riparian states to maximize their national interests. Although it is not in Egypt’s best interest to enter into agreements that might adversely impact its access to Nile waters, Mbaku and Mukum (2010) note the change in dynamics in today’s NRB political economy, where each of the riparian countries lay some claim to the river’s waters. Unfortunately, according to Knobelsdorf (2006), the legal scheme that governs the exploitation and allocation of the Nile waters is a set of colonial era agreements, which effectively reserved virtually all of the Nile’s waters for Egypt and Sudan.

iv. Turbulence in the Nile

Just as the sensual aspects of the Nile River are constantly changing (Brunnée and Toope, 2009), agreements relating to the River have become increasingly contentious as upstream riparian states start claiming the Nile is theirs too. Today, virtually all the upstream riparian states have denounced the Nile River Waters Agreements as irrelevant, anachronistic and a major constraint to their national interests (Mbaku and Mukum, 2010), and demand that new, alternative and more accommodating strategies for the management of the Nile River waters should be developed and adopted. Despite the upstream states demand that the agreements be renegotiated or totally replaced with a more comprehensive, inclusive and relevant legal framework, however, Knobelsdorf (2006) indicates there does not exist within the region a mutually accepted, beneficial and enforceable institutional framework that can provide the legal structure for the efficient, equitable, fair and sustainable management of the Nile waters. Yet, quite a few

countries [Sudan and Egypt] want the existing colonial era agreements scrapped and new, more inclusive and democratic schemes created (Kendie, 1999b).

In direct opposition to Egypt's and Sudan's view is the view of Ethiopia, and to some extent, the other Nile riparian states. While Ethiopia, Egypt, Sudan, and Uganda are considered as influential states in the Nile River basin, (Brady, 2015) Ethiopia argues that it has a complete natural right to exploit the waters that flow within its territory (Tadesse, in submission), where an estimated 75% to 85% of the annual flow of the Nile waters come from (Wolf and Newton, n.d.). Ethiopian officials have either repudiated the Nile Waters Agreements or called for the upstream riparian states to ignore them and consider them invalid and not binding on them (Kendie, 1999b). Wolf and Newton note that Ethiopia served notice in 1957 that it would pursue unilateral development of the Nile water resources within its territory, and suggestions were made recently that Ethiopia may eventually claim up to 40,000 million m³ (MCM) per year for its irrigation needs both within and outside of the Nile watershed (ibid). Although Wolf and Newton say that no other Nile Basin riparian state has ever exercised a legal claim to the waters allocated in the 1959 treaty, Kenyan and Ugandan officials have denounced the agreements as invalid and called for their dismantling. According to Bulto, Ethiopia wants to utilize Nile waters in a reasonable and equitable manner even if there is a decrease in the quantity and quality of flow into Sudan and Egypt. For such reasons Brunnée and Toope (2009), say the geographic and political circumstances, relations in the Nile Basin have often been cited as an example “of unremitting and open conflict, or at least incipient and barely camouflaged competition.” Okoth-Owiro attributes the contentious nature of the legal status of the Nile Water treaties since the 1950s, mainly because in 1956 the British government regarded the 1929 agreement and other treaties creating a regime over the Nile waters as subject to revision, and that it was intended to negotiate new terms on behalf of Kenya, Tanganyika and Uganda.

The view expressed by Julius Nyerere who became the prime minister of an independent Tanganyika in 1961 is seen as a driving force for the position taken by the upstream riparian states. What came to be known as the “Nyerere Doctrine of Treaty Succession,” argued that Tanganyika, which was the then new country, would not agree to be bound by agreements inherited from the colonial regime “unless required by international law” (Makonnen, 1984).All

states on the Nile basin, except Egypt, have adopted the Nyerere doctrine on state succession to treaties and have thus refused to be bound (Okoth-Owiro, 2004). Followers of the Nyerere doctrine, all the upstream riparian states, have argued that the Nile River Waters Agreements force the upstream riparian states to subject their development plans to the scrutiny and supervision of Egypt and that such an approach to development is not compatible with their status as sovereign States Knobelsdorf (2006). Available evidence also shows that upstream riparian states, all of whom did not participate in the creation of the agreements, are taking unilateral decisions on the Nile River or sub-basin approaches towards in the utilization and development of Nile water resources.

The regime of the Nile Basin was one of unremitting and open conflict; or at least of incipient and barely camouflaged competition (Brunnée and Toope, 2002). Even witnessed on everyday Nile dispute, they say journalists, as well as political and legal analysts, had been delighted in quoting a succession of regional statesmen, especially Egyptians, who spoke of the threat of war over scarce Nile resources. In the 1970s, the leaders of Ethiopia (Mengistu Haile-Mariam) and Egypt (Anwar Sadat) exchanged threats over the apportionment of Nile waters (Swain, 1997). Swain goes further to suggest that the Egyptian invocation of war was entirely strategic that they were never hesitated to make the threat of war to prevent upstream countries from taking any actions. In 1979 President Sadat was quoted as saying that “the only matter that could take Egypt to war again is water” warning that “tampering with the rights of a nation to water is tampering with its life; and a decision to go to war on this score is indisputable in the international community.” Similarly, in 1988 the then Egyptian Foreign Affairs Minister, Boutros Bourros-Ghali, who later became the UN Secretary-General, asserted that the next war in the Middle East would be fought over the Nile waters, not politics (Kameri-Mbote, 2007). As tensions rise between Egypt and Sudan in 1991 during the Gulf War, media reports suggested that Sudan aimed missiles at the Aswan High Dam in Egypt, rendering the Egyptian political hierarchy "apoplectic"(Ibrahim, 1991). Although these threats may never have been as serious as pundits feared, nonetheless Brunnée and Toope, note that the threats reflected the strongly competitive political and legal environment that dominated the Nile Basin for generations.

Meanwhile, upstream riparian states have failed to persuade Egypt, which seems to have taken the view that it can compel them to abide with the anachronistic Nile Agreements with its significantly superior military strength. Thus, recognized the absence of room to enter into new and inclusive negotiations over the exploitation and utilization of the Nile waters with Egyptians, upstream riparian states have entered into new agreements or made declarations that purport to declare the existing agreements null and void as far as they are concerned (Mbaku and Mukum, 2010).

Regardless of decades old disputes over the Nile waters tension escalated when Ethiopia announced in 2011 to the commencement of construction of a mega hydroelectric dam on the Abbay (Blue Nile) River located around 40km east of Sudan (Elbarbary, 2021). Although there are few African countries with a plan to deal with the doubling of their population over few decades, Ethiopia's ambition with the project plan came as it seeks to transform itself into a middle-income country, and meet its electricity demand (BBC News, 2018). Eventually, media report that Egyptian politicians, journalists and analysts turn the matter into as an "international security issue". Negotiations between Egypt and Ethiopia are not going well and even though Sudan and Egypt have been at loggerheads over water sharing, however with the ongoing state successions both countries later both called the dam a "national security threat," (Fenton-Harvey, 2021). Since the discussions concerning the Grand Ethiopian Renaissance Dam were not even at the stage of assessing the impact, but about how that will be determined, Fenton-Harvey says a "frozen conflict" could prevail, and international efforts will be critical to achieving a mutually beneficial scenario for Ethiopia, Sudan and Egypt. The irony of the current dispute is that Egypt did in the 1960s exactly what Ethiopia is doing today, when it built the Aswan High Dam (BBC News, 2018).

v. The Nile Basin regime

Cooperation in the NRB faces significant barriers for multiple reasons such as having the most basin states out of any river in the world (Brady, 2015). Scott Barrett in his book, 'Environment and Statecraft: The Strategy of Environmental Treaty-making,' explains that, "cooperation is harder to sustain, the larger the number of countries that contribute to or are affected by an externality,"(Barrett, 2003). According to him, the more countries involved in negotiation, the

more difficult it is to reach agreement. In this regard, the NRB, due to over a number of countries that it involves, should theoretically face the world's most challenging transboundary negotiation process. On the other hand, the River basin is a particularly important region to focus on because its diversity in terms of religion, linguistic and politics (government systems) and culture. Brady says this diversity of culture compounded with its history of colonization by France, Britain, Belgium, Italy, and Germany adds to the barriers that exist between the states and cooperation.

Since the late 1990s, several agreements have been signed between the NRB countries to protect their water security by ensuring that each country's share of water (Elbarbary, 2021). Although the upper riparian states have yet to put forth concrete explicit proposals for the governance of the Nile River, according to Mbaku and Mukum, these states clearly envisage a new legal framework, one that is negotiated and agreed to through a democratic process. Mbaku and Mukum see that the importance that all relevant stakeholders be provided with the facilities to participate fully and effectively in the compacting of a new governance scheme for the Nile waters. Despite Mbaku and Kimenyi (2010) disregarding the colonially-imposed Nile River Agreements as not sustainable for not taking into consideration the interests of most of the upper riparian states, and called to be set aside, however they cautioned recent attempts to negotiate an agreement without the participation of Egypt, that would only lead to increased conflict. Mbaku and Kimenyi also suggest inclusion of the local communities whose livelihoods are dependent on and intertwined with the Nile than only each country's elites at any negotiations along with the industrial countries and the multilateral organizations, which have a substantial economic presence as well as support development efforts in this region.

In 1992 when Ethiopia was undergoing a state succession under EPRDF's transitional government, Girma Bekele, who represented and spoke on behalf of the then Ethiopia's Minister of Natural Resources Development and Environmental Protection, Mesfin Abebe expressed Ethiopia's principle that it believes in inter-governmental cooperation of the Nile Basin countries (Brady, 2015). In 1993, Egypt and Ethiopia concluded a general cooperation agreement to consolidate mutual trust and understanding that focused on the Nile Basin as a "center of mutual interest" (Framework, 1993). The following year in 1994, speaking at a conference in Cairo Mesfin Abebe himself declared that the Nile to be a means for regional

cooperation rather than a source of conflict (Brunnée and Toope, 2002). Earlier that same year, as discussed by Aly M. Shady, Ahmad M. Adam and Kamal Ali Mohamed in their article 'The Nile 2002: The Vision Toward Cooperation in the Nile Basin' cited by Brunnée and Toope that a conference dubbed 'the Nile 2002' was held in Khartoum with a focus on means of furthering cooperation among the Nile Basin states, where a group of technical specialists was able to discern "a new spirit of cooperation" among the riparian states. Again that same year, Allan (1994), a seasoned Nile specialist argued that although the increasing potential for Ethiopian exploitation of the Blue Nile would seem to threaten greater conflict. For him, Egypt had already altered its policies to such an extent that the prospect for direct conflict was actually diminishing.

Water affairs Ministers of the Nile Basin countries from Democratic Republic of the Congo, Egypt, Rwanda, Sudan, Tanzania, and Uganda met in Kampala, Uganda in 1992 and agreed that future co-operation on water resource matters should be pursued for a transitional period under the name Technical Cooperation Committee for the Promotion of the Development and Environmental Protection of the Nile Basin, shortly known as TECCONILE (UNEP, 1999). At the fourth TECCONILE meeting in 1996 Ethiopian Minister of Water, reiterated the country's policy of "good neighborliness" and expressed its wish to realize a meaningful and effective cooperation to take place among the Nile basin countries on the basis of the principle of equitable utilization of the Nile water resources (Brady, 2015).

The year 1998 marked ease of tension between Ethiopia and Egypt over access to the Nile waters at the highest levels. Brunnée and Toope note media report that the Ethiopian Prime Minister suggestion that Ethiopia's positions were changing because Egypt had shown "more understanding of the Ethiopian viewpoint" in the previous year despite he admitted that the history of conflict was significant. The following year in 1999, after a meeting between the then leaders of Ethiopia and Egypt; Prime Minister Meles Zenawi and President Hosni Mubarak, media reported that then Ethiopian Foreign Minister Siyoum Mesfin told a press conference that the issues of the Nile "will never be the cause of a war" between Ethiopia and Egypt, while the Egyptian Minister of Public Works and Water Resources, Mahmoud Abu Zeid, had previously

declared that "there is no conflict or struggle between Egypt and any other Nile Basin country" (ibid).

Summary of NRB

The 1990s simple declarations of peaceful intent specifically, between these two major rivals of Nile waters, do not in themselves signal a regime transition, but more concrete evidence of a striking shift in attitudes and approaches was witnessing. In this regard the 1999 annual Nile Council of Ministers, a high-level political body charged to pursue information sharing and to promote coordination among the basin countries announced resolutions "to facilitate the transition from the era of confrontation to cooperation among the Nile Basin countries," reported Ethiopian media (Brunnée and Toope, 2002). At the beginning of 2000s Ethiopia, Sudan, and Egypt have agreed to enhance their cooperation with respect to the Blue Nile, while nine Nile riparian states have also agreed to the creation of a joint initiative, what becomes the Nile Basin Initiative (NBI) and established its secretariat in Uganda (NBI, 2022). The design of NBI is not limited to information sharing and technical assistance, but also to strike joint development initiatives. As seen in its structure (NBI, 2001), the institution serves as a "transitional arrangement," intended to facilitate basin-wide discourse until a "permanent legal framework" is in place." A promising start towards cooperation was reported at the 2000 meeting of water resources ministers from all ten Nile riparian states, before the creation of South Sudan, held in Khartoum. Brunnée and Toopereported the then vice-chairman of Sudan's Water Resources Authority, Osman el Tom, was quoted as saying: "remarkable convergence toward future cooperation." Just over a year consensus on many parts of the framework was reported to be emerging. In a 2001 meeting of Nile Basin states, the international donor community, and NGOs, and other participants expressed support with an initial aid of 140 million USD. They hoped that the NBI will emerge as "an example of how international waters can become catalysts for cooperation, development, and stability"(WB, 2001).The NBI is currently debating the shift from allocation of the Nile waters to benefit sharing of the overall costs and benefits from the river system (Ayaa, 2012).

2.3.3 Key transboundary water management practices in the SRB

Unlike the Nile River research on the Senegal River is very limited. The Senegal River spreads over Guinea, Mali, Mauritania and Senegal in West Africa covering a surface area of over 337,500 km². The basin has a population of around 3.5 million inhabitants, which accounts for 16% of the total populations of the four basin states (OMVS). The Senegal River Basin also has challenges related to its geographical and hydrological characteristics as well as to riparian populations' and states' use of the river and its resources (Schmeier, 2012). Among the natural conditions, Schmeier sees the climatic regime is particularly crucial for conflict and cooperation in the basin. Therefore, the annual flow patterns of the river have been varying because of climate and weather patterns. While the climate of the basin varies from mountain terrain in Guinea, receiving on average 1,475 mm of precipitation annually, to the more arid valley and delta regions, which receive as little as 270 mm of annual precipitation (UNESCO, 2015), the basin region receives only an average of 660 mm of rainfall per year (Newton, 2008). With a generally dry climate and short rainfall periods every year, the wet season is extremely important to riparian populations, eventually the Senegal River waters represent the key to agriculture in the region. The river is a key resource for all basin states, where large herds of cattle, camels, goats and sheep migrate season to season across their borders and herders rely on this water source to sustain their herds (Newton, 2008).

i. The complexity of water resources use in the SRB

Despite the Senegal River's long history of cooperation among the basin states that dates back to the colonial era – with some 13 international agreements have been signed (OMVS), however following the basin states independence from France, tension remained in the region due to the instability of the political powers and the influence of neo-colonial states such as the United States and the Soviet Union (Newton, 2008). As to Newton, there were a few areas of concern in the river basin the first being that of the climate. This has direct implication on agriculture, which is the most important water use sector in the basin, where the populations depend highly on both rain-fed and irrigated agriculture (Schmeier, 2012). Because of the populations' dependence on rainfall for crops, the droughts caused severe disruption in the economies of the basin states,

mainly due to the continuous drop in rainfall from early 1960s until the mid-1980s. Thus, according to Newton, the impacts to the economy were a result of the affects of the drought on the environment. The basin has a history of seasonal flooding that permits recession farming within the valley on 15,000 to 150,000 ha depending on the flood flow (Vick, 2006). According to the National Scientific Press (2003) report, the basin suffered devastating floods in 1890, 1906, and 1950. Whereas; development projects, based since colonial times on irrigated rice-growing, that aim on the potential of the river have never taken age-old production system into account (Adams, 2000). Since the 1960s, rainfall and river flooding have declined considerably, and in some years have been non-existent totally affecting recession farming.

However, more problematic for the people and the economies of the region than flooding was the 1970s drought, (UNESCO, 2015) which caused famine within the region and changed the ecology of the riparian system. The lack of freshwater flows through the delta resulted in seawater intrusion, which formed a saltwater wedge 200 km upstream along with soil erosion, drop in groundwater, vegetation loss in the entire region. This situation resulted in the mass migration of inhabitants from the rural areas towards the cities (Newton, 2008). The extreme poverty in the region makes these populations very vulnerable to changes in the climate. The most interesting situation in this river basin is the case of Mauritania and Guinea. The former contributes nearly no water to the river's flow but uses it excessively for its agricultural sector, suffering from constant drought threats in the entire country. The later on the other hand, is much less dependent on the irrigation opportunities of the river due to the high precipitation it receives (Schmeier, 2012).

ii. Conflict management attempts in SRB

The problems in the 1960s and 1970s led the SRB states to look at ways to work together to mitigate the disastrous effects of severe droughts. Unlike other international water bodies, cooperation over this basin did not grow out of a conflict over use of the Senegal River resources. Regardless of the turmoil following World War II into the 1970s, Newton (2008) says the Senegal River continued to be a common link between the basin countries. Thus, the four basin states come to believe that collaboration on the development of the resource would

improve the standard of living of all involved. The vulnerability of the populations of the basin states catalyzed a desire between Guinea, Mali, Mauritania and Senegal to cooperate in the management of the basin so that all countries would benefit from its development.

Even prior to their independence, Mbengue, (2014) note that Mauritania and Senegal moved into the waters of cooperation through bodies such as the Organisation Autonome de la Vallée (OAV) and the Mission d'Aménagement du Bassin du Fleuve Sénégal (MAS). Eventually, the 1963 Bamako Convention for the Development of the Senegal River crystallized among the four riparian States led for the opening of a new avenue for the 'community of interest' to cooperate fully in the management of the Senegal River Basin. Few years onward another institution called the Organisation des Etats Riverains du Sénégal (OERS), was also founded in 1968 to promote and coordinate the development of the river basin on the territory of the three member states. However, it was broken up after the withdrawal of Guinea (Adams, 2000).

iii. The crystallization of the common interests over the SRB

The history of cooperation over the SRB has led to numerous multilateral agreements, projects and organizations the last 40 years. A milestone in the history of SRB cooperation was the creation of the Organization for the Development of the Senegal River or as commonly known as the OMVS in 1972 when the basin countries were experiencing the worst drought in decades. The 1972 Convention creating OMVS, and the general aspiration for cooperation in the river basin has been hailed to have carried into the twenty-first century as the river basin states work cooperatively toward more effective basin management (OMVS, 1972). The Convention signed by Guinea, Mali, Mauritania and Senegal follows the legislation of the four countries and gives the Commission the possibility of managing water. The basin countries agreed that the Commission controls and monitor the river courses, which involves the capacity to regulate the networks, electrical grids to facilitate the transport and navigation, allowing industrial development in the area (UNDESA).

According to Adams' (2000) critical review of the organization from the outset, OMVS tasked itself with aim to provide a secure and steadily improving livelihood for the inhabitants of the

river basin and neighboring areas, while safeguarding as far as possible the ecological balance of the river basin, in tandem with making the economies of Mauritania, Mali and Senegal, less vulnerable to climatic conditions and external factors; and eventually accelerating the economic development of the member countries by the intensive promotion of regional cooperation. In this regard UNDESA sees a very unique element of this cooperation, where the shared property of the dams that were constructed along the river, owned by three countries, which is quite exceptional on a transboundary river.

iv. The birth of SRB legal system

The end of 1970s saw the beginning of a joint legal regime based on a 'community of law' and 'solidarity' was perfected within the SRB. The 1978 Works Convention, (FAO, 1978) in particular provides that "the rights and obligations of the member states joint owners are founded on the principles of equality and equity." Far more than would be expected under the most cooperative theories of basin management or good neighborliness the SRB member states relinquished their sovereign control and even their ownership of the land and the river works to the OMVS. This makes the legal regime different from any of the four major theories of watercourse law that are based on state sovereignty, absolute territorial sovereignty (the Harmon Doctrine), absolute territorial integrity, or limited territorial sovereignty or community of interests (McCaffrey, 2001). As indicated by the Permanent Court of Arbitration's case (1976): 'when the states bordering an international waterway decide to create a joint regime for the use of its waters, they are acknowledging a "community of interests" which leads to a "community of law".' Hence, Mbengue (2014) sees the idea of a 'community of law' in the context of the SRB was from the very beginning inseparable from the need to establish a 'community of management' for the River's resources. The 'community of law' that was being built in 1972 adhered to a new legal architecture and consolidated community of management.

