

A Framework for the Sustainable Management of Water Resources in Lake Chad

A Master's Thesis submitted for the degree of
“Master of Science”

supervised by
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Affidavit

I, **ONANA IBOGO FÉLICITÉ MOÏSA**, hereby declare

1. that I am the sole author of the present Master's Thesis, "A FRAMEWORK FOR THE SUSTAINABLE MANAGEMENT OF WATER RESOURCES IN LAKE CHAD", 91 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
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ABSTRACT

Suffice to say that the sustainability of water resources requires implementation of frameworks that consider the socio-economic, political, and environmental realities of the region of concern. For instance, Lake Chad, one of Africa's oldest lakes, has for past decades been confronted with a series of environmental challenges threatening not only the socio-economic livelihood of its surrounding populace but also the entire region's development. Agriculture, fishing, livestock farming, and transportation are the most lucrative economic activities that populations benefit from the lake presence; population growth and exploitation of natural resources attributable to the lake presence have been a curse rather than a blessing. Uncontrolled development of irrigation schemes, cattle rearing, dam construction, and soil enrichment with chemical fertilizers have led to pollution and fish-number depletion, significantly increasing pressure on the lake's ground and surface resources, affecting its size and natural resources endowment. What's more, climate change leading to droughts, floods, and unpredictable rainfalls/failed rainy seasons, terrorism caused by Boko-Haram insurgencies, political instability, and population growth have all had a negative effect in the lake's ecosystem. These have caused inter alia, population displacement leading to climate and political refugees. To address these challenges, a series of efforts were set up at the national and regional level, including the creation of the Lake Chad Basin Commission (LCBC) in 1964 under the Fort Lamy convention to manage the basin's resources for the region's sustainable development. However, sixty years since it was created, the LCBC continues to be confronted with a series of challenges that defy its authority as an institution of basin management. Lack of funds and uncoordinated action have been detrimental to the LCBC management of water resources. The flaws of the LCBC in water management led to the formation of the Water Charter in 2012, the first binding instrument concerned with water resources management in the basin. However, not all states have ratified the convention, making the full implementation of its provisions to ensure water resources sustainability in the region difficult. Thus, implementing an Integrated Water Resource Management (IWRM) that promotes a holistic framework for a long-term adaptive and resilient management of water resources, protects the ecosystem, supports local livelihoods, and promotes regional cooperation, is essential, if not crucial, for the future of Lake's Chad water resources and its dependent populations.

Key Words: water resources management, sustainable water management, water demand and water supply

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LIST OF ACRONYMS

- AMCOMET:** African Ministerial Conference on Meteorology
AMCOW: African Ministers' Council on Water
AU: African Union AU
BGR: Bundesanstalt für Geowissenschaften und Rohstoffe
CAR: Central African Republic
DPSIR: Drivers, Pressures, State, Impact, and Response
EEA: European Environment Agency
EU: European Union
FAO: Food and Agriculture Organization
GIZ: Deutsche Gesellschaft für Internationale Zusammenarbeit
GWP: Global Water Partnership
IAEA: International Atomic Energy Agency
ICOLD: International Commission on Large Dams
IWRM: Integrated Water Resources Management
Km²: Kilometres square
LCB: Lake Chad Basin
LCBC: Lake Chad Basin Commission
m: metres
m³: Metres Cubes
mm: Millimetres
NEPAD: New Partnership for Africa's Development
OCHA: United Nations Office for the Coordination of Humanitarian Affairs
PIDA: PROGRAM for Infrastructure Development in Africa
RBM: River Basin Management
RBMP: River Basin Management Plan
TDA: Transboundary Diagnostic Analysis
UNDP: United Nation Development Program
UNECE: United Nations Economic Commission for Europe
UNEP: United Nation Environment Program
UNESCO: United Nations Educational, Scientific and Cultural Organization
WAP: Water Allocation Plan
WB: World Bank
WBG: World Bank Group
WHO: World Health Organisation

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1. INTRODUCTION

1.1. Relevance and motivation

“Water is life. Every human being, now and in the future should have enough clean water for drinking, appropriate sanitation and enough food and energy at a reasonable cost. Providing water to meet these basic needs must be done in an equitable manner that works in harmony with nature (...)”
(Serageldin, 2000).¹