Mbengue noted that prior to 1972; the 1963 Bamako Convention and the 1968 Labé Convention encompassed both procedural and substantive rights and obligations with respect to the management the Senegal River's resources. Thus in 1972 Mali, Mauritania and Senegal opted for a different approach that consisted of separating to a certain extent the joint "substantive"

legal regime from the joint “procedural” legal regime appertaining to cooperation within the River basin (ibid). It is in this context that the basin states concluded the 1972 Convention on the Status of the Senegal River as a single agreement dealing with the substantive rights and obligations of the riparian states (in particular those related to agricultural and industrial uses and navigation and transport purposes) and another “institutional” agreement establishing the Senegal River Development Organization often known as OMVS in French abbreviation. Moreover, without explicit wording, there would be no predictability as to whether activities and measures on the River are subject to the prior agreement rule. Accordingly, the only legal safeguard that was foreseen by the riparian states to ensure the effectiveness and the predictability of a community of management was to subject the implementation of measures or activities within the SRB to the unanimity rule or a prior agreement rule. It was in this context that the prior agreement rule was strengthened when Mali, Mauritania and Senegal concluded the 1972 Convention on the Status of the River (ibid).

Summary for SRB

Through the 1972 OMVS Convention the SRB become a first in the design of legal frameworks relating to water resources management in Africa. The ‘global forces’, (Reinner, 1999) such as international financial institutions and foreign donors supported OMVS, and has grown to become an important actor in the governance of international watercourses, not only in Africa but also at the global level(Moynihan and Magsig, 2014).The development and evolution seen in SRB was not necessarily foreseeable (Mbengue, 2014). Stressing the fact that Mali, Mauritania and Senegal ‘will have to do what no other group of states has yet managed to do, during the early days two experienced observers of the OMVS, (Parnall and Utton, 1976) were wondering whether the organization, despite its early achievements, would ‘really work’. Thus, it remains to be seen whether any truly effective international river authority can survive the political, economic and social pressures inherent in river regulation’ (ibid). However, for Mbengue the success story of the OMVS should speak for itself.

Mali, Mauritania and Senegal ultimately used all the legal ingredients for sustainable cooperation over water resources management and for the development of the law of watercourses in Africa

(Mbengue, 2014). Even in the face of adversities the sophisticated character of the legal regime allowed the development and autonomization of a genuine ‘water diplomacy’ (ibid). For instance, at early 1990s Mauritania and Senegal ceased all diplomatic relations because of a conflict over the frontier between the two countries on the Senegal River involving Mauritanian Fulani herders and Senegalese Soninke farmers over grazing rights, (OECD, 2010). Hence, the only forum within which the two States were still cooperating was the OMVS. Nevertheless, in light of the ever-changing international context, Mbengue notes the ‘essential mutuality of the interests’ of the Senegal River Basin’s riparian states required the adoption of a third generation of legal instruments and policies in order to better accommodate these mutual interests, which became the era of the ‘2002 Senegal River Water Charter’ (ibid).

Regardless of the commendation given to Conventions of the 1970s problems also occurred immediately following development of the river under this regime, (Vick, 2006). Although cooperation and negotiations between the four basin states have continued over time even when there have been disagreements, (UNDESA) there have also been some failures often associated with “micro-nationalisms” and the desire of some to act independently. Since no country could find proper funding on their own the cooperation is ruled as successful, in part because it has included different categories of stakeholders. On the other hand despite a good level of cooperation and the existence of institutional arrangements, riparian states are dealing with many challenges due to climate change, poverty and mitigation of environmental and human (public health) impacts of the dams (ibid).

Every state has had a representation, including the scientific community, while the permanent commission of the basin organization is composed by the technical services, management agencies, different users, and associations coming from each state. Beyond the helms of the governments the representatives of the water users, the NGOs are now interested on how this is managed. The experts committee composed of ecologists, scientists, academics, politicians meets every three months to study the new activities that are going to take place. In this context it is the final user who plans and designs the uses (OMVS). Due to the illiteracy in some cases in the member states communication is a problem for stakeholder involvement (UNDESA). Communication problem and conflicts that arise including politicians, and scientific community, among others have also been observed, calling for a need to highlight communication at different

levels issuing that the organization was created for the benefit of the four countries (ibid). Benefit sharing in the Senegal River valley has helped resolve conflict and reduce tensions among the countries in the region. The fact that Guinea, the fourth riparian state which initially did not want to be a part of the organization joined the OMVS lately, shows that the organization has been successful at encouraging cooperation among the countries sharing the River and in managing the river basin effectively (Ayaa, 2012).

Chapter Three

Research Methodology

This chapter, which constitutes the major focus of the study, incorporates methods used, the research design and approach as well as sources of data with sample selection techniques. This section further outlines how first-cut selection of cases and how comparative cross-case analysis, as well as explanatory one-on-one interviews is conducted. Accordingly, the research methodology explained in this chapter will be applied in the document analysis, case selection and analysis parts of the study, which will be guided by a logic model.

3.1 Physical and Political Context of NRB and SRB

3.1.1 The Nile River Basin

The Nile River is the longest river in the world (6,825 km), its basin connecting 11 riparian countries: Egypt, Ethiopia, Sudan, South Sudan, Burundi, Eritrea, Kenya, Republic of Congo, Rwanda, Tanzania and Uganda. It is very large both in terms of drainage area as well as in terms of the quantity of water it carries in its watercourse (Tadesse, 2010). It is one of the most important reliable sources of renewable water supplies in the Nile basin countries, and a source of food and water security. This has historically led to tensions around management of the scarce water resources (Knaepen and Byiers, 2017). The Nile Basin's extraordinary variety of geographical and ecological systems makes it difficult to easily characterize or subdivide. For some countries, such as Rwanda, Sudan, Uganda and Ethiopia, most of their area is situated within the Nile Basin. For most other countries, the Nile Basin forms only a very small part of their territory (Tadesse, 2008).



Figure 2: Map of Nile River Basin
©WB, 2000

Geographically-speaking an upstream state is a state that water flows out of, and a downstream state is one that water flows into. Burundi, the Democratic Republic of the Congo (DRC), Ethiopia, Eritrea, Kenya, Rwanda, South Sudan, Tanzania, and Uganda are typically considered upstream states, while Egypt and Sudan are the states that are typically considered downstream states. This key geographical dimension to the relationship among the Nile River Basin states comes with the division between the Blue Nile states and White Nile states, the two main sources of Nile River. The Abbay originates in Ethiopia, and flows into Sudan where it meets the White Nile and becomes the Nile River that originates in the Great Lakes region of Central Africa.

3.1.2 The Senegal River Basin

The Senegal River, the second-largest river in West Africa, originates in the Fouta Djallon Mountains of Guinea where its three main tributaries, the Bafing, Bakoye, and Faleme contribute 80% of the river's flow. After originating in Guinea, the Senegal River then travels 1,800 km crossing Mali, Mauritania and Senegal on its way to the Atlantic Ocean (Newton, 2008).

Most of the Senegal River basin has a sub-Saharan desert climate, which has been aggravated by more or less long periods of drought during the 1970s. The basin has three distinct parts: the upper basin, which is mountainous, the valley, and the delta, which is a source of biological diversity and wetlands. Topographical, hydrographic and climatic conditions are very different in these three regions and seasonal temperature variations are extensive (Adams, 2000).



Figure 3: Map of the Senegal River Basin ©OMVS

Topographical, hydrographic and climatic conditions are very different in these three regions and seasonal temperature variations are extensive (Adams, 2000).

In 1963 the Bamako Convention, signed by Guinea, Mali, Mauritania, and Senegal, recognized the Senegal River's international status and created the Interstate Committee (CIE) to manage the river. Colonial conferences on the status of Africa's rivers had not recognized the Senegal

River as an international river, as it belonged to a single colonial power. After independence landlocked Mali sought to have the Senegal River’s international status recognized in order to ensure navigation rights. Freedom of navigation on the Senegal River derives from the principle of reciprocity, not universal access (Alamand Dione, 2004).

3.2 Research Design

The research methodology is designed in a way that seeks to construe a better understanding of the issue of cooperation process in the contexts of the two river basins, on the one hand, and to clarify the significance of equitable utilization in influencing perception and boosting future cooperation for regional development among the NRB countries on the other. Having established this need for a new understanding and expansion of research, and to address the profound research problem and examine the perplexing questions, this study explores using the convergent design within Qualitative Comparative Analysis (QCA) logic diagram.

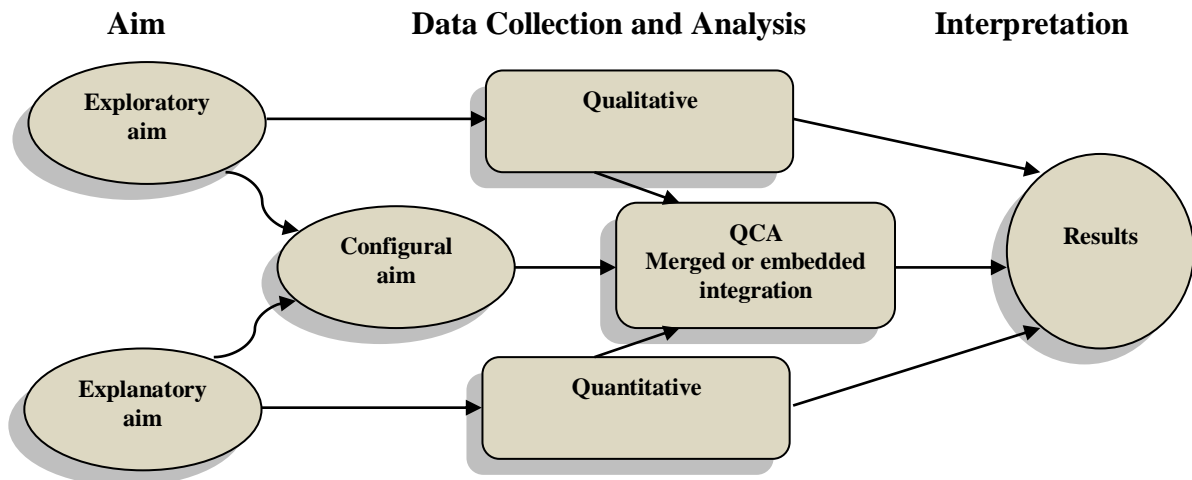


Figure 4: Qualitative Comparative Analysis (QCA) research logic diagram; Kahwati and Kane (2019), adapted from Curry and Nuenz-Smith (2015)

Depicted as convergent design in the Figure 4 above, the qualitative (exploratory) and quantitative (explanatory) data have come together to address the research questions (Kahwati and Kane, 2019). Hence, this study takes a proactive stance in responding to the ramifications of conflicts over transboundary water resource in NRB by analyzing potential conflict, and

cooperation potential on a multi-scalar approach. To do so, the researcher, based on a holistic cross-regional outlook, used a comparative case-analysis for the purpose of cross unit comparison between the NRB and the SRB.

3.2.1 Research Approach

This study followed Qualitative Comparative Analysis (QCA) in mixed method research approach to identify significant factors that boost the propensity of producing cooperative and sustainable transboundary water resources managements that support their equitable utilization. Since the purpose of this study is to describe, explain, or evaluate, which particularly addresses complex issues relating to the river basins, the mixed methods approach has been identified as an appropriate in order to come up with a more comprehensive understanding of the phenomenon under investigation (Leavy, 2017).

Moreover, having established the need for a new understanding and expansion of research, a QCA method approach serves as a complete and well-rounded research approach. QCA is a methodology that enables the analysis of multiple cases in complex situations (Vanfraechem and Aertsen, 2017). According to them, this method can help explain why change happens in some cases but not others. Since QCA is designed for use with an intermediate number of cases, it has been used considering the situations where there are too few cases to apply conventional statistical analysis for this study.

The study's main focus being qualitative analysis, however as to Mathison (1988), qualitative and quantitative methodologies are not antithetic or divergent, rather they focus on the different dimensions of the same phenomenon. Considering superiority of qualitative research compared with quantitative research methods, in tackling issues that are hard to quantify in numbers, such as human feelings, perceptions, and behavioral data as well as complex causality; the researcher values the underlying unity of the two methodologies even when these dimensions may appear to be confluent. Abukhater (2013) note the qualitative approach is intended to unravel the mystery and ambiguity surrounding the theoretical aspects of the research topic and develop a better understanding of complex issues related to such an elusive concept. Hence, both qualitative and

quantitative data sets can aid in interpreting the QCA results; whereas examining the cases depends on the qualitative data (Kahwati and Kane, 2019).

3.2.2 Sources of Data

Given the complexity of the transboundary water issues that this research attempts to address, the study employed the following primary and secondary sources of data. The researcher reviewed extensively on topic specific documents gathered from the two basins and conducted initial screening of (snapshot case analysis) for each basin in tandem with patten matching of comparative case-analysis of selected cases from both river basins and supported the cases with explanatory one-on-one interviews in each of these detailed cases.

Methods of data collections

This study utilized empirical data for case selection purpose and in-depth interviews to support the analysis with expert opinion. The two data collection methods are explained as follows:

(a) In-depth interviews: The study analyzes five major contexts and issues that are systematically selected based on contextual characteristics of the two river basins discussed in Chapter two. In addition, for each context the researcher engaged the opinion of acclaimed experts in subject matter from the two river basins.

(b) Document review: Document analysis is a systematic procedure for reviewing or evaluating documents found in both printed and electronic format (Bowen, 2009). Documents used for systematic evaluation for this study take a variety of forms such as empirical studies, case studies, treaties, organizational or institutional reports, statues, books and brochures; diaries and journals; event programs; maps and charts; newspapers and press releases; survey data; and various public records. Through skimming (superficial examination), reading (thorough examination), and interpretation of documents, thematic analysis is used which involves a careful, more focused re-reading and review of the data. As Bowen states for thematic analysis, the researcher takes a closer look at the selected data and performs coding and category construction, based on the data's characteristics, to uncover themes pertinent to a phenomenon.

Moreover, in order to effectively answer the key questions posed in this research, which represent the “why,” “what,” and “how” categories, the case study research method is employed with the help of the documents reviewed. Because according to Yin (2003); “a case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident.” These methods provide a rich opportunity to examine parameters associated with cooperation attainability, or lack thereof, through a comparative cross-case analysis.

3.2.4 Sample selection procedures and technique

The NRB and SRB were selected as comprehensive cases to reflect a wider range of issues and variability in transboundary water resource management practice. These two cases were carefully identified based on existing literatures, which reflect a variety of categories and geopolitical contexts, to be able to examine, test, and validate casual associations. Using multiple literatures, the development and effectiveness of cooperative framework relating to the NRB and SRB have been analyzed (Table 2). Prior to this, a template for analysis was developed, reflecting the theoretical and conceptual framework in chapter two, along with a set of hypotheses based on previous work by other researchers.

Interviewees were selected deliberately to ensure that quality data is obtained, as well as to select participants that illustrate the full range of viewpoints about basin cooperation. Snowballing technique was also utilized in order to encounter and discuss the central questions with knowledgeable and helpful subjects, identified based on their reputation and a snowball sampling (they were asked to suggest names of other experts in transboundary water management expert).

Interviews were conducted with two (2) professional transboundary water negotiators, two (2) officials from basin organizations, two (2) scholars and/or scientific experts knowledgeable about the intricacies of the NRB and the SRB water management. In order to ensure representation interviewees were from Ethiopia, Uganda, Senegal and USA in person, via video call application using Skype, and on phone call. The purpose of these interviews was to develop a contextual understanding of implementation, as well as perceived cooperation, and of the level of satisfaction between the river basins. These follows the technique of semi-structured

interviews as described by Leech (2002), using both grand tour questions and floating prompts. The purpose of this technique is to use open-ended questions to allow respondents to share freely while maintaining enough consistency across interviews to aid hypothesis testing. However, other backup questions were also asked when needed, to clarify certain issues or to obtain more relevant information. The interviews were transcribed and analyzed to extract significant lessons and relevant content.

Criteria	Contexts and issues
<ul style="list-style-type: none"> • Degree of implementation/level of monitoring: Full and partial implementation of cooperation is considered. Data on this criterion was obtained from expert opinion and secondary sources. • Perceived Cooperation – level of satisfaction or satiation: To find out the level of cooperation as high and low. This is obtained and triangulated from expert opinion and other secondary sources. 	<ol style="list-style-type: none"> 1. Drivers/factors pushing for change 2. Upstream/downstream perspectives 3. State defection from non-cooperation to cooperation 4. Community of interest and international support 5. Legal and institutional frameworks for cooperation <ul style="list-style-type: none"> ✓ NBI /CFA ✓ OMVS

Table 2: Sample selection criteria of the study

The cases were picked by the researcher and entailed detailed examination of the pertinent data, papers, research findings, treaties and conventions. The intention was to demonstrate the great range of institutional options selected for the two river basins. The purpose of analyzing each setting and problem independently is to draw attention to the disparities in the interests and perceptions of conflict and cooperation between the two basins. Since this study is focused on the contextual knowledge of transboundary water resource management in the two river basins representing a diversity of geographic circumstances, the selection criteria for case studies employed the two-dimensional model illustrated in Figure 5.

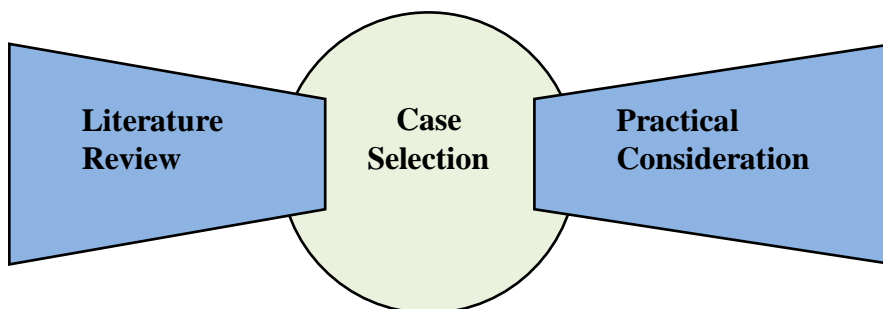


Figure 5: A comprehensive approach to case selection

First, among any African transboundary river basins, the SRB has been characterized and governed by the most pioneering, progressive and articulated legal regime. According to Parnall and Utton (1976), since the inception of this legal regime, its leitmotif has been to ‘engage in an experiment in international organization that is not only following the most advanced concepts of integrated river basin development, but which may also afford a lesson in cooperation on a broad scale’. Second, based on practical considerations the transboundary nature of the NRB creates a unique tension among the riparian states, and continuous effort to cooperate, the built-up tensions are on the verge of collapsing (Udobong, 2016); whereas the legal architecture designed to foster cooperation over the management of the SRB has influenced the development of the law of international watercourses in Africa (Mbengue, 2014).

3.3 Data Analysis Methods

The data are carefully selected to reflect a variety of contexts and degrees of cooperation in the two river basins settings that inform policymaking on various scales and levels, including at national and regional levels. For the literature study the comparative case study approach has been used using different types of literature, including the development and effectiveness of the institutions relating to the two river basins. Then the qualitative data’s results from the interview were categorized and analyzed by using narration. The information from the documents reviewed including selected descriptive component are also analyzed and translated in qualitative terms. To quantify factors between the two basins the researcher utilized selected hydrological data analysis in selected cases.