Water and water resources are essential sources of food security, energy, and overall livelihood. Lake Chad, located in the Sahel region of Africa, is an essential source of livelihood for about 45-50 million people (Nuhu, 2023). The huge population living around Lake Chad can largely be attributed to the richness of Lake Chad’s waters. Lake Chad’s waters possess abundant resources, contributing to the development of a series of socio-cultural and economic activities such as farming, cattle rearing, fishing, and transport. Although these activities are essential for the survival of the population living around the lake, the same populace pose a severe threat to the sustainability of Lake Chad’s water resources.

Demographic growth led to increasing pressure on the lake’s waters, triggering the depletion of its resources, contributing to the outburst of food insecurity, armed conflict, underdevelopment, and poverty in the Lake Chad Basin (GIZ, 2018). As an illustration, the development of agricultural farming around the shores of Lake Chad led to the massive use of its waters for irrigational purposes (UNEP, 2004). Traditional rice cultivation has led to massive water withdrawal; in Chad, it accounts for about 75 percent of its national production (Odada and Oguntola. This intensive use of water for irrigational purposes has been among the causes of the observed 1980s and 1990s Lake Chad’s decline in volume (Lemoalle and Magrin, 2014).

Another activity impinging the lake’s natural resources is the construction of dams. Dams’ construction around Lake Chad restrained the availability of water resources. For instance, in 1979, a 30km dam was constructed on the upper Waza-Logone floodplain. This was for an irrigation rice scheme project known as the Semery (Claude, 1989). When combined with these factors, water pollution leads to water quality degradation in

¹ Statement made by Ismael Serageldin, Chairman of the Global Water Partnership, and the World Commission for water in the 21st Century.

the basin. This has been a significant cause of several regional health problems and fish depopulation (UNEP, 2004, P.55).

Coupled with demographic pressures, the climatic situation of the region is also worth considering. Climate change has been affecting the LCBC for past decades. This has led to variations in the surface area of the lake. The region has been affected by a series of droughts leading to the lake's size reduction. From about 26000 km² in 1963, the lake shrunk to about 2500km² in 1987 and to 1500 km² in the year 2000 (Bdliya and Bloxom, 2012).

Nevertheless, if excessive droughts have been perceived as a curse to the region's water resources endowment, precipitation in the region has been received as a mixed blessing. Excessive rainfalls have led to floods, inundations, and destruction of houses and farmlands. This has contributed to the massive displacement of people in the basin. A case in point is the heavy downpour of 2013 which led to a rejuvenation of the lake with a surface area of about 14000 km² (Bouchez et al., 2023). Despite the rejuvenation, the downpour contributed to the massive displacement of people around the basin. However, even the rejuvenation was short-lived as the lake shrunk back to 1500 km² in 2021. Today, the lake has once more rejuvenated with a surface area of about 17000 km² (Koffi, 2023), creating a total amount of displacement of about 1.76 million people (OCHA, 2022)