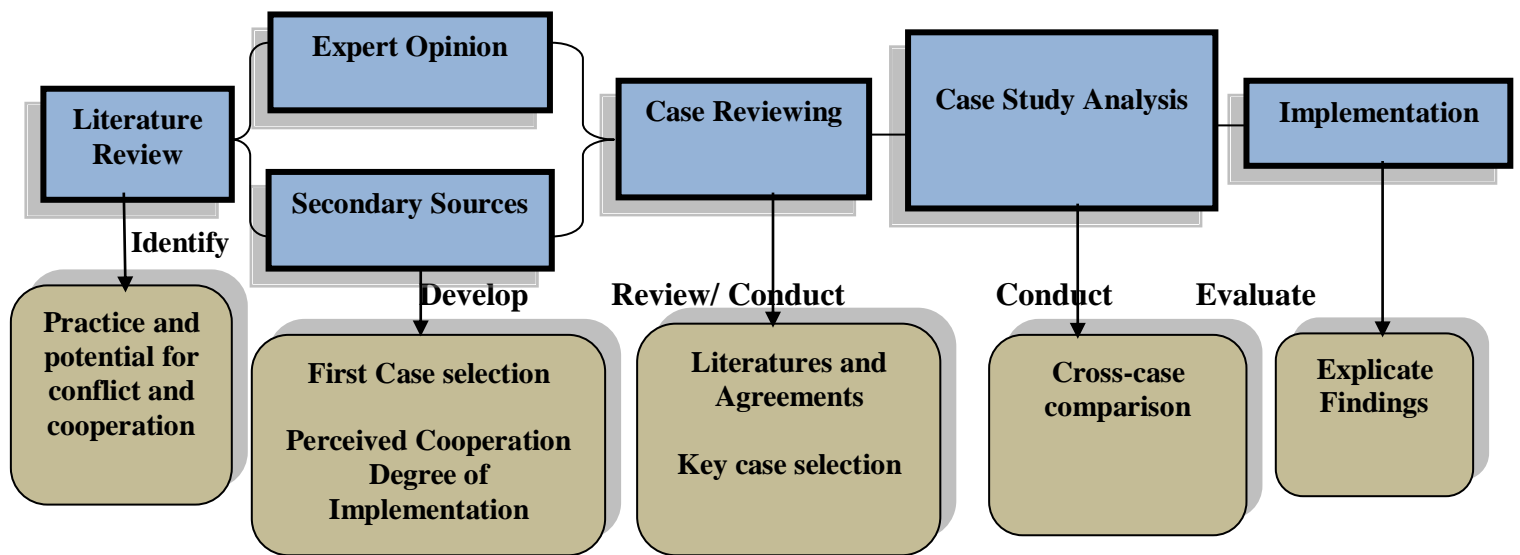


Figure 6: Data Analysis Methods; adapted from Abukhater (2013)

The qualitative approach is intended to unravel the mystery and ambiguity surrounding the theoretical aspects of the study under investigation and develop a better understanding of complex issues related to such an elusive concept (Abukhater, 2013). The data analysis also takes into account the methodological criticism concerning the required flexibility of the dependent variable (cooperation/conflict). The objective of the case analysis and storytelling helps reveal important details providing a comprehensive understanding of the contextual details of the study. Furthermore, the qualitative approach is to explore how and to what extent cooperation process parameters correlate to cooperative and sustainable agreements over the sharing of transboundary waters.

3.4 Validity and Reliability

This study established its validity using review of different cases of transboundary water resource management on two different basins. Although both basins are different in terms of the shared common features, important issues, and historical phenomenon with each other and the context of the target arid regions, yet selecting comparable cases was helpful to its validity. The sample included hydrological factors, along with socio-economic and legal-institutional drivers. The inclusion of diverse respondents created a base for valid results by reducing its biasness towards only one type of outcome. The amount of parallel information shared was restricted to

ensure that the study was not biased with preconceived notions of the respondents. The data are less vulnerable to charges of subjectivity and bias, which would enhance their validity. Enough data has been collected that helped to draw necessary conclusions. Moreover, the validity of the interview guide was established using opposing interests of basin states. Thus, the statements that did not go well with the subject of the study were removed.

In terms of reliability, two processes were conducted, namely; recording the data in a separate transcription that provided the researcher with a chance to quickly interpret the results as per the record of key informant and realize the progress of the research. Moreover, theoretical triangulation was adopted when examining other publications of the similar theme. Thus, the analysis was presented in the form of literature review that supports the results claims of the data collection and analysis process. Thus, the triangulation of data provided an additional layer of reliable stamping to the research. These measures helped to establish the validity and reliability of the results gained, proving the accuracy of the study.

3.5 Ethical Considerations

The researcher adheres to ethical code of conduct when obtaining data or information from either key informants or institutions. Accordingly, interviewees were invited based on voluntary participation, and they were also given informed consent and time to review the information they provided, maintaining anonymity with a promise to communicate findings.

Considering the highly sensitive nature of the research topic and water security being a top national security agenda, the identities of the interviewees have been excluded from this study for the purpose of confidentiality. Personal details are not written on this report, thus participants are referred to by an assigned number rather than their name, and data are stored securely. However, academics and officials who assisted the researcher are acknowledged by consult.

Chapter Four

Results and Discussion

Comparative Case Analysis

In order to identify important transboundary cooperation issues linked to more equitable outcomes, this chapter offers a comparative case analysis. It also outlines lessons and parallels for the theory and application of cooperative concepts in transboundary water resource management. In this part, the focus is to address the main research questions presented in chapter one of this study. Accordingly, cases collected from the two river basins are used to substantiate the analysis. This chapter is also dedicated to the analysis of interview data collected from selected respondents from across the continent and outside of the continent with a focus on the NRB and the SRB countries. Moreover, through assessing the representation of both basins, this chapter attempts to evaluate the application of cooperation principles by the two basins, and further outlines a comprehensive basin-wide institutional regime and eventually sustainable conflict resolution strategy that can transform water negotiation from a non-cooperative to a cooperative state, where the NRB riparians in dispute can engender equitable hydro-diplomacy and satisfactory agreements. This approach, which is outlined in detail in this chapter, is referred to as a “transformative approach to cooperation.”

4.1 Analysis of key drivers of change in NRB and SRB

4.1.1 Hydro-ecological regimes

Significant part of the NRB is classified as arid and semi-arid, having hugely diverse ecosystems coupled with diverse climatic zones (NBI, 2016). The river’s hydrology is formed with complex geographical features made up of a two main tributaries which have very distinct hydrologic regimes, to include snow-capped and forested mountains, extensive wetlands, and barren deserts (Batisha, 2013). The basin has climates ranging from the tropical high rainforests to arid desert. Its extreme arid have rainfalls in the Nubian part of Egypt (less than 1 mm per year) and Sudan to Ethiopian plateau (less than 1500 mm per year), and the mountains of Rwanda and Burundi having as much as 1800 mm per year (Fraser and Keddy, 2005). The climate and the

hydrographic network are the two primary factors that govern the present extent of the vegetation along the NRB. Fraser and Keddy states local climatic changes do not have significant effect on the aquatic and riparian vegetation of the river basin, while the land is subjected to seasonal flooding. For half of its course, Nile flows through north of Sudan and Egypt with no effective rainfall, where it is diverted to the irrigation schemes, and most of the river discharge into re-used water and the Mediterranean Sea (NBI, 2016). Despite having relatively low discharge compared to the world’s other large rivers; Nile River’s hydrological cycle links the land with water bodies.

River	Source	Daily flow MCM	Percentage share
White Nile	Central Africa plateau/ Victoria Lake	70	10%
Blue Nile	Ethiopian highlands	485	68%
Atbara	Ethiopian highlands	157	22%

Table 3: Daily flow of the main Nile river at Aswan dam and Khartoum (Hurst, 1952)

On average Ethiopia contributes 84% of the main Nile water per annum, while 16% comes from the Central Africa lake plateau (Murakami, 1995). Although relatively small and isolated, the East African lake region and the Ethiopian highlands take the highest share to contribute to the total flow of Nile.¹ The NRB covers an area of about 3.2 million km², which represents some 10% of the African continent and hosts nearly 20% of the African population (Table 4).

Country	Area within the river basin – km ²	% of basin
Burundi	13,860	0.44
DR Congo	21,796	0.69
Egypt	302,452	9.52
Eritrea	25,697	0.81
Ethiopia	365,318	11.5
Kenya	51,363	1.62
Rwanda	20,625	0.65
South Sudan	620,626	19.54
Sudan	1,396,230	43.95
Tanzania	118,507	3.73
Uganda	240,067	7.56

Table 4: Area shared among NRB countries adopted from NBI (2016)

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

The SRB is formed by three smaller tributaries of Bafing, Bakoye, and Faleme making it the second-largest river in Western Africa (Orsenna, 2012). The Fouta Djallon Mountains in Guinea serve as the main sources of the SRB contributing 80% of the river’s flow (Newton, 2008). From its major sources in Guinea the Senegal River travels 1,800 km crossing Mali, Mauritania and Senegal and discharge into the Atlantic Ocean. Senegal River dries during the dry season (FAO, 1997), and it has a special hydrology at a point where the river reaches the border point between Mali, Mauritania and Senegal, where it becomes one river and continues forming the border between Senegal and Mauritania. The SRB’s annual rainfall varies largely, with high variability between wet and dry seasons and also from year to year. The SRB has three distinct zones, the mountainous upper basin in Guinea making the significant rainfall (about 2000 mm per year), the middle valley, and the delta characterized by wetlands and biological diversity (ENSAP, 2006).

River	Source	Percentage share
Bafing	Guinea	50%
Bakoye	Guinea	25%
Falémé	Mali	25%

Table 5: The flow of the SRB adopted from Orsenna (2012)

From estimated at 24 BCM total annual discharge of the Senegal River, (WB, 2013), Guinea contributes about 75% of the total flow, regardless of its highly irregular annual flow. The Senegal River has special characteristics that its flow rate is considerably variable by season.¹ The region’s limited average rainfall of 660 mm per year also makes its waters the key to agriculture in the region (Newton, 2008). The SRB forms most of the northern boundary of Senegal, and it covers an area of about 300 thousand km² including the territories of four countries (Table 6).

Country	Mali	Mauritania	Senegal	Guinea
Area within the river basin – km ²	155,000	75,500	27,500	31,000
% of basin	53	26	10	11

Table 6: Area shared among SRB countries adopted from ENSAP (2006)

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

The above findings indicate that in both river basins the upstream and mid-upstream (Ethiopia in the case of the NRB) countries have the greater share of contribution. Similarly, despite being the major contributing countries to the basins, Ethiopia and Guinea share certain similarity by which they have relatively small area of land that fall within the river basin. The contrast between the size of the basins and the comparatively small volume of runoff in the NRB is also an important feature. The rainfall of the NRB basin indeed is scanty compared with the SRB.

vi. Water use in the basins

As is common around the world, agriculture is by far the largest user of water in both river basins. Water use in the NRB includes consumptive as well as non-consumptive uses such as for irrigated agriculture, hydropower, municipal and industrial (M and I) uses for large urban centers, fisheries, mining, and navigation as well as evaporation from dams. Based on the observation of Nile waters demand estimates for the period 1950 – 2014, irrigated agriculture is the highest consumer of Nile waters at approximately 80%, while the total water demand for municipal and industrial uses of the entire basin has been estimated at 12,900 MCM per year (NBI, 2020). Majority of irrigated agriculture and 97% of municipal and industrial demand uses occur in Egypt. Accordingly, in all NRB countries except Egypt, food production is almost entirely dependent on rain-fed agriculture. This situation makes production increasingly vulnerable to climate variability and hence uncertainty of rainfall.¹

Country	Crop Water Requirement [MCM]	Irrigation Water Demand [MCM]	Extracted Water From River (MCM)	Extracted From GW or Reused (MCM)	Actual Withdrawal [MCM]	Unmet Demand [MCM]
Burundi	28.89	28.9	28.7	0	28.7	0.13
DR Congo	0.00	0.00	0.00	0.00	0.00	0.00
Egypt	49185.42	66551.5	57417	8637	66054.0	499.38
Eritrea	1035.50	2018.2	1501	0.00	1500.9	517.34
Ethiopia	180.01	367.4	307.50	0.00	307.5	59.87
Kenya	1.69	3.4	3.16	0.00	3.2	0.00
Rwanda	28.71	58.6	57.38	0.00	57.4	0.85

¹ Skype interview with key informant, January, 2023, Maryland, USA

South Sudan	10249.86	13959.8	13303	0.00	13921.6	38.26
Sudan	50.10	102.2	63.42	0.00	63.4	38.82
Tanzania	127.58	260.4	260.32	0.00	260.3	0.05
Uganda	28.89	28.9	28.7	0	28.7	0.13
Total	60887.76	83350.45	72941.55	8636.59	82196.95	1154.71

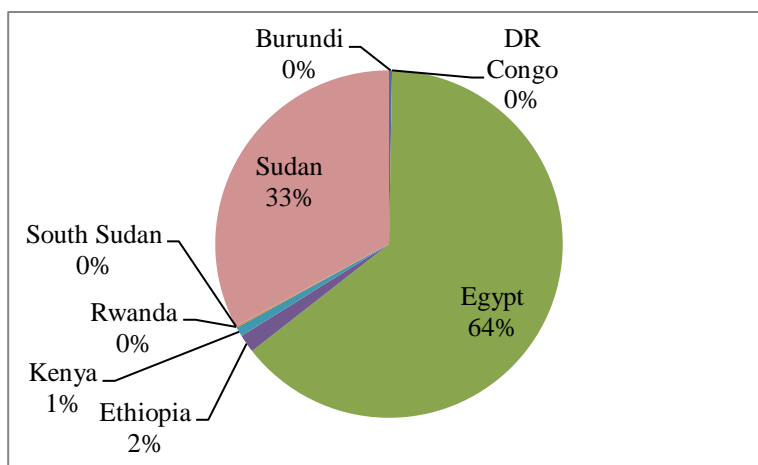
Table 7: Irrigation water demand, abstraction and estimated unmet demand by NRB Country (NBI, 2015)

As indicated in Table 7, in reference to ‘Total Supply Requirement’ is the volume of Nile waters that must be withdrawn from the source (surface or groundwater) to meet the crop water requirement and the losses in the conveyance and distribution systems. The ‘Actual Withdrawal’ column shows the amount of actual water abstracted from the Nile river system to deliver water to irrigation fields, while the ‘Unmet Demand’ column show and the deficit due to shortage from supply side. Although, the total unmet demand in the system is about 1.2 BCM, Egypt by far has the highest actual withdrawal in the basin relative to its unmet demand, where it manages to use groundwater, while Sudan relatively overtaken its unmet need with actual withdrawal. The total irrigation water demand stated in Table 7 has been estimated based on assumed cropped area for each irrigation scheme or district.

Country	Equipped Area (‘000ha)	Cropped Area (‘000ha)
Burundi	14.96	8.74
DR Congo	-	-
Egypt	3447	5021
Ethiopia	91	134
Kenya	47.8	20
Rwanda	7	7
South Sudan	0.5	0.15
Sudan	1764.63	1146.7
Tanzania	19.753	6
Uganda	9.7	9.7
Total	5,402	6,354

Table 8: Irrigation area in NRB (NBI, 2015)

In Table 8, ‘equipped area’ represents the area that has been equipped with the necessary infrastructure for irrigation but not all area might be cultivated in any given year or growing season. The ‘cropped area’ refers to the area that is actually under cultivation. In most basin states, the cultivated area is less than the equipped area. Accordingly, most of the



existing irrigated area falls within Egypt and Sudan, while many of the NRB countries depend on rain-fed agriculture and recession agriculture with little irrigation. Whereas, mainly in Egypt, more than one crop is cultivated per year and, therefore, the cropped area is bigger than the equipped area. Similar to the NRB, irrigated agriculture is the largest water consumer in the SRB, while water withdrawals vary by country and by sector of activity (Table 9).

Abstraction in MCM	Mali		Senegal		Mauritania	
	Value	%	Value	%	Value	%
Water withdrawal for agriculture (10 ⁹ m ³ /year)	5075	97.9	2063	93.0	1223	96.6
Water abstraction for industrial uses (10 ⁹ m ³ /year)	0.004	0.1	58	2.6	31.8	2.4
Water withdrawal for municipalities (10 ⁹ m ³ /year)	107	2.1	98	4.4	95.4	7.1
Total water withdrawal (sum of sectors) (10 ⁹ m ³ /year)	5186	100	2221	100	1350.2	100

Table 9: Water use by main economic sectors in SRB countries (Faye, 2022)

As to Table 9 distribution of 2006 water use by main economic sectors in the SRB, all basin countries use the water for agricultural consumption. In Mali (2006) water resources withdrawals were over 5 BCM apportioned: for agriculture 5075 MCM amounting to 97.9%, for communities 107 MCM amounting to 2.1% and for industry 0.004 MCM, amounting to 0.1%. In Senegal (2000), water resources withdrawals were 2221 MCM apportioned: for agriculture 2063 MCM

amounting to 93%, for communities 98 million amounting to 4.41% and for industry 58 MCM, amounting to 2.61%. Similarly, as seen in Table 7, in the case of Mauritania (2000), total withdrawals were 1350.2 MCM of which 1223 MCM went to agriculture amounting to 96.6%, 95.4 MCM went for domestic use amounting to 7.1% and 31.8 MCM to industry amounting to 2.4%.

vii. Water use infrastructures in the basins

A Strategic Water Resources Analysis conducted by the NBI Secretariat in 2015 that covered storage dams, hydropower plants and irrigated areas in the basin, indicates there are 14 storage dams basin-wide with a total storage capacity of about 203 BCM (NBI, 2015). In addition, the GERD is projected to add 74 BCM more live storage, while the Owens Fall (Nalubalee) dam built at the outlet of Lake Victoria in Uganda provides an additional 200 BCM of live storage.

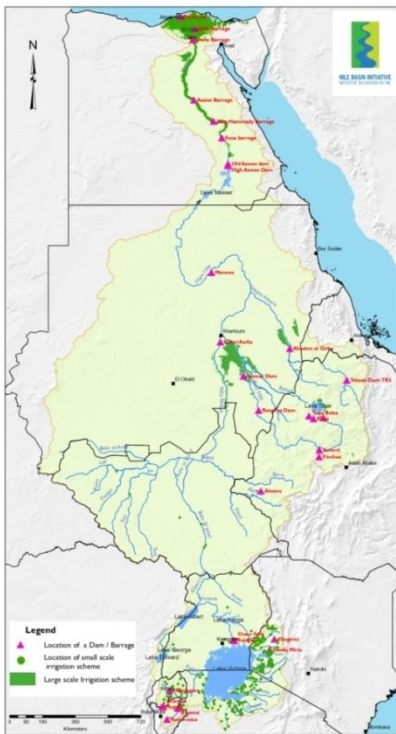


Figure 8: Water use infrastructure in NRB (NBI, 2014)

From Figure 8 distribution of water use infrastructures across the NRB, most of the large scale irrigation schemes are located downstream of the river basin (in Egypt and Sudan), while

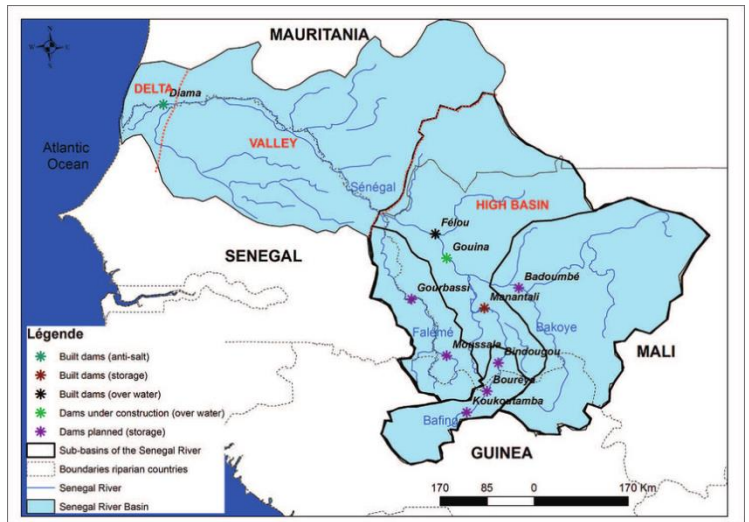


Figure 9: Watershed and dams built and planned in SRB (Faye, 2022)

upstream countries are limited to mainly small scale irrigation schemes, but dams and bridges are distributed across the basin. The most downstream countries exploit Nile waters for agricultural or hydroelectric as well as multipurpose freely.¹ Whereas, the NBI Strategic Water Resources Analysis indicates that hydropower is one of the main purposes for most dams in NRB, where the aggregate installed capacities of 22 hydropower plants basin-wide is 5,660 MW. When looking at a map of the SRB (Figure 9), majority of the water use infrastructures are built in high basin or upstream of the river basin.

Country	Cost assumed	Benefits withdrawn
Mali	35.3%	<ul style="list-style-type: none"> • 52% of hydroelectric production • opening up thanks to the navigation pane
Mauritania	22.6%	<ul style="list-style-type: none"> • 15% of hydroelectric production • 33.6% of the 375,000 ha of land made irrigable
Senegal	42.1%	<ul style="list-style-type: none"> • 33% of hydroelectric production • 64% of the 375,000 ha of land made irrigable

Table 10: Cost and benefit distribution in SRB(Faye, 2022)

Looking at the cost benefit distribution of the SRB (Table 10) the three basin countries have made use of the river for hydroelectric production having a direct relation to the cost they encored.

viii. Water storage in the basins

Riparians in both river basins continue developing a large amount of water storage infrastructures. While the growth in aggregate storage capacities of all dams in the NRB has significantly increased in recent decades (Figure 11), it is interesting to note that, after a period of four decades of near stagnation in dam construction during 1968 – 2007, the NRB is witnessing more and more storage dams added to the system (Figure 13). This change has been attributed to the GERD.