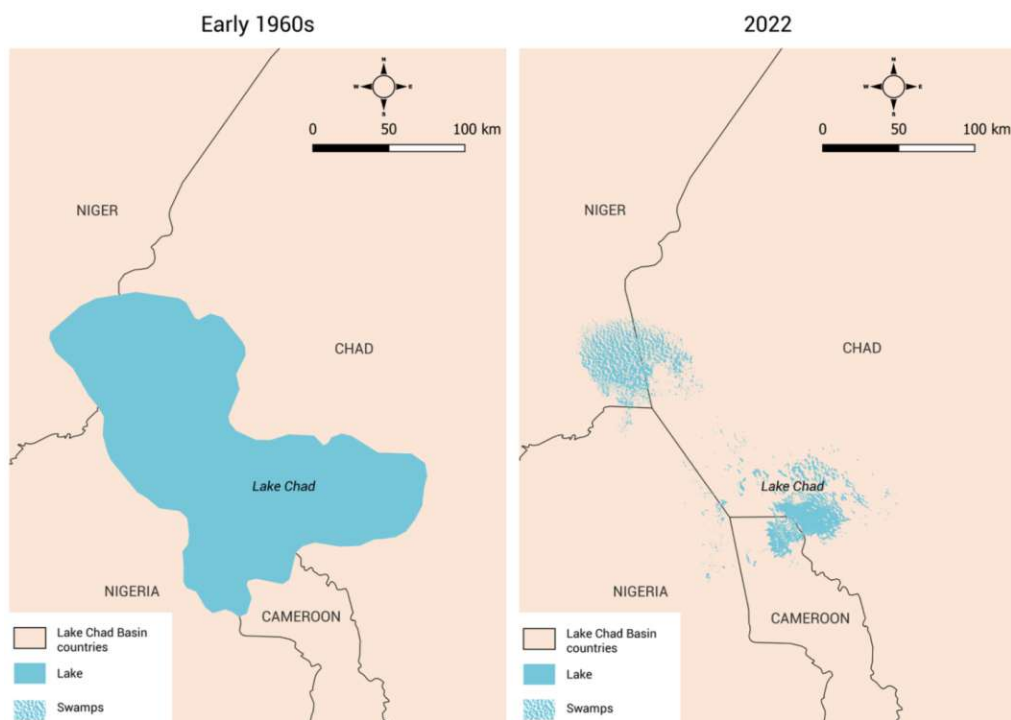


Figure 1: Lake Chad Water Level Fluctuation. Source: acaps, 2022.

The displacements of populations around the basin due to droughts and floods are significant causes of conflict, poverty, and consequent underdevelopment in the region. A major conflict that occurred around the Lake Chad area was the Cameroon-Nigerian conflict of 1959 and 1994, when the Nigerian portion of the lake decreased, there was a massive migration of Nigerians to the Northern borders of Cameroon. The case was brought to the International Court of Justice. There have also been frequent confrontations between the riparian population over the control of land and water resources, especially around the 1980s and 1990s (Njeuma and Malaquais, 2004).

The combination of the above-stated factors makes the sustainable management of water resources a critical issue that needs to be addressed because it has been an essential determinant for sustainable development, peace, and security in the LCB. Owing to that need, in 1964, under the Fort Lamy Convention, the Lake Chad Basin Commission was created. The LCBC mandate aimed at ensuring development in the Lake Chad Basin and the sustainable management of its water resources. The founding states were Cameroon, Chad, Niger, and Nigeria. Although the Fort Lamy Convention and its statute aimed at regulating the uses of water resources in the Lake Chad Basin, it did not provide for water allocation rules. Therefore, attempts were made by Cameroon and Chad in 1970 with the Moundou Agreement to specify the Logone River (one of the principal rivers feeding Lake Chad) water levels limits. However, this agreement was non-binding and did not provide for abstraction limits (Odada and Oguntola, 2005, p.83), leading to the observed chaotic exploitation of the basin's water resources.

Further steps were taken by the commission aimed at recovering the basin's waters, such as the Inter Basin Water Transfer (IBWT) project from the Ubangi River of the Democratic Republic of Congo (DRC) to Lake Chad in the 1970s. The commission uniformly agreed to the project in 2018 at the International Conference of Lake Chad in Abuja, Nigeria, under the auspices of United Nations Educational, Scientific and Cultural Organization (UNESCO). However, it has not yet been implemented because of the environmental and political discourse surrounding it (Caner and Nagabhatla, 2020). Moreover, around the 1990s, other institutional efforts made included the redistribution of competencies within the commission (leading to handing project implementation processes to member states in 1990) and adopting the LCB Master Plan for developing environmentally sound management of the LCB resources. Furthermore, there was an enlargement of the commission, which started in 1996 with the admission of the Central African Republic (CAR) and in 2008 with the admission of Libya².

² Lake Chad Basin Commission available at <https://cblt.org>

In 2000, the various challenges faced by the institution internally, such as the lack of funds to carry out its mission efficiently, the low participation of stakeholders as well as the growing climatic and political insecurity in the region, contributed to the formulation of the Lake Chad Basin Vision for 2025³:

“The Lake Chad Region would like to see by the year 2025 the Lake Chad – common heritage – and other wetlands maintained at sustainable levels to ensure the economic security of the freshwater ecosystem resources, sustained biodiversity and aquatic resources of the basin, the use of which should be equitable to serve the needs of the population of the basin thereby reducing the poverty level” (LCB vision 2025).

Further in 2012, the Lake Chad Basin Water Charter was adopted. The LCB Water Charter aims to efficiently manage surface and underground water resources. The Water Charter provides the LCBC with a legally binding instrument for water resources management. This supplement the constitutive texts of 1964 (the Fort Lamy Convention and its Statute), (Interview 1, 2023).

Moreover, efforts made by the international community to support the LCB institutions and riparian populations in finding sustainable solutions for the future of water resources management in the basin are worth considering. Among such efforts is the “sustainable management of water resources in the Lake Chad basin” project. A co-joint project undertaken by the Federal Institute of Geosciences and Natural Resources (BGR) of Germany. It is divided into two modules: “adaptation to climate change” managed by the German Agency for International Cooperation (GIZ) and “groundwater management” managed by the BGR. They are meant to enhance the organisational capacities of the LCBC (that is, planning, communication, and cooperation among staff). The project was implemented for six years, from 2011 to 2017⁴. Another project is the “applied water resources management project of the LCB” (2019-2022) managed by the Federal Ministry for Economic Cooperation and Development (BMZ) project of Germany. This project aims to support the LCBC in its mission of ensuring sustainable and integrated management of water resources.

To supplement these efforts, a series of legal texts and declarative documents have been developed at the international level to guide national and regional institutions in water

³ Ibid.

⁴ Ibid.

management, especially transboundary water management. Among these legal texts are the 1996 Helsinki Convention on “the Protection and Use of Transboundary Watercourses and International Lakes” and the 2003 “EU Water Framework Directive” geared towards managing integrated River basins in Europe. As far as the declarative documents are concerned, there is the 2030 Sustainable Development Goals (SDGs), especially goals number 6 on “clean water and sanitation” and number 14 on “Life below water.” Further, there is goal number 13 on “the need for climate action”. The SDGs originate from the UN Millennium development goals (MDGs), which consisted of eight goals to be achieved from the year 2000 to 2015. MDG7 on “ensuring environmental sustainability” in its target 7(c) explicitly referred to “access to safe and drinking water.” These international documents have inspired the present-day Lake Chad basin water charter and guided its vision:

“A Lake Chad Region where all member states have equitable access to safe and adequate water resources to meet its needs and rights and maintain its freshwater, ecosystem, and biodiversity resources (LCBC, vision 2025).”⁵

1.2. HYPOTHESIS, RESEARCH QUESTION AND OBJECTIVES

1.2.1. Hypothesis

Lake Chad water resource management has been confronted with a series of challenges. According to a report published by the Ministry of foreign affairs of the Netherlands (2020), these challenges include:

- Governance;
- Demographic growth and pressure;
- Climate change;
- Violent extremism.

Coupled with the above-mentioned challenges other factors affecting water resource management in the region are:

- Lack of environmental water resource planning;
- Absence of public participation;
- Absence of binding water laws.

⁵ Ibid.

The Lake Chad Basin Water Charter adopted in 2012, through its principles provides a suitable framework for water resources management in the region. It embraces a whole set of issues which have long posed a threat to water sustainability. The charter gives a binding character to water resources management by addressing critical issues such as: public participation and cooperation among member states, climate change, and security around the lake. However, not all the LCBC member's states have ratified the charter (Interview 1, 2023).

The LCB Water Charter is of extreme importance for the implementation of a sustainable framework for water resources management in Lake Chad. There is the need for a holistic and integrated system of water management in the Lake Chad basin for a successful implementation of the Charter. According to Van der Zaag (2014) in "*Principles of integrated water resources management (IWRM)*", the move towards a holistic and integrated water management system will necessitate one's country to review its water policy. Sandra Postel in her book "*The Last Oasis Facing Water Scarcity*" (1992), identifies three important principles guiding water policy: equity; ecological integrity and efficiency (the three E's).