¹ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

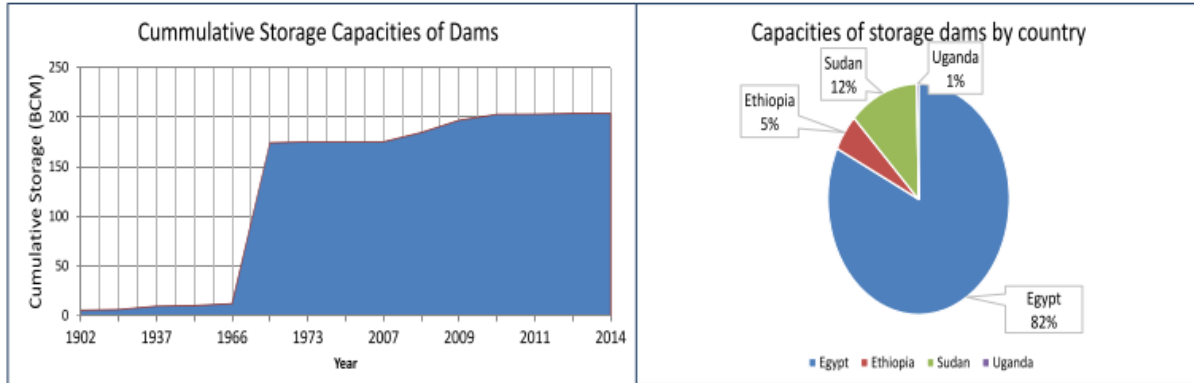


Figure 10: Growth in cumulative storage capacities of dams and cumulative storage capacity by country in NRB (NBI, 2015)

The cumulative storage capacity of Egypt is incomparably large at 82% with the rest of the riparians. With an aggregate basin-wide storage capacity of just over 200 BCM, most of the NRB countries have the least per capita water current installed capacities of hydroelectric power plants, megawatt storage by world standard (NBI, 2015). With severe seasonal and intra-annual variability and anticipated climate change, absence of adequate storage capacity means more vulnerability to impacts of climate shocks.

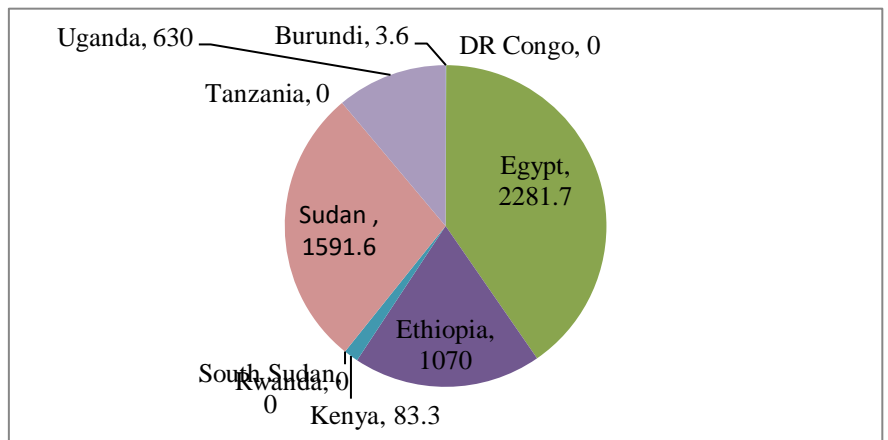


Figure 11: Distribution of installed HP plants (MW) (NBI, 2015)

ix. Growth projections in water resources infrastructure

The NRB has considerable hydropower potential that is not yet fully tapped. Thus, there will be unilateral developments boosting the water demand made for the time horizon of 2050. Therefore, the key driver of water demand in the basin will be the growth in water resources infrastructure (multi-purpose dams) for food (irrigated agriculture) and energy production (NBI, 2015). Based on existing plans, the projected growth in total storage capacity that will be

available in the NRB basin will reach to approximately 445 BCM. Most of the new storage dams are planned to be built in the Eastern Nile.

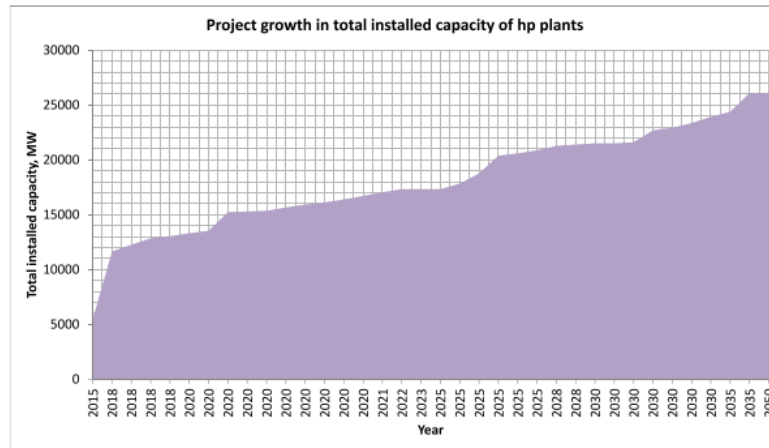


Figure 12: Projected growth in total installed capacities of hydropower plants in NRB (NBI, 2015)

The projection on Figure 12 is made based on data obtained from each member countries, where the total installed capacities of hydropower plants in the basin is expected to increase by about 21,000 MW and reach to 26,000 MW in 2050. “Such demand for development will continue to be a source of contention among upper and downstream states.”¹ For upstream countries like Ethiopia the great potential for irrigation and hydropower generation from Nile stands in stark contrast to the limited implementation of development plans (Yacob, 2007). However, the NBI casts optimism that the increasing number of dams as to provide the basin with more storage capacity and, hence, reduce vulnerability to climate shocks. At the same time, the total evaporation from these dams will grow.

The potential of the SRB has been identified for hydroelectric supply to meet the needs of the region’s populations.² Current electricity production represents 16% of the basin’s production capacity. The current demand of the riparian states of the basin is estimated at 4400 GWh per year. If the growth rate is maintained on all the SRB countries’ electricity networks, energy needs will be around 15,000 GWh. Similarly, in order to overcome the limited and unequal distribution of water resources and to manage floods and drought, the SRB countries stored billions of cubic meters of water in dams (Faye, 2019). The same interest applies for the SRB

¹ Skype interview with key informant, January, 2023, Maryland, USA

² E-mail correspondence with key informant, June, 2023, Dakar, Senegal

riparians, because access to electricity is identified as a real problem to development, and all the countries are struggling with shortages and growing demands for energy.¹ This water storing measure by the SRB riparians is made within the framework of the OMVS making countries like Mali, which host a joint mega investment, to have larger share. Meanwhile, the riparians would continue to develop a large amount of water storage infrastructure to improve the water storage capacity in the basin.²

Country	Dam	Storage capacity (MCM)	Function
Mali	Manantali	11,300	Hydroelectricity + Regulation
	Badoumbé	10,000	Hydroelectricity + Regulation
	Felou	0 (over the water)	Hydroelectricity
	Gouina	0 (over the water)	Hydroelectricity
	Moussala	3000	Hydroelectricity + Regulation
	Maréla	3000	Hydroelectricity + Regulation
	Bindougou	2000	Hydroelectricity + Regulation
Guinea	Boureya	5500	Hydroelectricity + Regulation
	Koukoutamba	3600	Hydroelectricity + Regulation
	Balassa	0 (over the water)	Hydroelectricity
Senegal	Gourbassi	2100	Hydroelectricity + Regulation

Table 11: Dams and dam projects and their storage capacity in SRB (Faye, 2022)

The Table 11 distribution shows the various facilities across the SRB, which makes it possible to store nearly 23 BCM of water. Thus, by doubling the storage capacities of Manantali and Diama dams together the countries achieve almost total control of the flows of the river at more than 97% (Faye, 2022). At riparians level, Mali has the largest storage capacity with the largest total capacity of dams per inhabitant with 783.5 m³ per inhabitant, while Senegal has the lowest with 16.52 m³ per inhabitant and in between lays Mauritania with 122.9 m³ per inhabitant. Regarding planned storage structures, Mali will get the largest one at 29,300 MCM, Senegal a 2100 MCM and Mauritania none, while national rainwater harvesting programs should be supported in all riparian states. The effect of climate change is taken into account by altering both water

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Key informant, *Supra Note 1*

availability and demand among riparians, while altering performance and suitability of different water storage options.¹

x. Expansion plans of irrigation areas

Most of the existing irrigated area that falls within Egypt and Sudan is expected to change as other upstream countries such as in Ethiopia and Kenya implement new plans to develop irrigation schemes.

Country	Baseline ('000 ha)	Planned Additions ('000 ha)	Expected total area by 2050 ('000 ha)
Burundi	8.74	0	8.74
DR Congo	0.00	0.00	0.00
Egypt	3447.00	444.00	3891.00
Ethiopia	91.00	1420.06	1511.06
Kenya	47.80	63.25	111.05
Rwanda	7.00	4.45	11.45
South Sudan	0.50	273.13	273.63
Sudan	1764.63	1146.60	2911.23
Tanzania	19.75	0.00	19.75
Uganda	9.70	0.00	9.70
Total	5,396.12	3,351	8,748

Table 12: Planned growth in irrigation areas in NRB (NBI, 2015)

Based on existing national plans in riparian states, Table 12 lists the projection of irrigation areas that Egypt and Sudan are set to maintain their existing greater share. In terms of distribution of the planned expansion in areas equipped for irrigation (Figure 13). If the current level of cropping intensity is applied, the total cropped area will be approximately 10 million ha (NBI,

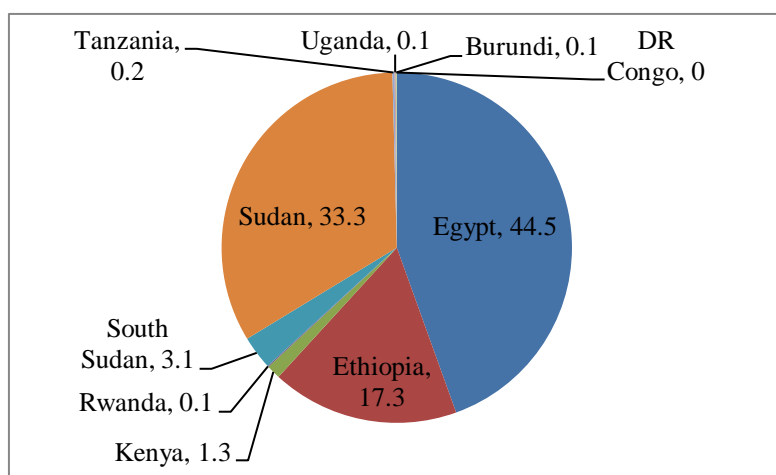


Figure 13: Distribution of future irrigation areas by country (NBI, 2015)

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

2015). Thus, it is estimated that the cropping intensity can grow and the cropped area will be higher than this figure. Even if irrigation water demand is determined by the cropped area rather than the equipped area, Ethiopia is projected to push for more water demand. Nonetheless, one respondent contests Egypt’s increasing water demand stating that “Egypt’s agricultural system is excessively wasteful of the scarce water resources.”¹ Therefore, a substantial increase in irrigation water demand is a nearby scenario. Likewise, in the SRB irrigation will take the most of the basin’s water from the existing 10,000 ha of industrial crops (Faye, 2022).

Sector	Water Demand in MCM/year	
	Current	2025
Irrigated agriculture	1437	5200
Municipal and industrial	-	-

Table 13: Water demand estimate in SRB

In the SRB, as to Table 13 distribution, current irrigation water demands are estimated at 1437 MCM per year, mainly distributed between Senegal and Mauritania, representing more than 90% of the total demand of the four countries (ibid). Given the objective of increasing the irrigated area to 255,000 ha by 2025 irrigation water demand in the SRB will be 5200 MCM per year. This implies 90% of agricultural developments in the valley and the delta, while the development of irrigation will still remain very low in the upper basin. Accordingly, the areas developed in this part of the basin will represent less than 10% of the total irrigated area. Moreover, demand for drinking water supply, livestock and mining remain constant throughout the year, while the combined needs are very low and account for less than 10% of the basin’s water needs. The valley and the delta concentrate more than 90% of low water support requests.

4.1.2 Water stress in the basins

The “Falkenmark Water Stress Index” (Falkenmark, 1989), characterizes the NRB by a water-scarce region lived with turbulence and riparian disputes. In this regard, the NRB displays an inherent water stress problem mainly because the current amount of waters in the basin is not sufficient for its hundreds of millions of people. Prior to evaporation the Nile used to be

¹ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

calculated 84 BCM of water and that is clearly not enough to supply the needs of all people in the NRB.¹

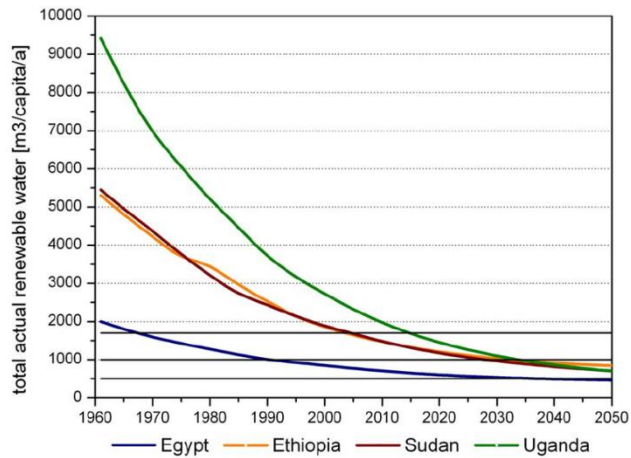


Figure 14: Increasing water stress projection in all Nile countries under the assumption of constant water availability (Link et al., 2013)

Figure 14 shows that since 1960 the NRB exhibits an increasing water stress, and the same threshold projection in all Nile countries under the assumption of constant water availability shows since 1990s Egypt surpassed water stress and falls under water shortage at below 1000 m³ per inhabitant per year. Similarly, the basin becomes more likely contentious, particularly between Ethiopia, Egypt, Sudan and Uganda falling under water shortage at below 1000 m³ per inhabitant per year starting from early 2030s (Link et al., 2013). The growing level of water stress in the region can be expressed through a speech of former Egyptian Foreign Minister and UN Secretary-General, Boutros Bourros-Ghali, who said “the next war in the Middle East would be fought over the Nile waters, not politics” (Kameri-Mbote, 2007).

The NRB and SRB share certain similarities as part of the global physical water course systems, irrespective of their distinct nature. In terms of physical and economic water scarcity, the NRB suffers from high level of economic water scarcity where human, institutional, financial capital limit access to water even though water in nature is available locally to meet human demands (FAO, 2007).

¹ Skype interview with key informant, January, 2023, Maryland, USA

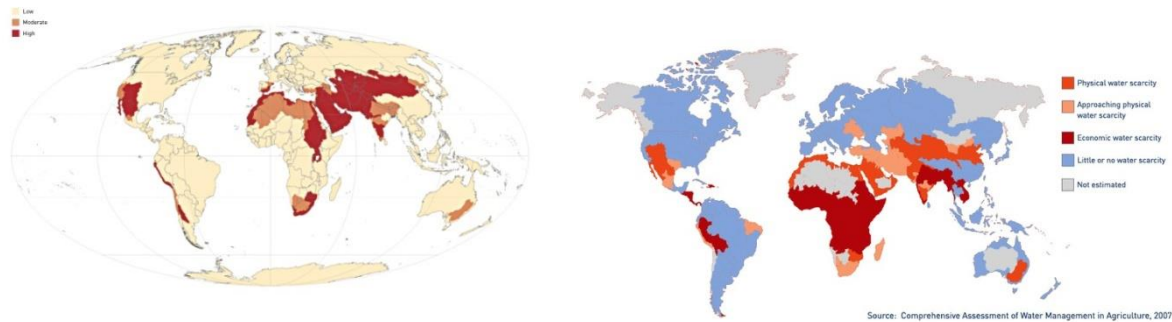


Figure 15: Global distribution of physical water scarcity by major river basin (FAO, 2011) (L); and areas of physical and economic water scarcity (FAO, 2007) (R)

Figure 15 shows the distribution of physical water scarcity between the two river basins; thus, the NRB has a high physical water scarcity compared to the SRB, which has a combination of low, moderate and high physical water scarcity (FAO, 2011). The NRB has inherent water scarcity problem because the amount of water in the Nile is not sufficient for hundreds of millions of people in the region.¹

The water stress in the NRB makes the region lived in turbulence and riparian disputes, particularly between Ethiopia, Egypt and Sudan lined with the core question of “historic” versus “sovereign” water rights, which is complicated by the technical question of the river’s nature. This situation can be substantiated in a 2017 national water resource plan of Egypt, which puts “through cooperation Egypt will get less water from Nile” calling not to cooperate over the Nile.² It is widely recognized that Egypt and Sudan, where the former to the greater extent, have a very little internally generated surface water. A UNICEF (2021) report states that Egypt could run out of water by 2025 as the country is facing an annual water deficit of around 7 BCM.

¹ Skype interview with key informant, January, 2023, Maryland, USA

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

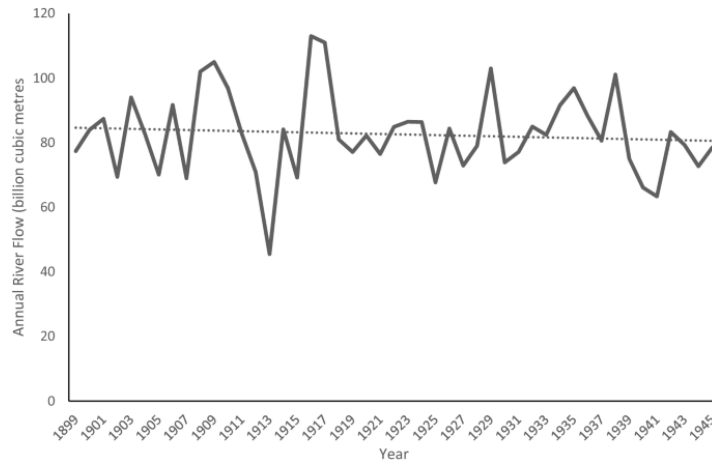


Figure 16: Annual flow of the Nile at Aswan during the 1899–1945 sub-period (Hurst et al. 1946 cited in Tayia et al. (2021))

The decline of the annual discharge of the Nile during the 1899–1945 sub-period was the most significant aspect of the physical environment of the NRB that have induced Egypt to concentrate its efforts to guarantee and to try to increase its annual supply of water (Tayia et al., 2021). As the primary water consumer of Nile waters, Egypt made technical and diplomatic efforts. The technical efforts aimed at establishing reservoirs and dams in Egypt and in other Nile riparian countries to mitigate the negative impacts of flood and drought periods on the Egyptian population in general and on the Egyptian agricultural sector in particular. However, these technical efforts were regarded as insufficient to achieve its objectives. Thus, Egypt had to intensify its diplomatic efforts by working together with the United Kingdom, its colonizing power until 1954, to establish a legal framework that guaranteed the annual water requirements of Egypt (ibid). These legal frameworks took the form of binding bilateral agreements in the historical evolution of the Nile Basin and laid its influence on the current interactions among its riparian states.

Water security in the NRB foretells the future and it is meant sufficient water consumption equitably and accessibly, and future oriented to the current global climate change, current capabilities of countries, water need for development or consumptive demands.¹

¹ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

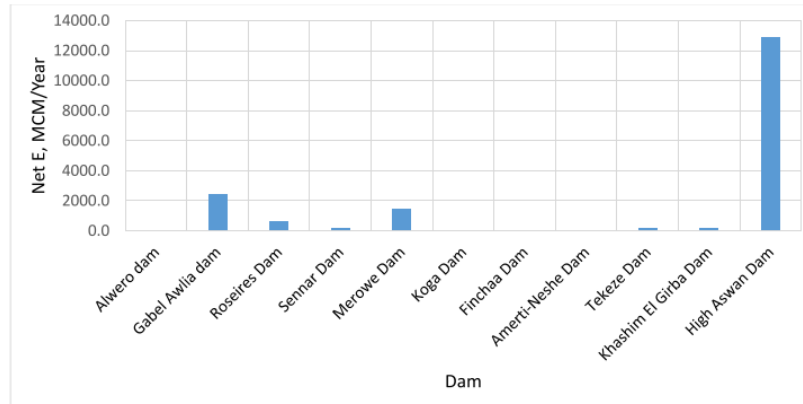


Figure 17: Distribution of evaporation losses from dams in NRB (NBI, 2015)

Figure 17 shows distribution of the evaporation losses from dams in the NRB, where the total estimated net evaporation on loss from the dams has been estimated as 18 BCM per year. Thus, the evaporation from the High Aswan Dam in Egypt is the biggest due to the size of the reservoir surface area and the climate. Ascribed to the 1993 agreement between Ethiopia and Egypt, signed to enhancing cooperation and to establish a common interest between the countries, Yacob, (2007) finds an irony in that Egypt wanting to have Ethiopia to streamline more volume of water, while the Aswan High Dam is losing more than 10 BCM water annually.