Thus, by looking at Lake Chad's situation, this thesis will attempt a demonstration of a sustainable water resource management framework. To achieve this, the IWRM principles will be used to demonstrate the importance of a holistic approach to water management.

1.2.2. Research questions

The following questions will guide our analysis throughout this research:

- What are the challenges of managing the water resources of Lake Chad?
- Which policies have been established to ensure the sustainable management of water resources of Lake Chad?
- What are the recommendations for improving the management of water resources of Lake Chad?

1.2.3. Research objectives

To provide an answer to the stated research questions, the following objectives will guide this study:

- To know the different challenges confronting Lake Chad's water resources management;

- To highlight the state of water resources management of Lake Chad;
- To provide recommendations for stakeholders on the need to sustainably manage water resources.

Hence, this thesis will be structured into five essential parts. The first part titled the introduction will consist of a presentation of the work. The second part will present different challenges confronting Lake Chad's sustainable water resources management. The third part will present the policies put in place nationally, regionally, and internationally to enhance Lake Chad's water resources management. The fourth part will present the IWRM holistic approach for the sustainable management of Lake Chad's water resources. The last part titled Recommendations will aim at providing suggestions to improve water resource management.

1.3. METHODOLOGY

This research focuses on a framework for the sustainable management of water resources in Lake Chad. This is because Lake Chad, once considered the sixth largest lake in the world in the Palaeocene era, has been confronted with a series of crises affecting its population and water resources. From the Palaeocene period to the present, variables have been set forth to explain the origin of this crisis. These variables englobe a wide range of factors: institutional, demographic, and climatic. The complexities of these different variables make Lake Chad a suitable case to highlight the importance and the need for sustainable frameworks to manage water resources.

The IWRM holistic approach principles will be a practical guide for implementing a sustainable water resource management framework in Lake Chad. The reason for choosing IWRM principles for a holistic approach to water resources management stems from their uses for water resource management plans worldwide. Further, it has been highly recommended for areas facing complex water management crises. As an illustration, in an article published by Swetapadma and Ojha on "River Basin Management and Planning" (2017), the holistic approach is used as a critical recommendation for Indian rivers such as Ganga and Krishna, which are amongst the country's largest rivers. These rivers have not been spared and have also been confronted with complex water management challenges.

The collection method used in this study is the qualitative method, consisting of both primary and secondary data. The primary data collected consist of in-depth responses from the riparian population, the Lake Chad Basin Commission, and personal analysis. This information was gathered thanks to a 10-day (28th January-8th February 2023)

study trip undertaken to Chad. Chad is the host country of the institution managing Lake Chad and the country with the most significant portion of the lake, about 45% (GWP, 2023).

A one-day trip was also made to Cameroon in Kousserie, precisely in the Madagascar quarter inhabiting the Logone, one of the main rivers feeding Lake Chad. A total number of 20 interviews were collected. The interviewees were:

- The riparian populations of Lake Chad, including fishermen, traders, and households from Niger, Nigeria, Cameroon, and Chad;
- The LCBC water experts;
- Personnel.

Additionally, experts from critical organizations and staff working on projects related to the Lake Chad Basin were interviewed. One of the critical challenges of collecting these data was the inaccessibility of Lake Chad because of the Boko-Haram insurgences. However, it was possible to access the southern part of the lake, precisely the area of convergence between the Chari and the Logone river (the main river replenishing the lake) from their converging point to where they fall into the basin. The merging of these two rivers forms the Logone-Chari River, which then falls into the basin to form Lake Chad.

Coupled with these primary sources, a consistent documentation from the LCBC was collected. These documents are, “the LCBC-GEF project on the reversal of land and water resource degradation (the Lake Chad basin transboundary diagnostic),”; “the Strategic Action Program for the LCBC,”; “the annual monitoring report (AMT) of the LCBC for the year 2017-2018”); “the Regional strategy for the stabilization of the Boko Haram affected areas of the LCB region” and “the LCB Water charter.”

The secondary data collected consist of published reports and articles. Some of the documents collected are reports from international organizations such as United Nations Environment Program (UNEP), United Nations Development Program (UNDP), United Nations Educational, Scientific and Cultural Organization (UNESCO), German Agency for International Cooperation (GIZ), Food and Agriculture Organisation (FAO), and International Atomic Energy Agency (IAEA). A limitation concerning this secondary data source is that there have been few recent works on Lake Chad. Most of the works focus on the Lake Chad Basin with little or no emphasis on Lake Chad’s sustainable resources management. The focus is mainly on the institutional, socio-economic, and political nature of the LCB. Furthermore, some of the available online documentation consists of

past publications and reports, which need to be updated in consistence with the present state of the lake.

The data presented in this research can thus be termed reliable because, according to Lisa Bagolione (2020), in her research book “Writing a Research Paper in Political Science: A Practical Guide to Inquiry, Structure, and Methods,” there are five main criteria for evaluating research sources which were used to interrogate the previously stated sources. These dimensions are authority (the legal and institutional character and qualification of the publisher); accuracy (the relation of the chosen document with the subject matter of the thesis); coverage (the possibility of reviewing the documents collected); currency (the update of sources) and objectivity (the consistency of the writer’s position with the research). These criteria are also found in “A Manual for Writers of Research, Thesis, and Dissertations” written by Turabian Kate and William (2018) though not explicitly expressed. The clear illustration of these criteria in this piece of work thus makes the stated sources reliable.

2. THE LAKE CHAD REGION: OVERVIEW AND CHALLENGES OF WATER RESOURCES MANAGEMENT

“The value of Lake Chad resides in the ecosystem services it provides, and these are particularly precious to the Sahelo-Saharan environment characterised by aridity and erratic availability of water resources (Sanusi, 2017)⁶”.

2.1. LAKE CHAD: OVERVIEW

2.1.1. Geography and hydrology

Lake Chad is a freshwater lake in the West-Central African Sahelian Zone. It is found in the interior of one of the world's oldest basins, the Lake Chad Basin. Lake Chad is historically known as Mega Lake Chad, a vast expanse of water that existed about 7,000 years ago, covering a surface area of about 400,000 km² (Bdliya and Bloxom, 2017) slightly larger than the Caspian Sea, the earth's biggest lake today. The climatic peculiarities of the lake are high temperatures throughout the year and low humidity, except between June and September. However, there are generally high precipitations in September (Carmouze et Lévêque, 2012).

Lake Chad straddles the borders of Nigeria, Chad, and Cameroon. The active watershed of the lake is dominated by two major sub-basins, which are: The Chari-Logone River basin in the South, with a surface area of about 690,000 km², and the Komadougou Yobé River basin in the North, with a surface area of 148,000 km² (Lemoalle and Magrin, 2014). The division of the lake into the southern and northern basins can largely be attributed to sedimentation, a significant problem affecting Lake Chad (Interview 3, 2023). The Chari River has its source in the mountainous areas of the Central African Republic, where the annual rainfall is around 1500 mm/year. This permanent river crosses the Republic of Chad for about 800 km. During its journey, the Chari joins the Logone at N'Djamena and Kousserie, then marks the border between Cameroon and Chad. The waters of the Chari, further increased by the Logone, provide Lake Chad with nearly 90%

⁶ Speech of Sanusi Abdullahi, executive secretary of LCBC at the high-level conference on Africa towards renewed partnership with Africa organised, by the European Parliament on the 22nd of November 2017 in Brussels.

of its superficial inflows for a basin of approximately 610,000 km² (Lemoalle and Magrin, 2014).