AQUASTAT database results show a trend of water stress or scarcity for the SRB at below 1700 m³ per inhabitant per year, and then of water shortage at below 1000 m³ per inhabitant per year (Zisopoulou et. al., 2022). At below 2500 m³ per inhabitant per year, Senegal and Mauritania are in a situation of water vulnerability (Faye, 2022).

Country	Period		Characteristics of renewable freshwater per capita (m ³)
	1958 – 1962	2017 – 2022	
Mali	22,301 m ³	6290 m ³	Renewable freshwater resources per capita (in m ³) continued to decrease between 1958 and 1962 and 2018–2022 at the level of the three countries.
Mauritania	12,538 m ³	2589 m ³	
Senegal	11,612 m ³	2458 m ³	

Table 14: Declining renewable freshwater resources per capita (m³) in SRB

The water stress in the SRB was shared due to the 1960s and 1970s severe draught that led the basin countries to look at ways to work together to mitigate the disaster.¹ Prior to the construction of Bakel gauging station, and Diama and Manantali dams the SRB has an important feature of inter-annual irregularity in its flow volume. However, the impact of the Manantali dam since its construction in 1988 has been contested for having no effect on the regulation flooding (Sakho et al., 2017), the issue of water stress is recorded as a driver for investment on shared dams.

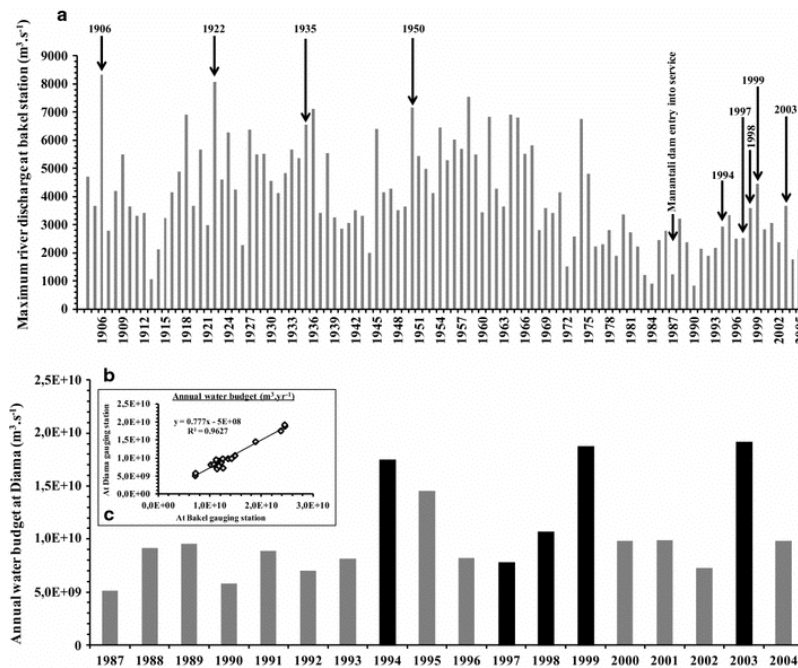


Figure 18: Annual water discharge and consequences on the downstream SRB (Sakho et al., 2017)

Figure 18 shows the positive hydrological changes observed in the SRB due to the construction of dams, which helped the basin's valley and delta zone to have availability of freshwater for irrigation agriculture during low flows periods. Accordingly, the evolution of maximum river discharge depends on long-term rainfall variability. The seasons between 1950s and 1960s correspond to periods of higher river flows, while unprecedented river flows deficits was recorded due to the droughts of the 1970s and 1980s. Since 1994, it has been observed at seasonal scale that there is a strong relationship between rainfall and runoff. Hence, alternating wet and dry seasons resulted in rapid hydrological responses. Regardless of the flood years of 1994, 1997, 1998, 1999 and 2003 the flows during dry seasons were due to water storage.

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

For a long time the inter-annual flood irregularity posed a major problem for the valley, as it decreased the potential for guaranteed agricultural production in the region. More specifically, the water stress in the SRB was shared due to the 1960s and 1970s severe draught that led the basin countries to look at ways to work together to mitigate the disaster.¹

The inflows of the SRB are significant, variable, inter-annually irregular and in an average year around 20km³. In the wet year of 1924 the riparians reached 41km³ and in the dry year of 1987 went down to 6.15 km³ and due to the Sahelian climatic deterioration the average inflow went down to 13 km³ per year (Faye, 2022).

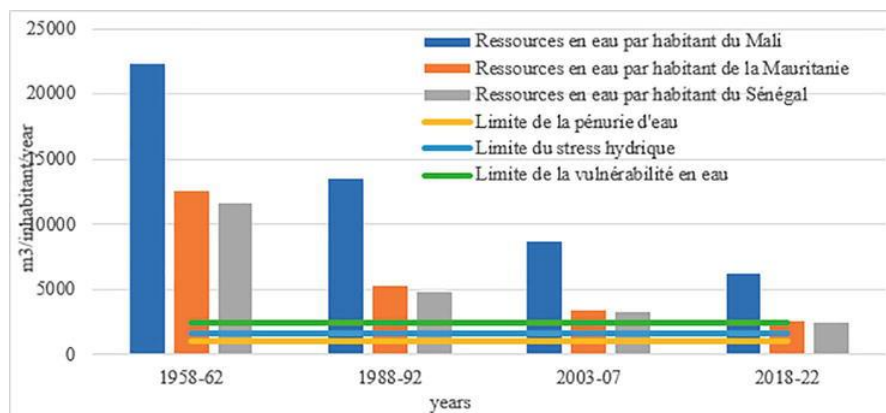


Figure 19: Evolution of total renewable water resources per capita between 1958 and 1962 and 2013–2017 in SRB (Zisopoulou et. al., 2022)

As seen in Figure 19 water consumption in the SRB increases at an exponential rate due to population increase leading to the creation of a state of competition for water (Paris, 2011). Among the river basin countries, Senegal suffers from a chronic water crisis due to drought, floods, contamination and unprecedented population growth.² As to Faye, the situation leads to insecurity as high transboundary river water import dependent countries such as Mauritania which is 96.49% dependent, will consider water to be a matter of national security justifying the use of force for its safeguarding. Faye further indicates that the basin countries will target water uncertainty reduction in-border river flow regulation via dams which is detrimental to the other contesting countries.

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Key informant, *Supra note 1*

4.1.3 Community of interest among riparians

Of the total 487.3 million estimated population size in the NRB countries, 53% or 257 million live within the NRB. While Ethiopia has the highest population of the basin, Egypt has the highest population living within the basin, followed by Uganda, Ethiopia and Sudan. Over the next 30 years, however, the proportion of urban population is expected to rise in all the basin countries (NBI, 2023). The community of interest comes evident in both river basins, “because transboundary river basin management helps to enhance development and to wisely and rationally utilize natural resources in the riparians.”¹ It is also seen from a rule based management by which it offers the best option for cooperation among the basin countries and reduces the possibilities of conflicts.² Kenya, for instance, with technological support aspires to develop its dry high potential land in the basin area for food self-sufficiency by lifting water from Lake Victoria (Yacob, 2007). Therefore, community of interest in terms of river basin management in the NRB refers to “the actual management of water itself and the political implications that come along the water use and the water use right issues,”³ while in the SRB it defines “the need to set new rules of engagement for mutual trust and confidence that requires no less than paradigm shifts.”⁴ The urban population proportion of NRB is expected to rise in all basin countries despite current largest share population in rural areas. However, the rural population is expected to rapidly shrink in all countries. By 2050, the percentage of urban population is expected to reach over 50% of the total population in four of the 11 NRB countries (NBI, 2023), while in seven countries the urban population makes up more than 40% of the total population.

Ethiopian highlands have a lot of development potential and the country’s population growth is now bigger than Egypt with over 120 million people. Looking at this trend a downstream country like Egypt where most of its water is coming from an upstream country feels it has “historical, natural or legal rights right on the water.”⁵

¹ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

² E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

³ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

⁴ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

⁵ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

On the other hand, the total population of the SRB is estimated at 35 million, of which 12 million live in the basin, whose livelihoods are by fishing, farming, and livestock breeding (Padt and Sanchez, 2013). These are among the most vulnerable groups in the region comprised of mostly subsistence or smallholder farmers. The SRB population growth rate is estimated at 2.7% and it is expected to double every 25 years (WB, 2015).

Poverty in both NRB and SRB regions is high, with the quality of life among the lowest in the world. The NRB suffers changing climate, and its vulnerability is deteriorated by poverty, disease, conflict and a low adaptive capacity (Batisha, 2013). Hence, unilateral strategies to manage the climate change are less likely to build sustainability of livelihoods and ecosystems. Based on key measures including the Human Development Index (HDI), six of the 10 NRB countries are among the poorest in the world (NBI, 2020), while each of the four SRB countries come in the bottom 25% of global rankings of the same measure (FAO, 2019). In other words, both basins call for ensuring the water, food and energy security on a sustainable basis as a primary focus.

Hydrology of NRB is “very much skewed,” and yet the population growth of the basin poses another challenge. For example in 1950s the total population of the Nile Basin countries was around 100 million and in 2010 it grew to more than 400 million and now it is well over 500 million people. Even if not all the population in most of the basin countries is dependent on the Nile, but the water volume does not grow that much, while the per capita of the water availability is going down.¹

Given the existing socioeconomic circumstances in Mali, Mauritania and Senegal; Mwendera and Atyosi (2018) see an increasing demand for water as most national planning initiatives such as mining, industry, agricultural development, municipal water supply, energy security, and tourism and recreation become components of the inevitable social development agenda of the countries. Thus, the demographic and urban growth of the NRB countries exerts strong pressure on the often limited available water resources in the basin.

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

i. Vision sharing Vs. Benefit sharing

The NRB countries initiated a program called "shared vision" as of 1999, with about eight projects, which were designed to build confidence between the riparian countries and to put in place enabling environment for cooperation (NBI Act, 2002). According to NBI Policy Guidelines, the shared vision program is set to create a coordination mechanism and enabling environment on a basin-wide scale (NBI, 2017). Hydropower development, efficient irrigation use and trading opportunities, environmental analysis, and public information exchange as potential projects listed under the program. The common desire in the NRB is enshrined in the shared vision program through equitable utilization and sustainable development of the NRB. Eventually, the NRB countries wanted to use the Nile for development and they designed a subsidiary action program, which is an investment program of the Nile waters.

Desire to cooperate in NRB is about what each of the 11 riparian countries really wishes from the NBI, which differs from one another, and this situations of the NRB countries especially for many of the upstream countries, necessitates the agenda of development, but for downstream countries like Egypt it means an issue that affect its water security.¹

In spite of vision sharing among NRB countries, the desire to develop Nile cooperatively comes with its own challenges of impracticality because a joint management of the river and all infrastructures may be the desirable scenario but difficult to achieve.² These countries have the obligation to come together to create frameworks so that they can be supported, while “the rights and procedures of water use is guided and secured.”³ On the other hand, the concept of “benefit sharing” plays an important role in the cooperation between the SRB riparian countries and the management of hydroelectric facilities. The sharing of benefits between the SRB countries is governed by the principle of "common and indivisible property," which is designed to manage the common facilities in the basin (Bolognesi et al., 2015).

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² Interview with key informant, February, 2023, Addis Ababa, Ethiopia

³ E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

In order to balance the share of benefits received and the share of investments made in each of the SRB countries, the sharing identifies mutually beneficial and sustainable arrangements to ensure the direct benefits generated by the facilities and distributed benefits derived from the multiple uses of water rather than physical water allocation.¹

Accordingly, the basin countries agree on making an “equitable basis” for the distribution calculation according to the sectoral allocation, which notably has a direct impact on how the common funding mechanism works in the region. Thus, the SRB riparians ensure that desirability meets possibility through what is called “a pan-African paradigm shift.”² Noticing the challenge for Africa in building new benchmarks and avenues for broader cooperation among countries, the leaders of the SRB countries were imbued with the spirit of Pan-Africanism borne out of years of anti-colonial struggle (ENSAP, 2006). The SRB countries share some commonalities, such as the French language, education systems and other institutions to further capitalize on their anti-colonial legacy. As French colonies, they shared a common heritage of anti-colonial resistance and that is the historical basis for the emergence of a strong sense of solidarity.³

4.1.4 Unilateral development projects

Nile River basin riparians pursue unilateral actions, and resist any political pressure in order to push for governance architecture that promotes equitable utilization. Upstream countries can employ the tactics of leverage mechanisms, which include water diplomacy, unilateral construction of development infrastructures and coalition with other upstream countries (Endaylalu, 2019). Although Egypt, Ethiopia, and Sudan recognize Nile River’s international character, however there is no agreed regime governing the actions of the three countries (Kendie, 1999a). This situation creates room for creation of unilateral development projects. No one or entity has a right to prevent a sovereign country to develop its water resources within its sovereign boundary.⁴

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Key informant, *Supra note 1*

³ Skype interview with key informant, January, 2023, Maryland, USA

⁴ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

Kendie's arguemnt that unilateral action by any riparians can cause considerable damage to the other riparian countries that can lead to serious international conflicts is downplayed that in order to promote equitable utilization of the Nile waters powerful countries can keep developing the river.

*The use of might is needed, because the world proved to be unfair in supporting upstream countries interest to benefit from the Nile waters due to their historical and political interests.*¹

However, “the benefit coming out of the development projects should target other basin member states through regional energy integration.”² Because it is ruled-out that unilateral utilization of shared water resources without considering the supply and demand patterns in riparians leads to uneconomic utilization (Yacob, 2007). Nevertheless, there is a conviction that unilateral action is already influencing Egypt and Sudan positively to come to smooth governance architecture that brings everybody to the negotiating table with equal power.³

i. The role of GERD in creating upstream counter hydro-hegemony in NRB

The GERD is a major single project in the Nile basin, which affects the major upstream country – Ethiopia and the recipient countries – Sudan and Egypt. The GERD project provides an alternative countering discourse, but Egypt sees it negatively and decided to use all means to subvert the project (Endaylalu, 2019). The GERD has broken the myth that downstream countries have veto power over the use of the Nile.⁴

*The GERD demonstrated that upstream countries can build and operate huge hydraulic infrastructure without external aid or loan, eventually countering the negative campaign of Egypt to block external financing of projects on Nile.*⁵

¹ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

² Interview with key informant, February, 2023, Addis Ababa, Ethiopia

³ Key informant, *Supra note 1*

⁴ Key informant, *Supra note 1*

⁵ Key informant, *Supra note 2*

Other upstream countries have also supported Ethiopia as they argue that Egypt should not undermine Ethiopia's right to the Nile (Chen and Swain, 2014). Meanwhile, according to one respondent, there was no challenge or any objection about the project from NBI.¹ This could be in a sense as Suhardiman et al. (2018) recognize the minor impact hydropower development could have because such investment does not in principle “subtract” the amount of water from a river – as a hydropower dam is designed to take a certain amount of water from the river and release it back to that river after using it for power generation. Moreover, the GERD initiated a lot of discussions, negotiations, and diplomatic activities between upstream Ethiopia, and downstream Sudan and Egypt.² It has created a lot of diplomatic and political interactions including agreement between Ethiopia, Egypt and Sudan on Declaration of Principles (DOP) in 2015. Despite Egypt maintaining the 1929 and 1959 colonial agreement, Endaylalu (2019) states the commencement of the GERD shifted the hydro-politics of Nile, as well as changed Ethiopia's reactive policy into a more proactive and assertive with the creation of ‘facts on the ground’. This is a new development which only happened after commencement of the GERD,³ while Ethiopia maintains that it has a “sovereign right to use its water.”⁴

Respondents also see with the latest trend that the downstream countries will have a tendency of losing. The coming of GERD initiated “the upstream non-hegemonic riparian states to began challenging the age-old Egypt's hydro-hegemony” (Endaylalu, 2019). Once GERD is completed Egypt's next demand could be ‘joint governance of the project,’ which they have shown interest in the past, and they might also come up with ‘getting priority from the power generated.’⁵

*The negotiations between Ethiopia, Egypt and Sudan involve a lot of give and take in terms of making sure everybody's interest is met and the compromise that worked out was that Ethiopia agreeing to extend the number of years it takes to fill the GERD.*⁶

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² Interview with key informant, April, 2023, Addis Ababa, Ethiopia

³ Key informant, *Supra note 2*

⁴ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

⁵ Key informant, *Supra note 2*

⁶ Skype interview with key informant, January, 2023, Maryland, USA

This situation implies that once basin member countries start building capabilities, especially source countries, their bargaining power would also increase and eventually downstream countries could give up and come to terms of negotiation.¹

4.2 Conflict and cooperation in NRB and SRB

4.2.1 Conflict and cooperation in the basins

Like many other international river basins Nile and Senegal River basins take into consideration a number of “historical contexts,”² giving them exceptional characteristics that go beyond water management but tackle conflict. In the NRB there is “some degree of cooperation.” But in many cases Nile did not come with an actual cooperation that can bring basin-wide benefits, and ongoing negotiations — associated with not negotiating when there are strong power asymmetries between Nile basin countries.

There is no black and white answer for presence of cooperation in the NRB. I cannot say there either is cooperation or no cooperation in the NRB. However, a cooperation which can grow is seen through NBI’s activities.³

Even though cooperation has been promoted in the NRB, still some of the approaches followed by some countries are not conducive for cooperation.⁴ However, “bilateral cooperation agreements remain the preferred course of action by few countries as the cooperating riparian countries expect the benefits to eventually outweigh the risks.”⁵ However, interviewees alike identified the creation of the NBI and CFA as the main instance of cooperation. All the Nile basin countries are participating in the NBI and its subsidiary action programs that are currently promoting cooperation except Egypt, which participates as an observer in some meetings of the NBI.⁶ Link et al. (2013) states that the Nile basin countries are still far from implementing an efficient basin-wide water resources management system. Despite one respondent’s argument of

¹ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

² Key informant, *Supra note 1*

³ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

⁴ Key informant, *Supra note 3*

⁵ E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

⁶ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

moving from ‘tension to cooperation’ as part a universal aspiration of riparian states,¹ amid several cooperation projects listed under NBI, another respondent sees the hydro-political arena of the Nile rather very often brings more “tension than cooperation.”² Nevertheless, lots of attempts have been made to create cooperative frameworks and cross border cooperation between the NRB countries, and all that has not been satisfactorily materialized, regardless of the opposing positions and excess conflictive rhetoric.³ Even though, the NBI envisions for the creation of a basin-wide cooperation, “the mode of cooperation between Egypt and Sudan solely protects their interest by avoiding a further basin-wide cooperation like through CFA.”⁴ The two most downstream countries act of “cooperation not to cooperate” is specific and targeted under “historical water right” pretext.⁵ In other words, this mode of cooperation is manifested in Article 5 of the 1959 Nile water sharing agreement between Egypt and Sudan, which states that “either of the two countries can not engage with any other county in NRB.”⁶ Yet, there is optimism for gradual progress towards cooperation in the NRB on the basis of equitable utilization.

*Since there is no inherent reason for conflict between upstream and downstream countries of the Nile, cooperation will not be difficult because all riparian countries share the same desires ‘to achieve development’ regardless of their socio-cultural context and geographic differences or stages of development.*⁷

Brady (2015) states that the NRB saw an emergence of both institutional and legal cooperation during which time water scarcity was continuously increasing because of population growth, economic development, and climate change. Brady further argues that the signing of the CFA and the construction of the GERD were the instances of conflict in the Nile basin, rather than increasing water stress. Rather, they are conflicts rooted in specific actions and events, motivated by economic advantages to upstream countries defecting from Egypt’s hegemony.

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² Interview with key informant, February, 2023, Addis Ababa, Ethiopia

³ Key informant, *Supra note 2*

⁴ E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

⁵ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

⁶ Key informant, *Supra note 5*

⁷ Skype interview with key informant, January, 2023, Maryland, USA

Despite Ethiopian leaders' willingness to come closer from time to time with Egyptian and Sudanese regimes, however, Ashow Swain sees that at the same time these leaders do not want Egypt, an 'Arab' nation to dominate the 'Black' African affairs (Swain, 1997).

In contrast, the SRB countries, from the start were in attempt to find a mutual interest in the light of ever changing context (Mbengue, 2014). The river basin states sought to artificially control the availability of water in the basin amid the emerging tremendous social, economic and ecological problems due to unsustainable water management (Vick, 2006).

The vulnerability of the populations of the Senegal basin states served as a catalyst for cooperation, because in order to improve the countries believed that collaboration on the development of the water resource would improve the standard of living of the population in the region.¹

Hence, the SRB states did not wait for a conflict to happen to adhere to a cooperative approach over the use of the water resources. The Senegal River is a successful international cooperation model.² It is indicated that the ultimate reason why the SRB has overcome all possible differences between the four riparian countries unlike the NRB is that, “the basin is not politically contested river basin.”³ Even though the SRB cooperation brought the construction of large dams and increased irrigation agricultural land (Böge et al., 2011), this acclaimed change came reportedly (Adams, 2000) at the expense of fisheries, flood-recession farming, the environment and the health of the local population. However, the cooperation between the SRB countries is implied through a joint planning, non-visa requirement for citizens to move from one basin to the other basin country.⁴

4.2.2 Power asymmetry and hydro-hegemony in the basins

The different trajectories of relations among the NRB and the SRB countries show how power manifests in water allocation, management and development. The role of asymmetric power and

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

³ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

⁴ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

hydro-hegemony or a state with more relative power in the basin can determine the status-quo of “water allocation”. Egypt’s overwhelming asymmetry in power sustained its Nile hegemony (Cascão, 2008). Thus, power disparity between upstream and downstream did not waver, as Egypt’s comparative hard power (economic and military) and soft power (international support and technical capabilities) with the weakness of upstream riparians (Brady, 2015). The NRB has “unnatural water right politics because it is a basin where the sources of the water did not benefit but those politically powerful non-contributors or downstream countries.”¹ The downstream countries are very adamant to come forward to genuinely cooperate.² However, Brady sees that among upstream countries Ethiopia took moves forward to ensure the establishment of the NBI. That was highly motivated by domestic political benefits. Ethiopia’s role demonstrated a relatively weak upstream country can influence the institutional structure of basin-wide water management via reconfiguration of domestic water policy.

The old-age bilateral agreements between downstream countries of Egypt and Sudan lay the foundation for their “historical right” over the Nile waters. Particularly, the 1959 bilateral agreement between Egypt and Sudan, which allocates 100% of the Nile waters to themselves, is the major challenge to strike cooperation in the river basin.³ Egypt and Sudan always insist on their ‘historical right’ and have agreed to stand against any demand arising from upstream countries, and they cannot change their thoughts.⁴ Such traction gains an absolute hydro-hegemonic view in the basin. The regular views expressed by these downstream countries of the NRB are often threat rather than good faith and cooperation.⁵

Moreover, the geopolitics of the region also affects the NRB, because some of the riparian countries have gained leverage due to their geopolitical strategic significance to the surrounding area.⁶ Exploitation by one user reduces resources availability for others, state Suhardiman et al., (2018), which is often referred to as “subtractability” or the “zero-sum” principle. One

¹ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

² Key informant, *Supra note 1*

³ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

⁴ E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

⁵ Key informant, *Supra note 1*

⁶ Key informant, *Supra note 3*

respondent concludes “the case for Nile would not be different from zero-sum game because it becomes the heart of the world politics today.”¹

Contrary to the NRB, there was no such as absolute hegemonic practice in the SRB, except for Senegal considered as a benevolent hegemony.² Although the major (75%) of the Senegal River’s three headstreams rise in Guinea, the country joined OMVS lately in 2006 and left in 2023. The new military government of Guinea states the country’s concerns and strategic interests have not always been taken into account by OMVS since its creation, and reasons out the delay in financing of the Koukoutamba hydroelectric dam in its territory for its departure (Africanews, 2023). Despite France’s absolute control over the river during its colonial rule even prior to the organization of the OMVS; Guinea, Mali, Mauritania, and Senegal belonged to the Senegal River Riparian States Organization, which helped to “manage the river basin and later served as transition to joint management.”³ Though sporadic violence broke in 1991 between Mauritania and Senegal, and smoldered ethnic and land reform tensions in the region, the two countries later managed to restore diplomatic relations keeping joint work at basin-wide level.⁴

4.2.3 The role of external actors in helping cooperation

The international community and different donors supported the process of NBI project and OMVS as a successful and effective organization. The World Bank (WB) played huge role to bring the Nile and Senegal basin countries and different donors together for support with its ‘Regional Hydropower Development Project’ that was active in the area already since the 1960s.⁵ Nile riparians prepared the Nile River Basin Action Plan in 1995 and would be later reviewed and approved by the donors, namely; WB, United Nations Development Program (UNDP) and Canadian International Development Agency (CIDA) in 1997 (Cascão, 2009). Likewise, OMVS garnered financial support from donors involved in financing different activities, programs, and projects.⁶ These are, the International Development Association (IDA), the Agence Francaise de Développement (AFD), the Kreditanstalt für Wiederaufbau (KfW), the

¹ Skype interview with key informant, January, 2023, Maryland, USA

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

³ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

⁴ Key informant, *Supra note 3*

⁵ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

⁶ Key informant, *Supra note 3*

CIDA, the European Union, the European Investment Bank (EIB), the Islamic Development Bank (IDB), the African Development Bank (AfDB), the Arab Fund for Economic and Social Development (FADES), the West African Development Bank (BOAD), and the Nordic Development Bank (NDB), the Global Environment Facility (GEF) and the UNDP were also involved in financing OMVS projects (Gawad, 2014). Twelve donors support building the Manantali and Diama Dams project, on which the WB and USAID declined to support the construction due to unpredictable negative influences on the environment and the livelihood. Yet, the later provided financial and technical assistance for environmental assessment and resettlement. Currently, the WB and the USAID are involved in projects in the SRB again.¹

Nonetheless, the views and arguments of respondents vary about the role of these external actors in channeling negotiations among basin countries towards cooperation. The international development partners played a significant role especially in the early days of NBI and, the WB in particular played big role at political level in the NRB, and when the countries were negotiating the CFA.² However, this respondent further indicates that financial support from the donor countries, institutions or development partners comes with their own strategy and priorities, and it is just like a “negotiation between development partners sometimes and the countries themselves. The first International Consortium for Cooperation on the Nile (ICON) was largely formed by the WB to mobilize funding for NBI and Nile cooperation.³ The first meeting was in 2001 and the WB formed the Nile team and mobilized huge resources and supported the cooperation financially and also technically. In 2003 the Nile Basin Trust Fund (NBTF) was established as a multi-donor support to NBI. Managed by the WB the initial financial contribution was made from 10 donors including Norway, European Commission (EC), Department for International Development (DFID), The Netherlands, Sweden, Denmark, Canada, Finland, France and the WB. Through the NBTF these “development partners” aimed to support to achieve the Shared Vision Objective of NBI (NBI, n.d.). The NBI also benefited from direct bilateral funding from multi-lateral donors such as SIDA, BMZ/GIZ, UNDP and AfDB. However, another respondent claims the western powers want to control African countries by keeping them poor.

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

³ Key informant, *Supra note 2*

There is a prejudice and ideology among western nations that they do not fully commit themselves into supporting water resources development infrastructure projects in Africa, because of there are geopolitical oligarchies, who do not want to see the African nations become economically sovereign.¹

This respondent argues that these “oligarchies” are ascribed to “Neo-Malthusianism theory that claims there are too many people in the world, and they believe that they may be better off with less Africans, less robust, less developed and less industrialized economies so as to manipulate and exploit them.² It is this case that neither the three successive US administrations supported the GERD nor European Union (EU) said something positive about the project, which is indicative of the mentality of the Western powers.³ Similarly, Chen and Swain (2014) say with the help of Chinese financial and technical support Ethiopia has unilaterally taken up a number of hydropower dam projects in the Nile river. They say China’s assistance helped Ethiopia, when Ethiopia was not successful to raise finances from the WB and AfDB for its development projects over Nile waters for many years. Irrespective of this claim the international community has to lobby to press Egypt and Sudan, they “refrain from being part of the comprehensive NRB agreement such as CFA.”⁴

4.3 Legal and institutional frameworks for cooperation

The cultural orientations governing the NRB and the SRB diverge between “vision sharing” and “benefit sharing,” respectively, as means for equitable utilization of the water resources. Almost all major regulatory agreements governing the NRB were achieved in the period that extended from the second half of the 19th century to the end of the first half of the 20th century. This historical period can be divided into two sub-periods, the first starts from 1870 and extends to 1898, while the second period covers the first half of the twentieth century. According to the Identification, Authentication, Authorization, Accountability (IAAA) statistical model developed by Ostrom (1990), the regulatory structure of the Common Pool Resource (CPR) was analyzed

¹ Skype interview with key informant, January, 2023, Maryland, USA

² Key informant, *Supra note 2*

³ Key informant, *Supra note 2*

⁴ E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

to map the physical conditions of the NRB. Hence, during this period there were significant catalysts of the efforts of the riparian countries to regulate the Nile waters, both legally and technologically.

Sub-Period	Average Annual Discharges	Characteristics
First (1870 – 1898)	109,775 BCM	<ul style="list-style-type: none"> • High annual discharge and were above 100 BCM in most of this sub-period
Second (1899 – 1945)	82.6 BCM	<ul style="list-style-type: none"> • Lower than 100 BCM in most of this sub-period with exception of only 5 years • In 1913 one of the lowest flows in modern history was recorded at 45.5 BCM • Egypt was most affected by the decline in the Nile flow

Table 15: Average annual discharges and characteristics of Nile River until mid of 20th C

As discussed in chapter three of this study, there have been intensive negotiations to establish principles, rights and obligations that ensure long-term and sustainable management and development of the shared Nile waters. However, these efforts were extremely politicized and maintained the longstanding dilemma in the basin. All respondents agree that the politicization of the Nile waters is more pronounced than the Senegal River, where “the management of Nile goes beyond water usage or equitable utilization of the river because its political characteristics are much broader involving external or regional powers.”¹ Thus, the NRB governance framework has been undergoing a series of tensions. This is notably characterized by policies that are primarily dependent on the national scale and on the implementation of numerous bilateral agreements, recalling the strong heterogeneity of preferences from within the riparians.²

¹ Interview with key informant, April, 2023, Addis Ababa, Ethiopia

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

1920 – 1929	1929 - 1959	1959 - 1990	1999 - present
Evolution in the distribution of waters	Agreement for the Full Utilization of the Nile Waters (1959 Egypt/Sudan)	Aswan High Dam project	Negotiations for CFA (1997-2007)
Negotiation between Egypt/Great Britain	Investment by the colonial power	Egypt spearheaded Undugu/brotherhood (1983)	Vision sharing
Nile Waters Agreement (1929 Egypt/Great Britain)	Sudan’s independence	TECCONILE (1993 to 1999)	Birth of NBI (1999)
Unilateral control and development of Nile waters	Development of bilateral agreements (Egypt/Sudan)	Nile 2002 Conference Series (1993-2004)	Ethiopia emerged as regional engine for counter hydro-hegemony
Marginalization of upstream countries	Bilateral agreement and marginalization of upstream countries	The Nile River Basin Action Plan (1995)	Stabilization of economic growth in the region
		Coups and government changes	Unilateral development of project such as GERD
		Failure to include all the Nile riparian countries	Ideation of Nile Basin Commission
		Pressure and negotiations, which merely focused on technical issues and avoided the legal challenges	Lack of “Action”

Table 16: Synthesis of drivers of change in the governance of the NBI

As charted on Table 16, the evolution of the NRB governance system has come through four notable transitions. First, the period between 1920 and 1929 marked Egypt’s full control of the Nile waters, which led to the Nile Waters Agreement with Sudan on 7 May 1929. It was followed by the advent of a new deal between Egypt and Sudan during the period from 1929 to 1959. After Sudan’s transition from the colonial period to independence it signed the Agreement for the Full Utilization of the Nile Waters (Nile Waters Treaty) with Egypt on 8 November 1959. The fourth period began in the late 1990s, when the NRB enters a new phase. It is characterized

by a series of discussions and calls for adjustments in the governance system. The current institutional framework for cooperation in the NRB entails two parallel processes: a) the NBI, which is an inter-governmental transitional institutional mechanism, and b) the negotiations for a new legal and institutional Cooperative Framework Agreement (CFA) that, once concluded, will provide a permanent status to the NRB cooperative institution (NBI, 2002).

4.3.1 Nile Basin Initiative (NBI)

The birth of NBI in 1999 is seen as an instrument for the first time, among the NRB riparians, to agree on a “shared vision objective” which aims to achieve sustainable socioeconomic development through “equitable utilization” of the Nile waters (NBI, 2020). The NBI is much comprehensive in the sense that “the riparian countries exchange knowledge and workout all possible avenues and mechanism to cooperate” in order all countries in the basin can have the chance to develop without interring to unnecessary conflict.¹ Similarly, the NBI has a unique nature that it is to the greater extent is member country led institution where the countries have the bigger say.²

One respondent rates the achievement of NBI to be quite a lot through surviving for 24 years given the history and the legacy of Nile.³ The NBI Secretariat also states that confidence and trust has been initiated through the joint institutions that contribute to a culture of dialogue for regional transformation (NBI, 2020). The riparian countries still continue to collaborate on things they think they can collaborate under NBI; however “sustaining the NBI has its own ups and downs.”⁴ An NBI Secretariat factsheet states that as of 2020, NBI accumulates a total investment volume amounting to 6.5 billion USD for all finalized projects and runs three centers to leverage its unique potentials. Through capacity building, generation of policies and knowledge, the NBI supports the countries and people of the NRB to better manage their shared water resources. Eventually, 32 strategies have been designed that provide policy directions for NBI member countries; 10,000 knowledge products produced, while 102,377 people have directly engaged through NBI capacity building events (NBI, 2020). Upon one respondent argument on the

¹ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

² Interview with key informant, January, 2023, Addis Ababa, Ethiopia

³ Key informant, *Supra note 2*

⁴ Key informant, *Supra note 2*

success of NBI is especially in common data or shared knowledge generation as well as numerous policy formulations,¹ however, it is still difficult to assess the progress or success of the NBI on all of the policy areas.² And yet, the NBI over the last decade has gained traction in promoting dialogue and cooperation among basin countries through setting a common vision and common development projects.

4.3.2 CFA as an all-inclusive multilateral cooperation

All respondents see the Cooperative Framework Agreement (CFA) as an approach that seeks multilateral negotiations for a comprehensive legal framework among NRB countries. The negotiation process for the CFA was initiated in 1997 and concluded in 2007 (NBI, 2007). As stipulated in Article 1 of CFA, it serves an institutional mechanism for cooperation among Nile Basin states to the use, development, protection, conservation and management of the NRB and its resources (CFA, 2007). Possibly agreed among all respondents, CFA is considered as a good basis to implement the principle of equitable and reasonable utilization in the NRB, in accordance with the natural capacity of the water flow and other development factors and need that are possible to implement in each country.³

The ultimate possible option for the NRB countries is to cooperate under the CFA.⁴

Even though so far the CFA has been signed by six countries or supported by two-third majority of the Nile basin countries and it is now under ratification,⁵ it is still in the hands of the NBI members' heads of state for final decision-making. Once ratified, a permanent river basin organization named as the Nile Basin Commission (NBC) will replace the transitional NBI (Cascão, 2009), which facilitates joint development programs for countries to discuss about their projects in complementary manner. Hitherto, the effort to ratification process proves to be unachievable given the current political situation.⁶ Although the NRB countries negotiated since 1997 in most of the CFA Articles except for Article 14, which was about “water security.”

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

³ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

⁴ Key informant, *Supra note 2*

⁵ Key informant, *Supra note 3*

⁶ Key informant, *Supra note 2*

Historically, Article 14 was not about water security but it was initially about “prior agreement”¹ on the Nile waters, where many other agreements on Nile, including the 1929 and 1959 by downstream countries were in place. This brings the stagnation of CFA.

*The NRB countries questioned the fate of the previous agreements on Nile upon signing and ratifying the CFA, because they are pushing for a new agreement based on the principle of "equitable utilization" that could eventually lead to a renegotiation of the volumetric water allocations in the basin.*²

This situation leads to a division among basin countries; where upstream countries agree to sign if these previous agreements will be void to the extent they are inconsistent with CFA. However, the downstream countries of Egypt and Sudan very much see the previous agreements as part of their right and did not accept the suggestion to void them; because countries usually enter into treaties, which for them are meant to serve forever unless some arrangements are there.³ Then, a clause of “water security” was introduced, which does not talk about prior agreement.

Upstream	Downstream
<ul style="list-style-type: none"> • Principle: Equitable utilization • Abolish previous agreements • New comprehensive agreement for the whole basin • New uses of water, new allocations • New investments without notification or veto – ensure access to international funding • Change status-quo 	<ul style="list-style-type: none"> • Principle: No harm • Acquired water rights and prior use • Retain existing agreements and allocations • Prior notification of projects regarding the Nile • Ensure water security • Information exchange • Keep status-quo

Table 17: Positions of NRB countries regarding the CFA

The ultimate cause of disagreement on CFA between upstream and downstream countries is summed as Egypt wanting to add respecting or protecting existing water rights and uses into the Article, while the upstream countries take ‘respecting the existing water rights and uses as a

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² Key informant, *Supra note 1*

³ Key informant, *Supra note 1*

means of accepting the existing agreement. Therefore, NBI members wanted to agree that the water security of all countries will be insured and sustained (CFA, 2007). It is a bit vague statement but if everybody can be happy with it why not.¹ Although there is conformity on the possibilities to achieve inclusive agreement mainly on the basis of the CFA, however, there is no possibility to agree on existing bilateral agreements such as the 1959 Agreement.² There is also a likelihood of continuation of the problem of overcoming “good faith” between upstream and downstream countries of the NRB. Mainly because the NRB countries cannot in actual sense deny the use of water resources especially in upstream countries.³ Therefore, the expectation is that in the long-run all countries will realize that cooperation is better than conflict, and obstructing water use in the upstream.⁴

4.3.3 Organization for the Development of the Senegal River (OMVS)

The legal and institutional framework for the SRB is comprehensively defined through OMVS. Previously, the Senegal River was not recognized as an international river, as it belonged to a single colonial power. However, after independence landlocked Mali sought to have the river international status recognized in order to ensure navigation rights (Alam and Dione, 2004). The foundation of OMVS was laid with the 1963 Bamako Convention signed by Guinea, Mali, Mauritania and Senegal, which paved the way for a joint management system of the river.

The OMVS has implemented a special legal regime since 1978’s Bamako Convention with the adoption of specific instruments for the management and operation of joint works (Bolognesi et al., 2015). Not only was the Bamako Convention the first post colonial West African treaty concluded in relation to water resources management, but the institutional machinery upon which it rested was progressive and the powers entrusted to the Inter-State Committee departed from general international law as well as international practice. Mbengue (2014) says the Convention has left almost no room for unilateral action by the riparian countries in the exploitation of the river. The Convention provides that the SRB countries share the investment

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² E-mail correspondence with key informant, March, 2023, Addis Ababa, Ethiopia

³ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

⁴ Key informant, *Supra note 1*

costs and operational fees on the basis of the benefits that each co-owner country will have from the operation of common works.¹

OMVS is depicted as a demonstration of a pioneering approach to transboundary water cooperation in Africa. In the SRB solidarity means everything exhibited through mutuality, harmony, shared values, concern for the interests of the other and thus community.² The cooperative framework among the SRB countries led water resources management to be seen as the epicenter for the economic, cultural and social development of the SRB countries.³ In addition to that, OMVS is founded on member countries cooperation on the principles of solidarity, equity and consultation, having a useful practice in the development of the Joint Multipurpose Project (JMP).⁴

*Every national or common projects on the SRB, its tributaries and sub-tributaries have been made dependent on the unanimous approval of the Interstate Committee that had given each member countries some kind of right of veto on any project of another member country.*⁵

This move is exceptional by which even the general international law still does not point in such a direction, as reflected in the 1997 United Nations Convention on the Law of the Non-navigational Uses of International Watercourses (Mbengue, 2014).

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

² Key informant, *Supra note 1*

³ Interview with key informant, February, 2023, Addis Ababa, Ethiopia

⁴ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

⁵ Key informant, *Supra note 4*

1802-1963	1968-1973	1974-1988	1990-2002
Colonial Authority published an Agricultural Plan for Senegal	Exclusion and marginalization of Guinea following conflict with Senegal	Definition of the financial breakdown	Manantali dam came online
Introduction of Bamako Convention	Drought in the Sahel	Senegal: benevolent hegemony	Water flow regulation
	Subsequent Bamako Convention	Investment costs borne by foreign donors	Intensification of environmental norms and emergence of the IWRM paradigm
		Finalization of joint projects	Reintegration process for Guinea (2006)
			Guinea resignation (2023)

Table 18: Synthesis of drivers of change in the governance of the OMVS

Table 18 charts the crucial historical governance phases of the OMVS. As the organization enters into a new era of environmental challenges at its fourth phase, its acclaimed success, is however criticized for weakness in analyzing the impacts of the dams to social contexts and knowledge of the inhabitants into sustainable development (Faye, 2022). The countries jointly, rather than unilaterally, developed Manantali and Diama dams and have improved provision of fresh water for agricultural and municipal uses (Alam and Dione, 2004). OMVS has one exceptional approach as “it does not operate in conflict with national programs rather works to reinforce them.”¹ Meanwhile, in a new milestone in 2023 Guinea left from the OMVS membership. The country’s ruling junta says the organization does not take its strategic interests into account (Africanews, 2023).

4.3.4 Joint investment projects

i. The Rusumo Fall Hydroelectric Dam on NRB

The NBI conducts a lot of feasibility studies that the pre-investment or pre-cooperation work is pretty much rich within NBI, where the challenge has been translating those into investment on

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

the ground.¹ Therefore, the NBI member countries have to go beyond technical studies, joint face studies or joint planning to joint development, which has been one big incentive for many countries to join the NBI. Under the NBI framework a joint project has been realized with Burundi, Rwanda and Tanzania signing a Tripartite Agreement in 2012 to jointly develop the Regional Rusumo Falls Hydroelectric Project (RRFP) (NBI, n.d.-a). Despite its small size, the project is a cooperative project which has a small dam in Rwanda and part of the water which is stored goes to Burundi and the power generated will be shared equally by the three countries.² Rusumo is a transformative power generation and transmission integration initiative to enable the three countries to have access to the benefits of Nile River that will be shared equally through a commonly owned Rusumo Power Company Limited (RPCL) based in Kigali, Rwanda (AfDB, 2023). The project comprises a run-of-river scheme at the common border of Rwanda and Tanzania on Kagera River and develops a head of around 35m at the local Rusumo Falls. The power production facilities and substation are located at the Kagera River in Tanzania and Rwanda, respectively.

The project has set a regional objective to enhance power generation and transmission capacity for the three countries and contribute to regional economic stability and integration by developing and managing joint assets. Its implementation will increase renewable hydroelectricity supply capacity to address the power deficit and allow the countries to address their low energy access rates. The African Development Bank (AfDB) states that with the project Rwanda and Tanzania will be able to shift from high cost of fuel import through production of cheaper hydro power; thereby contributing to the reduction of the current electricity tariff. Burundi will also expand its access and other economic activities with the project providing 50% of the current peak power demand, and reduce CO₂ emissions considerably. The WB provides the entire funding of 340 million USD for the 80 MW Power Plant, while the AfDB is providing 128 million USD for the 372 Km of 220Kv transmission lines. Although the project is relatively small it is a key project of the NBI prepared through the Nile Equatorial Lakes Subsidiary Action Program Coordination Unit (NELSAP-CU) and planned to complete by 2024 (AfDB, 2023).

¹ Interview with key informant, January, 2023, Addis Ababa, Ethiopia

² Key informant, *Supra note 1*

ii. The Large Manantali Dam on SRB

The first studies to build a dam in SRB dates back to the 1970s, and the focus was on calculations and simulations before and after the construction of the dam and the hydroelectric power station (Faye, 2022). Entirely located in Mali, the Manantali Dam was built between 1982 and 1988, on the Bafing River, the main tributary of the Senegal River. The project offers many huge benefits such as power generation, navigation, flood prevention and surface water availability, aquaculture, ecological protection, development-oriented restocking, food self-sufficiency, water transfer and supply in neighboring countries and irrigation. The dam has a storage capacity of 11.3 BCM and covers an area of 477 km² and an annual generating capacity of 800 GWh, and it consists of a dam 1460 m long and has a height of 66 m at the foundation (ibid). The dam also regulates the flow at 300 m³water per second. The Dam's network of 1,300 kilometers of transmission lines came on line in 2002 when electricity generation has become more reliable and is slowly transforming the lives of people in Mali, Mauritania, and Senegal (Alam and Dione, 2004).

Since May 2003 the station has been working at full capacity, generating 200 megawatts and laid transmission lines to Bamako, Dakar, and Nouakchott. In addition to an energy production function, Faye further states that the dam regulates the flow of the Senegal River and makes it possible to irrigate a potential 255,000 ha of land and, in the long term, should allow the navigability of the river over approximately 800 km from the mouth. The specific role of the OMVS is the operation of the Manantali Dam, and it is the success of the bet on regional integration around the SRB.¹ In 2000 the OMVS commissioned establishment the Manantali Dam Management Company (SOGEM) and the Diama Dam Management Company (SOGED) to operate the dam generating system. These agencies are; Under SOGEM's supervision the dam is operated by an independent entity from the private sector. In order to define the program of production, supply, and regulation of electricity production a Permanent Technical Committee on Interconnection was created, along with a Management Committee for Interconnection. This move mirrored OMVS's Permanent Water Commission, which has an advisory role on water allocation in the region (Faye, 2022).

¹ E-mail correspondence with key informant, June, 2023, Dakar, Senegal

Chapter Five

Summary, Conclusion and Recommendation

A comprehensive summation of key findings of the study and concluding remarks are presented in this chapter. Then, considering the interest of the regional governments and institutions as well as international communities in promoting an appeased and negotiated agreement for hared management to attain equitable utilization of the Nile waters, the researcher suggests recommendations. By identifying some of the gaps in the current research agenda, the researcher finally provides directions for future research and suggestions for related topics that could be addressed to satisfy these gaps.

5.1 Summary of Findings

5.1.1 Hydro-ecological issues

Hydrological changes in both the NRB and the SRB are critical drivers of change, as they directly affect water uses by leading to the development of hydropower, agriculture and navigation. Agriculture is the largest water consumer in both NRB and SRB, while water withdrawals vary by country and by sector of activity. In the case of Nile waters, irrigated agriculture is the highest consumer at approximately 80%, while the total water demand for municipal and industrial uses of the entire basin has been estimated at 12.9 BCM per year. In the NRB majority of irrigated agriculture and 97% of municipal and industrial demand uses occur in Egypt. In all of the NRB countries except Egypt, food production is almost entirely dependent on rain-fed agriculture and recession agriculture with little irrigation. Similarly, most of the large scale irrigation schemes are located in Egypt and Sudan, while upstream countries are limited to a number of small scale irrigation schemes. This situation makes food production in the NRB increasingly vulnerable to climate variability and hence uncertainty of rainfall.

Although, the total unmet water demand in the NRB system is about 1.2 BCM, Egypt by far has the highest actual withdrawal in the basin relative to its unmet demand, while Sudan relatively overtaken its unmet water need with actual withdrawal. In Egypt, more than one crop is cultivated per year and, therefore, the cropped area is bigger than the equipped area.

In the SRB current irrigation water demands are estimated at 1437 MCM per year, mainly distributed between Senegal and Mauritania representing more than 90% of the total demand of the four basin countries. Given the objective of increasing the irrigated area to 255,000 ha by 2025, irrigation water demand in the SRB is estimated to be 5200 MCM per year. Having the largest area coverage within the SRB, Mali has the highest water resources withdrawals of over 5 BCM. In terms of cost benefit three of the SRB countries have made use of the Senegal River for hydroelectric production that has a direct relation to the cost they encored.

Riparians in both river basins continue to develop large amount of water storage infrastructures. The growth in aggregate storage capacities of all dams in the NRB has significantly increased in recent decades. However, the cumulative storage capacity of Egypt is incomparably large at 82% with the rest of the riparian. With an aggregate basin-wide storage capacity of just over 200 BCM, most of the NRB countries have the least per capita water current installed capacities of hydroelectric power plants, and megawatt storage by world standard. However, based on existing plans, the projected growth in total storage capacity in the NRB basin will reach to approximately 445 BCM. Meanwhile, the total installed capacities of hydropower plants; in the NRB is expected to increase by about 21,000 MW and reach to 26,000 MW in 2050. Therefore, a substantial increase in irrigation water demand is also expected.

Similarly, various facilities across the SRB make it possible to store nearly 23 BCM of water. Thus, by doubling the storage capacities of Manantali and Diama dams together the countries achieve almost total control of the flows of the Senegal River at more than 97%. At riparian state national level, Mali has the largest storage capacity with total capacity of dams per inhabitant at 783.5 m³ per inhabitant, while Senegal has the lowest at 16.52 m³ per inhabitant.

5.1.2 Water stress

Both river basins are characterized as water-scarce regions with water consumption increasing at an exponential rate due to population increase leading to the creation of a state of competition for water. In terms of population by 2050, the percentage of urban population is expected to reach above 50% of the total population in four of the 11 NRB countries. On the other hand, the current total population of the SRB is estimated at 35 million and is expected to double every 25 years.

The NRB is characterized by a water-scarce region lived with turbulence and riparian disputes. Since 1960 the NRB exhibits an increasing water stress, while since 1990s Egypt surpassed water stress and falls under “water shortage” at below 1000 m³ per inhabitant per year. Starting from early 2030s the basin is projected continue to be more contentious, particularly between Ethiopia, Egypt, Sudan and Uganda falling under “water shortage” at below 1000 m³ per inhabitant per year. Therefore, the NRB displays an inherent water stress problem mainly because of the current amount of waters in the basin is not sufficient for its hundreds of millions of people. Prior to evaporation the Nile used to be calculated 84 BCM of water and that is clearly not enough to supply the needs of all population in the NRB.

In the SRB renewable freshwater resources per capita continued to decrease between 1958 and 2022. The basin also exhibits water stress at below 1700 m³ per inhabitant per year, and then of water shortage at below 1000 m³ per inhabitant per year. At below 2500 m³ per inhabitant per year, Senegal and Mauritania are in a situation of water vulnerability. This situation leads Mauritania which is 96.49% dependent of the water, to consider water as a matter of national security justifying the use of force for its safeguarding. Rainfall and river flows decrease by about 30%, and people become increasingly sedentary, concentrated, and vulnerable to climate hazards such as floods and drought. Subsequently, in the late 1960s the degradation of water availability was prolonged for decades. Until the 1990s development of water infrastructure was not found to be an effective response in the SRB. However, the water stress in the SRB was shared due to the 1960s and 1970s severe draught that led the basin countries to look at ways to work together to mitigate the disaster.

5.1.3 Power asymmetry and hydro-hegemony

The different trajectories of relations among the NRB and the SRB countries show how power manifests in water allocation, management and development. The role of asymmetric power and hydro-hegemony or a state with more relative power in the basin can determine the status-quo of “water allocation”. The NRB has unnatural water right politics because, it is a basin where the sources of the water or upstream countries did not benefit, but those non-contributors or downstream countries, namely; Egypt and Sudan are politically powerful. This gains an absolute

hydro-hegemonic view in the NRB mainly because of the 1959 bilateral agreement between Egypt and Sudan, which allocates 100% of the Nile waters to themselves. Moreover, Egypt wants to have Ethiopia to streamline more volume of water, while the Aswan High Dam is losing more than 10 BCM water annually. Such unilateral utilization of shared water resources without considering the supply and demand patterns in riparians leads to uneconomic utilization.

This situation serves the major challenge to strike cooperation in the river basin. The old agreements lay the foundation for downstream countries of Egypt and Sudan. They insist on their historical right and have agreed to stand against any demand arising from upstream countries. The regular views expressed by these downstream countries of the NRB are often threat rather than good faith and cooperation. On the other hand in the SRB, France's absolute control over the Senegal River during its colonial rule brought each riparian country to rally together in a spirit of Pan-Africanism. Although Senegal is a dominant power in the region, there is no absolute hegemonic practice, except for Senegal has been considered as a "benevolent hegemony". Even if the river's three headstreams rise in Guinea, however the country joined OMVS lately in 2005 and later left the organization in 2023. The new military government of Guinea states the country's concerns and strategic interests have not always been taken into account by OMVS since its creation.

5.1.4 Unilateral actions enforcing equitable utilization

Pursuing unilateral actions and resisting any political pressure is seen as a means to push for governance architecture that promotes equitable utilization from Nile waters. In the NRB upstream countries develop the move to employ the tactics of leverage mechanisms, which include water diplomacy, unilateral construction of development infrastructures and coalition with other upstream countries. In this course of action the benefit coming out of the unilateral development projects aims to target other basin countries. Unilateral project development is eventually causing pressure on Egypt and Sudan to come to smooth governance architecture that brings everybody to the negotiating table with equal power.

5.1.5 GERD creates upstream counter hydro-hegemony

The GERD project provides an alternative countering discourse and Egypt responded negatively and decided to use all means to subvert the project. However, the GERD brought new paradigm in shifting downstream countries veto power over the use of the Nile. The project demonstrates the upstream countries ability to build and operate mega water infrastructure without external aid or loan countering the negative campaign of Egypt to block external financing of projects on the Nile. The GERD also initiated a lot of discussions, negotiations, and diplomatic activities including the 2015 Declaration of Principles (DOP) between upstream Ethiopia, and downstream Egypt and Sudan. After the GERD the upstream non-hegemonic riparian country began challenging the age-old Egypt's hydro-hegemony.

5.1.6 Changes in the hydro-political structure

Like many international river basins Nile and Senegal River basins take into consideration a number of “historical contexts,” that give them exceptional characteristics that go beyond water management but tackle conflict. There is a consensus that there is some degree of cooperation in the NRB. But in many cases the NRB did not come with an actual cooperation that brings basin-wide benefits associated with not negotiating when there are strong power asymmetries between the basin countries. Yet, bilateral cooperation agreements remain the preferred course of action by few countries, as the cooperating riparians expect the benefits to eventually outweigh the risks.

The NRB sees an emergence of cooperation of both institutional and legal cooperation during which time water scarcity was continuously increasing because of population growth, economic development, and climate change. Even though cooperation has been promoted in the NRB, still some of the approaches followed by downstream countries are not conducive for cooperation. Eventually, there is a move from tension to cooperation as part a universal aspiration of riparians, and yet several cooperation projects have been listed under NBI. However, The Nile basin countries are still far from implementing an efficient basin-wide water resources management system.

In contrast, the SRB countries, from the start, were in attempt to find a mutual interest in the light of ever changing context. The demographic and urban growth of the SRB exerts strong pressure on the often limited available water resources in the basin. Accordingly, water consumption increases at an exponential rate leading to the creation of a state of competition for water. Yet, Senegal being the primary economic engine for the region plays a "benevolent hegemon" role. Hence, the river basin states sought to artificially control the availability of water in the basin amid the emerging tremendous social, economic and ecological problems due to unsustainable water management. The vulnerability of the populations of the Senegal basin states serve as a catalyst for cooperation, because in order to improve the countries believed that collaboration on the development of the water resource would improve the standard of living of the population in the region. Hence, the SRB countries did not wait for a conflict to happen to adhere to a cooperative approach over the use of the water resources. The Senegal River is a successful international cooperation model. The ultimate reason why the SRB has overcome all possible differences between the four riparians unlike the NRB is that the SRB is not politically contested river basin. Similarly, the cooperation between the SRB countries is implied through a joint planning, non-visa requirement for citizens to move from one basin to the other basin country.

5.1.7 Vision sharing Vs. benefit sharing

The cultural orientation governing the NRB and the SRB diverges between "vision sharing" and "benefit sharing," respectively, as means to equitable utilization of the water resources. This defines 'what is desirable' and 'what is possible' in either river basins. The NRB countries initiated a program called "shared vision" as of 1999, with about eight projects, which were designed to build confidence between the riparians and to put in place enabling environment for cooperation. Desire of the NRB 11 riparians differs from one another, and the situations for many of the upstream countries, necessitates the agenda of development, but for downstream countries like Egypt it means an issue that affect its water security. In the SRB the sharing of benefits between the SRB countries is governed by the principle of "common and indivisible property" which is designed to manage the common facilities in the basin. The benefit sharing

identifies mutually beneficial and sustainable arrangements to ensure the direct benefits generated by the facilities and distributed benefits derived from the multiple uses of water rather than physical water allocation. The OMVS parties come together around a “shared vision” of the river. The stability of the governance framework seems to have favored the inflow of financial resources at an early stage of cooperation.

In parallel, riparians benefit from highly interconnected economic dynamics, in addition to being relatively good and predictable. This economic environment is particularly favorable to cooperation. Conditions that are particularly conducive to cooperation surround the OMVS, which has demonstrated its ability to adequately address challenges. Moreover, the SRB riparians took advantage of their shared commonalities, such as the French language and education systems and other institutions. The countries Pan-African drive for anti-colonialism serves as a historical basis for the emergence of a strong sense of solidarity among each other.

5.1.8 Institutional drivers of change towards basin wide cooperation

The birth of NBI in 1999 emerges instrumental for the first time, among the NRB riparians, to agree on a “shared vision objective” which aims to achieve sustainable socio-economic development through “equitable utilization” of the Nile waters. The NBI is much comprehensive in the sense that the riparians establish cooperation in order for all countries in the basin can have the chance to develop without interring to unnecessary conflict. The Nile riparians still continue to collaborate on things they think they can collaborate under NBI; however sustaining the NBI has its own ups and downs. Initiated in 1997 and concluded in 2007, the Cooperative Framework Agreement (CFA) is also an approach that seeks multilateral negotiations for a comprehensive legal framework among NRB countries. CFA is a good basis to implement the principle of equitable and reasonable utilization in the NRB. Even though the NBI envisions for the creation of a basin-wide cooperation the mode of cooperation between Egypt and Sudan solely protects their interest by avoiding a further basin-wide cooperation like through CFA.

Defined by the legal regimes of the 1978 Convention on the Legal Status of Common Works and the 1982 Convention Regarding Financing Arrangements for Common Works, the OMVS regime adopted the "common works" approach. Accordingly, the Organization provides a

concerted and redistributive development model translated between different types of uses through co-ownership of development works between riparians and independent operator. According to Article 2 of the 1978 Bamako Convention, any work subject to a legal instrument is declared as "common property". Therefore, the "common and indivisible property" on the infrastructure works such as hydropower facilities is materialized through the establishment of a financing mechanism and a mechanism for the particular management of the facilities. The idea of the SRB common management is also realized through third-party management agencies under the supervision of the OMVS. The enrollment of these third-party operators satisfies the need for economic efficiency, while allowing for a quick development of managerial and technical capabilities.

The development of hydropower induced an intensification of cooperation in the SRB. To ensure the infrastructure's functionality financial and technical cooperation are instrumental. The benefits provided for other uses by the improvement of water security for the SRB countries also encourage cooperation. The challenge of water security was manifested through a number of natural phenomenon with increasing intensity, and reduced water availability. This situation encouraged and enhanced cooperation. Thus, decreasing water security in the SRB basin tends to demonstrate a link with growth, and the long-term benefits of investments dedicated to address water security.

For any of the construction or operation of jointly-managed facilities, the SRB member countries act as co-guarantors for the repayment of any loans extended to the OMVS. Each member countries have the obligation to make financial contributions. A country breaching its obligation of repaying within the appropriate period, in order to prevent a default with creditors, will bear the entirety of financial charges arising from the delay, including expenses related to any work and engineering contracts on joint facilities. Member countries have the capacity to borrow individually or jointly for the construction or operation of common investments. However, they will give back the loans to the Organization that ensures the control and management of joint infrastructure. Thus, OMVS is depicted as a demonstration of a pioneering approach to transboundary water cooperation in Africa.

5.1.9 Joint investments

Despite a number of feasibility studies conducted by the NBI Secretariat that the pre-investment or pre-cooperation work is pretty much rich within, however the challenge has been translating those into investment on the ground. Three NRB countries (Burundi, Rwanda and Tanzania) have begun attempting to strike cooperation through joint investment of a small regional hydropower project called “Rusumo Fall Hydroelectric Dam.” Upon completion it will have a small dam in Rwanda and part of the water will be stored in Burundi and the power generated will be shared equally by the three countries. For the SRB countries cooperation over shared investment dates back to 1970s with the ideation of Manantali Dam entirely located in Mali, which was built between 1982 and 1988. The project offers many huge benefits such as power generation, navigation, flood prevention and surface water availability, aquaculture, ecological protection, development-oriented restocking, food self-sufficiency, water transfer and supply in neighboring countries and irrigation. Since May 2003 the station has been working at full capacity, generating 200 megawatts and laid transmission lines to the capitals of Mali, Senegal and Bamako, Dakar, and Mauritania.

5.1.10 Factors of equitable utilization in SRB

The critical factors that contributed for the emergence and evolution of equitable utilization practices in the SRB and their policy implications are summarized in the table below.

Factors	SRB
Political will and investment	Riparians realized that in the absence of political will transboundary cooperation will not work and built solid foundation.
Coherent legal framework	Rules of the game were specified through conventions, agreements, and charters. This began with the 1972 landmark declaration of Senegal River as International River for Senegal, Mauritania and Mali.
Sovereignty	A paradigm shift was made through adoption of two types of sovereignties: National sovereignty and shared sovereignty.
Simplification of legal matters	Conventions and resolutions were introduced to facilitate decision making not to complicate things.

Institutional harmonization	OMVS never creates structures that conflict with national ones (what is done at regional level should reinforce, and not diminish national programs).
Development Vs management	Distinction is between development and management phases and their corresponding institutional, financial and legal requirements.
Clarity of strategy	Having clarity from the outset on the strategic options and modality of benefit sharing: benefits are shared among utilization sectors but not among states. Not all countries benefit equally from all sectors – some benefit more from one sector (e.g., transport) than others (e.g. agriculture). Countries benefit/suffer from “injustices of nature”: OMVS is there to correct these imbalances.
Dialogue and consultation	To strengthen key institutions. OMVS is a laboratory where community pedagogy is nurtured to open corridors of convergence of interest among states.
Legal Framework	Law alone is not enough to make transboundary cooperation work. Law must rest on and align itself with appropriate technical tools. It is from this realization that the Water Charter was borne. Transparent information needs to be available to create a community of law and interest.

Table 19: Factors for equitable utilization in SRB

5.1.11 Degree of cooperation and perceived conflict

Opinions of experts and other secondary sources were triangulated so as to find out the level of cooperation implementation as high and low through perceived level of satisfaction among the NRB riparians.

Upstream	High	<ul style="list-style-type: none"> • Multilateral cooperation • New framework agreement • Solidarity • Shared vision • Pan-African doctrine 	<ul style="list-style-type: none"> • Hydro-ecological challenges <ul style="list-style-type: none"> ▪ Water stress ▪ Freshwater demand • Socio-economic pressure • Accumulated knowledge • Development potential • Intimidation and competition
	Low	<ul style="list-style-type: none"> • Mutual trust • Confidence • Political will • Security 	<ul style="list-style-type: none"> • Bilateral cooperation • Unilateral investments • Hegemonic practice • Pro-colonial deal • Water allocation
		Low	High
		Downstream	

Table 20: Degree of cooperation and perceived conflict in NRB

5.2 Conclusion

The discussion in this study appears to reaffirm that the issues of transboundary water resources are highly political that are ruled by power. Despite developmental aspirations of the riparians, traditional and emerging forms of interaction in the Nile and Senegal River basins reveal the involvement of diverging power plays over the waters. There is also a benefit in establishing an accepted definition of “transboundary water resources cooperation”. Some cooperation can be coercive. However, cooperation among the NRB and the SRB should not be seen as a goal in and of itself. Thus, effective cooperation is required to meet the goals of the river basin countries. Transboundary river basin management matters because it helps to enhance development as well as to wisely and rationally utilize the water resources. It also offers the best option for cooperation among the basin countries and reduces the possibilities of conflicts. Therefore, transboundary river basin management implies the actual management of water itself and the political implications that come along the water use and the water use right issues.

5.2.1 A tale of two basins: context matters

Every river basin is unique, not only in terms of its hydrology, geography, and socio-economic status and related ecosystems that lend it its distinctive character, but also in terms of the communities of interest, geopolitical stature, policies and social structures that determine the nature and outcome of the interaction people have with the resources. This is also true in the case

of the Nile and Senegal Rivers. The immediate impetus for the emergence of the OMVS i.e. the impact of the 1972 drought is not unique to the countries of the SRB. The same drought during the same period had also affected, for example, the countries of Eastern Nile River as well. However, the action that followed is unique condition that favored the SRB countries to come together around the idea of forming a River Basin Organization.

The SRB countries share some commonalities, such as the French language and education systems and other institutions. As French colonies, they shared a common heritage of anti-colonial resistance and that could have been the historical basis to make possible the investment of significant political will, capital and commitment on the part of the then leaders of Senegal, Mauritania, and Mali, while the role of Guinea continues with contention until today. The leaders built mutual trust and confidence imbued with the spirit of Pan-Africanism borne out of years of anti-colonial struggle. This laid the foundation for the emergence of a strong sense of solidarity. The term “solidarity” takes high importance and is frequently mentioned by OMVS officials. Solidarity here means mutuality, harmony, shared values, concern for the interests of the other countries and their communities.

The SRB countries never had long, adversarial not to say hegemonic inter-state histories. Compared to the NRB countries their size, both in terms of population and land area, is considerably smaller. The NRB is relatively more complex not only in terms of hydrology, geopolitical interest but also in terms of ecosystem variation across its length and the variety of socio-economic structures and communities. All these contextual variables are factored in when contemplating what made the emergence of transboundary water resource cooperation and the OMVS smooth in the SRB. On the whole, the SRB region has been not geopolitically as sensitive as the NRB. For that reason the SRB was spared most of the post-colonial and cold-war instabilities and insecurities that characterized the NRB, more specifically the Eastern Nile.

The foregoing contextual factors that lent the unique favorable background for the emergence of OMVS need to be considered when thinking of the NRB negotiated cooperation in general and the joint investments in particular. Generally, the background contextual factors in the NRB are more complex, and thus require more ingenuity to manage their influence in a positive and

constructive direction. Each basin found itself benefitting from cooperation in either of bilateral or multilateral form for equitable utilization despite the fear of water scarcity and of opportunistic behaviors. To overcome this situation, transparency and exchange of information on earnings and interactions emerged as the essential cornerstones of greater coordination.

In the NRB, the discussions on the need to institutionalize cooperation, the transformative regime applicable to investments and infrastructure development is less dense and its materialization is a debatable issue. Unlike the case for the SRB, there is to date no international instrument that is specifically dedicated to bring the NRB countries together for equitable utilization of the Nile waters. But arrangements for observing the contours of the plan are contained in the NBI instruments adopted in the "shared vision" program that was launched in 1999.

5.2.2 Unilateral resource capture Vs. cooperation

The past interactions between the NRB riparians over Nile waters development could be summarized as an opposition between exclusive unilateral resource capture and containment strategies. This situation is notably characterized by policies that are primarily dependent on the national scale and on the implementation of exclusive bilateral agreements, recalling the strong heterogeneity of preferences from within the basin countries. Thus, apolitical water management approaches that do not consider the factor of power balances between countries ignore a crucial aspect influencing transboundary water cooperation. The most common barriers to reach to negotiated cooperation in the NRB include diverging water right issues and power asymmetry. Unequal power distribution influences water sharing and the negative environmental impacts. The establishment of fair and inclusive decision making structures for water resources management implementation necessitates a strong understanding of negotiated agreement and hegemonic power shifts among riparians. The NRB, the principal setting of this study, exemplifies precisely how non-negotiated consumption of water resources among riparian countries can disrupt effective implementation of river basin management. This is a specific and targeted action often comes under "historical or natural water rights." Except for the NBI itself, the major exception is the recent Declaration of Principles (DoP) agreement signed in 2015

between Ethiopia, Egypt and Sudan over the GERD project, and the ongoing joint development of the Regional Rusumo Falls Hydroelectric Project between Burundi, Rwanda and Tanzania.

The NBI is proved to be an instrumental project for Nile riparians to augment discussions, while OMVS serves a strong, stable regional organization, which is critically important for regional integration in West Africa. The SRB echoes the realities in the NRB, where the challenges are similar and the aspirations and opportunities parallel each other. The asymmetric control of the Nile's water resources is partially explained by the persistence of asymmetric power relations among the Nile riparians, which afforded Egypt a position of hegemony in the basin. The asymmetry is being confronted by riparians through strategies to influence relatively a powerful country of the basin with "win-win" solutions, or by transforming the "basin bully" or "hydro hegemony" into a basin leader. The two most downstream countries – Egypt and Sudan – manifest cooperation but only on the basis of not to cooperate with other countries in the basin. There is fear among governments that engaging in the issue of cooperation over transboundary water resources is too politically risky on their domestic scene. Yet, developing de-politicized initiatives and platforms may remain a challenge when it comes to transboundary water resources development. Amid historic backlashes, the GERD project significantly influenced the interaction between the NRB countries and raises the question as to whether the extent of its impacts is reasonable or not. The project could raise concerns, not from a technical point of view, but because of the possibility of the hydro-political implications.

Nile upstream countries clearly have the right to develop water resources on their borders. However, this point has not been openly contested by the downstream countries. Thus, an approach in line with international conventions that balance riparians development ambition would require greater dialogue. Hence, the search for an appeased compromise, whereby upstream countries would develop the Nile water resources, while harms to the most downstream countries, would remain reasonable.

However, viewing the recent developments in the hydropolitics of Nile as a change in Egypt's policy and the end of hegemony would be naïve. It seems a paradox and color change. Because Egypt has continued to maintain the status-quo by using various hydro hegemonic compliance

producing mechanisms found cost-effective. The historic analysis suggests that Egypt would use everything either of hard or soft power or both of them to preserve its hydro hegemonic position over the Nile waters. This situation expedites the lack of trust and good faith between the NRB riparians – particularly with the contest of Ethiopia against Egypt. Thus, hydro hegemonic compliance mechanisms and counter hydro hegemonic strategies can co-exist. Consequently, what makes the findings of this study so interesting is that, despite OMVS and the NBI operating in the African context, their certain fundamental differences might be unsound to match.

5.2.3 A perspective on coordination

The NBI and OMVS are characterized by the introduction of ambitious and robust framework for transboundary water resources management institutions covering such aspects as shared vision, knowledge generation, exchange of information, political and financial dimensions and coordination mechanisms, planning and public participation and most importantly shared benefit. The NBI is featured as a mechanism for transition to basin-wide transboundary cooperation, while OMVS has set a good practice in transboundary cooperation. Their actions cover key sectors of economic development. The nature, status and operating mechanisms of these two institutions represent real exceptions. These include the characteristics of the rivers basins, certain co-ownership arrangements on water infrastructure, and their regulatory frameworks through a forum for cooperation, investment and the granting of specific skills for the implementation of programmatic activities. The difference between NBI and OMVS notably helps to reflect on the concept of negotiated cooperation, by identifying favorable factors rather than barriers; and on the conditions for vision implementation illustrated by their resource management models.

The NBI maintains a “stronger together” narrative while hailing the mutual trust that has been built among its member countries working together by developing technical tools and identifying investment opportunities for over two decades. The NBI achieves joint investment projects that, like the Nile itself, span across national borders. It also plays an integral part in achieving not only water security, but also food and energy security in a bid to eradicate poverty in the Nile basin. However, the idea of “common and indivisible property” of all member countries is considered only in cases of joint facility and exclusive bilateral water sharing agreements such as

between Egypt and Sudan. Thus, the facilities of common interest are restricted to a limited number of countries and the NBI is considered as project acting on behalf of the Nile riparians.

The OMVS includes only four members whose economic interests are close and very interdependent. In the SRB, Senegal initiated fostering asymmetries for the emergence of a hegemon directing negotiated actions and eventually avoiding a political-economy of the status-quo. Yet, the NBI is dealing with a number of actors and with asymmetries which complicate the identification of win-win situations and the accounting of preferences. Therefore, the risk of inaction in the NRB is greater. The history of the NBI highlights this difficulty to go beyond the status-quo, particularly through the ongoing CFA ratification process that aims to institutionalize basin-wide organization. Nevertheless, the definition of a "shared vision" for the action of the NBI and the matching of costs and benefits into coordination efforts clearly illustrate the progress made towards revitalization in collaborative action.

5.3 Recommendations

Drawing upon the best practices of the SRB management; the following recommendations are forwarded for an audience that would be interested in finding a cooperative path for effective transboundary water resources management in the NRB. In that regard, the recommendations take a perspective that goes beyond a single river basin country's interests. Note that points in such a cooperative path considers to shun from issues that may not necessarily be the most relevant to follow for the NRB riparians compared to some unique and specific path taken in the SRB.

Focus on benefits, not allocations

The concept of benefit sharing is recognized to play an important role in the cooperation between the SRB countries, and the management of hydroelectric facilities that eventually reduce tensions and resolved conflict among the countries in the region. However, the NRB riparians are debating the shift from allocation of the Nile waters to benefit sharing of the overall costs and benefits from the river system. Nile riparians may require allocating the investment costs and

operational fees on the basis of the benefits that each co-owner country will have from the operation of common investment projects. Thus, the idea of joint works and benefit sharing can serve as a means of realizing the common interests in the NRB. It may also feed into the exploitation and maintenance of shared facilities in the basin. Despite the lack of practice in NBI, the common and indivisible property regime shall define the management of resources in the NRB, which involves sharing benefits among all 11 riparians.

Any kind of cooperation agreement in the NRB has to be part of a development plan for all the riparians. Because it is basically why countries want water is to increase the productivity of their economy and enhance the standard of living of their people. If the NRB countries are going to have a negotiated cooperation agreement they have to have a visionary strategic plan on how they will actually develop the region economically, which will include hydropower, irrigation agriculture, fishery, and other forms of manufacturing among others.

Focus on scientific or technical issues, not only political

The problem of water shortage cannot be solved with political solutions only, unless supported by technical solutions as alternative non-conventional water resources management side by side with political negotiations. Trust, good faith, awareness, technical research and capacity development are necessary but not sufficient conditions for the NRB countries to create. Continuing to develop awareness among the NRB riparians on the CFA is necessary if dialogue is considered as the best way forward. Awareness raising could also go beyond the legal aspects of transboundary water resources development.

Improving technical understanding of the controversial issues and the possible impact of various scenarios would be important for supporting any dialogue process. This would help to ensure that decisions are taken on the basis of information that encompasses all aspects of the challenges. Therefore, continuing to develop models that focus on the possible impacts of various scenarios of development in the NRB would be useful.

In order to facilitate a more informed understanding of the foreseeable repercussions of the path chosen, whether it is unilateral resource development or engaging in dialogue and negotiations,

focus should be on understanding the environmental, economic and social impacts of the planned projects. Dissemination of findings would need to be improved, which may help in limiting the aggravating factor of limited understanding of the issues among basin countries. Ideally, studies should be conducted by independent research institutions. Co-ownership by the governments of the NRB riparians would also be crucial and would be enhanced if studies of possible impacts are conducted in a joint fact-finding fashion that included all riparian countries.

In order to limit the politicizing of the Nile waters, debates on the sensitive topics could be facilitated and made accessible to non-political actors, including researchers, academia, and civil societies. This could include workshops, technical research, capacity development, and discussions on the added-value of cooperative scenarios. It may equally be important to facilitate people-to-people exchange programs and dialogue as well as debates that involve local water users, community leaders, and political actors, and public council members. The NBI may support incentives for public debates on transboundary water issues to help de-politicize and de-securitize the issue.

Impartiality level of the NBI should be reviewed to de-securitize and de-politicize Nile waters by allowing some of the critical issues that need to be debated publicly. This may help to keep control of the facts and assumptions or fears. This means that alternatives to the Nile riparians approach of unilateral resource capture would be taken seriously. Countries may engage in continuous negotiations.

Capacity building and technical research may not have much impact if the political will for practical engagement in dialogue remains limited. Thus, the NBI Secretariat may further push in developing de-politicizing and de-securitizing initiatives and platforms that encourage the resource sharing through river basin organization.

Understand the views of local actors

Independent research would be needed to understand the views of local actors. No agreement on basin-wide development architecture is likely to be viable if local water users are not convinced

that it is in their best interests. It may therefore be crucial to investigate how local communities perceive the possibility of cooperation leading to new investments; including their readiness to compromise and under what conditions they will do so. On this basis, foreseeable resistance or openness to cooperation can be assessed and guide governments at a national and regional levels.

Demonstrate the value added of a possible cooperation scenario

Assuming unilateral action is necessarily better by definition than non-cooperative solutions maybe naïve. There are pros and cons for the NRB in following unilateral actions. A negotiated cooperative path in the NRB would only be appealing to governments if they are convinced that the balance of pros and cons between negotiated and non-negotiated solutions is leaning toward negotiated solutions. Hence, increase the commitment of riparian governments for cooperation would be to demonstrate the added value that different scenarios (including alternatives to or compromises with existing development plans) could bring in terms of social, economic and political gains, as compared to the unilateral path.

In areas where there is little potential for direct benefit-sharing, exploring the possibilities for linking the water issue with non-water related issues such as “Pan-Africanism” could be given attention and become better articulated. This may be required if advocates of equitable utilization want to convince those who are opposed to negotiated cooperation that it should not be seen as a loss or something counter-productive to their interests.

The issue of politicizing water security may become less sensitive if efficient utilization of waters is in place in each basin country. However, such interventions may be insufficient and may provide very limited results depending on the strategic water management plans and foreign policy agendas followed by the NBI member countries. A reflection on the political gains would be particularly important considering the criticality of politics in shaping transboundary water interactions. In the absence of substantiated arguments there would be no reasons to deviate from the status-quo. Thus, more attention could be paid to the concept of issue-linkage, including direct compensations. The advantages of negotiated alternatives to the existing water use plans could be explored and evaluated, first from a socio-economic point of view.

Develop and support programs that meet increasing water scarcity

The foreseeable increase in irrigation water demand and storage capacity in the NRB upstream countries due to their growing development ambitions is at the heart of the existing and future tensions with downstream countries. This expansion is understandable for the purpose of increasing hydroelectricity production and crop production. But rather than focusing only on exploitation of the Nile waters, the upstream countries could try to find a balance between the exploitation and the gains that is going to happen. If the same result is going to be achieved as compared to only expanding irrigated areas or construction of dams, thus it only decreases tensions with downstream countries.

Contest the legitimacy of the old-regimes and change power relations in the basin

Since an equity treaty based regime is still under ideal scenario non-hegemonic riparians of the NRB may enhance their strategies and continue contesting the legitimacy of the existing order, envisioning CFA as a best alternative, and challenging the status-quo. Non-hegemonic riparians may employ tactics of leverage mechanisms through continuous water diplomacy for formation of basin-wide institutions and agreements such as CFA.

Investment projects on Nile waters by non-hegemonic countries may help to shift power asymmetries at the basin level in complex ways, modifying incentives or influencing to participate in river basin institutions, as well as opportunities for negotiable cooperation. Non-hegemonic riparians may form coalition and engage in development of unilateral investments, like the GERD project. New cooperative institutions and approaches to benefit sharing may become viable as a result of unilateral infrastructure development by upstream countries. Here are possible alternatives:

- Give priority to cooperating riparian countries in hydroelectric power supplies.

- Egypt and Sudan are first and foremost concerned with maintaining water flow from upstream. Upstream countries, particularly Ethiopia, could agree to maintain the volume of the annual flow of water in exchange for a negotiated compensation.
- The level of evaporation on dams built and cost of seasonal flooding is much higher in the downstream countries than in upstream countries. It may therefore be more economically beneficial for Egypt and Sudan to trade part of their old-age hegemony. Socio-economic models could support the development of such a scenario to assist decision-making.
- Improved water security, access to funding, and general improvement in relations with riparians could emerge as collateral outcomes of engaging in a genuine negotiation process.
- Given that upstream countries have the potential to develop the Nile water resources, another alternative could be to negotiate financial support from downstream countries (Egypt) to invest the planned infrastructures in exchange of maintaining the water flow.
- Considering Egypt's water stress that emanates from limited immediate source of fresh water other than the Nile, to mitigate its high dependence on water coming from Nile, it has to pursue mobilizing new resources and engineering solutions such as desalination of sea water and exploitation of ground water resources, and reuse of treated wastewater, as well as virtual water trade.
- The NBI has to create a room to ensure that what riparians gets in return for compromising on water use would be more beneficial from a socio-economic point of view than existing regimes.

Regardless of potential for both upstream and downstream sides to find a satisfactory compromise, there are also important practical limitations to such an approach, when negotiations or unilateral resource utilization happen.

- Full control of Nile waters contradicts with international watercourse laws and will be a direct cause for conflict.
- A pre-requisite of CFA on the Egyptian and Sudanese side has not yet happened.
- Negotiations on the GERD would be an important area of cooperation that could benefit both sides.
- In order to ensure that the water flows reasonably, Egypt and Sudan could support construction of the new infrastructures on the upstream countries side as a form of compromise. This way, the Nile waters would maintain its flow from its sources and would not cause damage on the downstream countries.
- The risks associated with pursuing the existing plans through a non-negotiation path may also be difficult to assess and quantify, but the scenarios need to be drawn.
- Political and diplomatic gains or losses may be more difficult for the international community to raise and evaluate as such assessments and suggestions may be viewed as politically motivated.
- It should not be assumed that the pros and cons of cooperation scenarios would necessarily outweigh the pros and cons of pursuing unilateral utilization of the Nile waters. But in the absence of convincing arguments, those who would support a non-cooperative settlement may not be able to change their status-quo.

The international community should support negotiated settlements

It is worth noting that the international community is already engaged in ongoing activities to do with technical support in the NBI. Such activities should be maintained, but their scope and targeted beneficiaries could be expanded. Donors could provide training and capacity development to non-political actors as well, including academics, students and key actors in governments. This may help to improve understanding around issues such as limited territorial

sovereignty when it comes to water resources among political decision-makers and influential leaders. The international community could further promote public forums and discussions among national actors on how to approach transboundary water resources development. A long-term and sustainable cooperative solution may also be found if nonpartisan civil societies are given space in the negotiations process.

Recommendations for further research

In the light of the findings of this exploratory research, it would be important to improve further the understanding of the local, national, regional, geopolitical and economic or developmental dynamics that keep NRB and its riparians in a full-fledged non-cooperative state. At the same time, it would be important to better understand the dynamics that could not bring the riparian countries closer in good-faith, trust and genuine and sustained dialogue. It would also be particularly important to further investigate how the national political dynamics within Ethiopia, Egypt and Sudan affect the nature of the transboundary water interactions and future development of the Nile waters as well as why Guinea in the SRB deviates from OMVS.

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