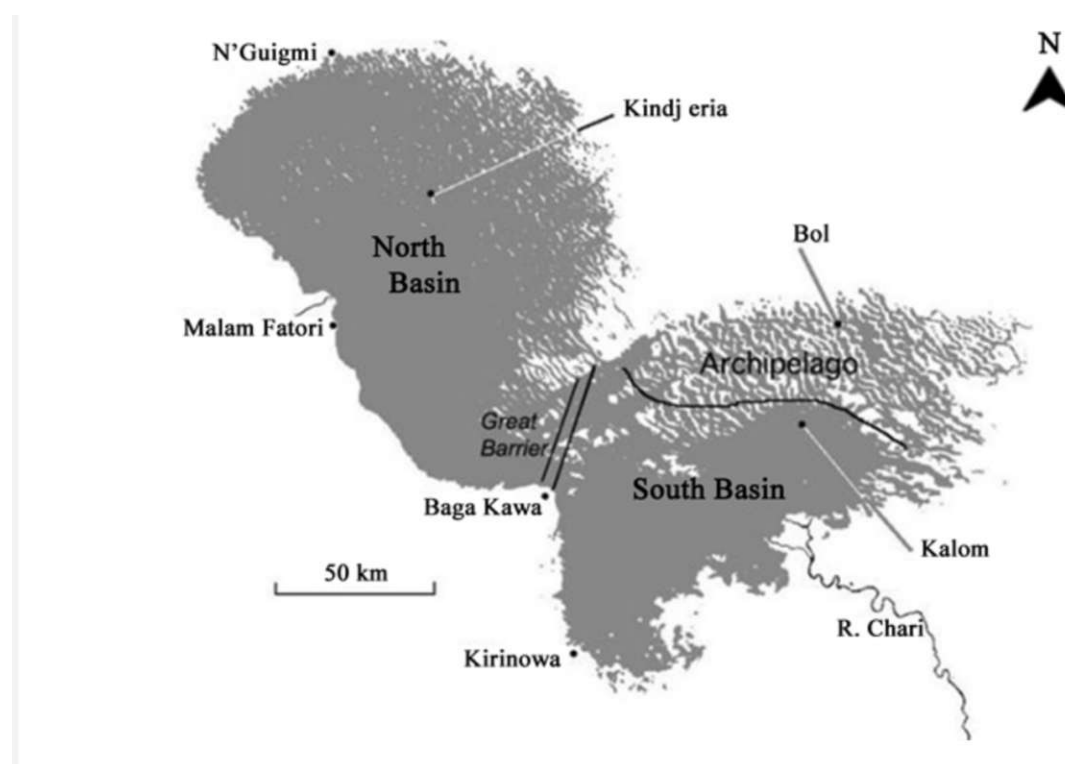


Figure 2: The North and South Basin of the LCB. Source: Lemoalle and Magrin, 2014.

The Yobe River (Komadougou Yobé) originates from the humid regions of Nigeria, especially the Jos Highlands, and flows through the dune area on the shores of Lake Chad. The Komadougou Yobé flows between Niger and Nigeria for about 150 km before reaching Lake Chad near Bosso north of Malam Fatori. It loses 40% of its flow through infiltration and evaporation. El Beid, Yedseram, and Ngadda river basins in Nigeria (approximately 30,000 km²) are other small river basins feeding the lake. Together with these other small rivers, the Yobé River accounts for about 10% of Lake Chad's waters (Lemoalle and Magrin, 2014).

The water balance of Lake Chad comes from contributions of rivers (mainly the Logone-Chari River and Komadougou-Yobé River), direct rainfall, evaporation losses, and low infiltration into the ground. When the contributions of a year exceed the losses, the lake level rises, and its surface increases. This also increases the losses by evaporation and tends to restore a new equilibrium at a slightly higher level. Some research indicates that the lake's surface area is limited to its open water surface. In contrast, other research

shows that the lake's surface is the total flooded area, including open water and swamps. Swamps are, therefore, often neglected in the estimation of the surface area of Lake Chad. However, these swamps, when they are flooded, must be considered aquatic ecosystems; as they mainly contribute to fish production (Carmouze et Lévêque, 2012).

Furthermore, variations in the surface area of Lake Chad over the past sixty years have led to the classification of the lake into different phases. These are:

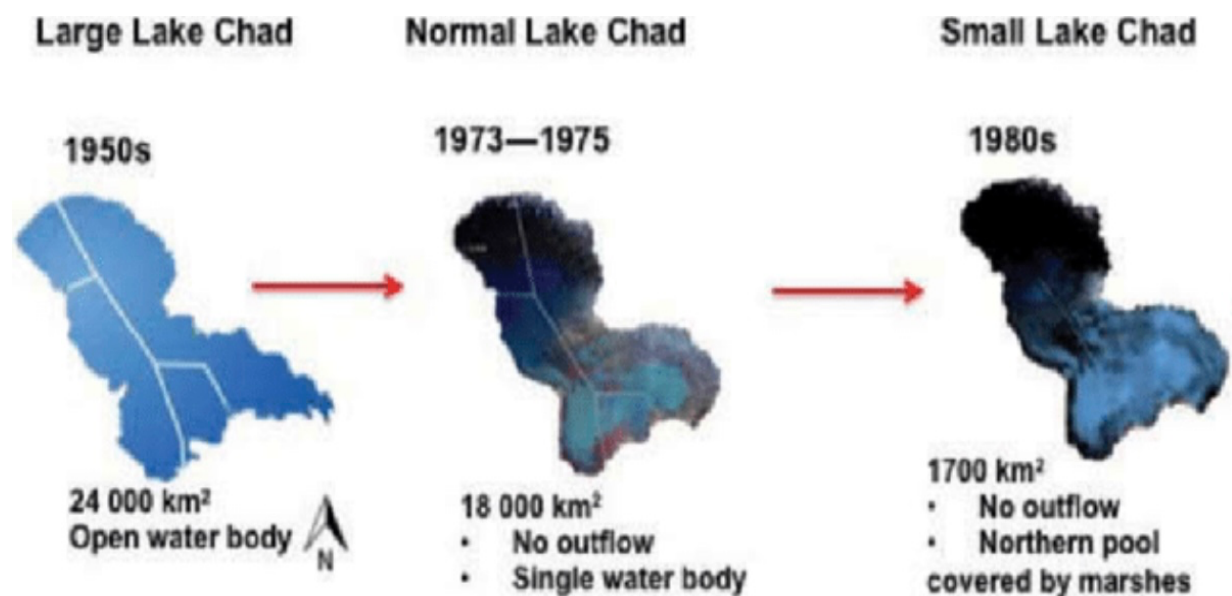


Figure 3: Lake Chad phase variations. Source: Okonkwo, 2014.

Large Lake Chad: It is characterized by a vast surface of water superior to 282.3m, which extends to 24000km² bordered by an undeveloped dune archipelago. The lake overflows to the east into the Bahr El Ghazal, which leads to the Bodélé depression, located 550 km to the northeast and about 120 m lower than the lake. This stage of Greater Chad has only appeared in brief episodes over the last century and for the last time in the mid-1950s.

Normal Lake Chad: In the period of Normal Lake Chad, the lake presents throughout the year a single body of water that covers between 15,000 and 20,000 km² at an altitude of 280 to 282 m, with two large basins, south and north. An archipelago, made up of a fossil erg, gradually sinks into the lake from the northeast. The archipelago is extended towards the lake's interior by islands vegetations, called banks of islets, corresponding to high dune bottoms submerged and colonized by aquatic phanerogams. Normal Lake Chad is characterized by the extent of the open water zones, the navigable space between the islands of the archipelagos, and a limited vegetation strip along the coasts.

This situation prevailed between the years 2013 and 2018. Presently with the abundant rainfall of October 2022, the present size of the lake, which is estimated to be about 17000 km², is said to be in the phase of normal Lake Chad.

Small Lake Chad: This comprises separate bodies of water for most of the year. In the southern basin, an open water surface of approximately 1,700 km² is in front of the Chari Delta, with a depth of 2,279 to 281 m. It is surrounded by extensive permanent swamps, which are often overlooked in estimating the flooded area of the lake. The northern basin is separated from the southern basin by the permanent exposure of the Great Barrier. Permanent or seasonal swamps cover the lake between 2,000 and 14,000 km² (Leblanc et al., 2011). Between 1957 and 2008, Lake Chad was at 69% in the state of Small Chad and 31% in the state of Middle Chad or Greater Chad (Lemoalle et al., 2011). 1985, 1987, 1988, and 1991 correspond to a dry Lake Chad (Small Lake), with a dry northern basin all year round. This basin was dry for most of the year in 1975, 1977, 1982, 1984, 1990, 1992, 1993, and 1994. It retained some water in 1989 and from 1995 to 2013 (Carmouze et Lévêque, 2012).

As far as underground water is concerned, the Lake Chad basin is among Africa's largest groundwater sedimentary basins. Three principal aquifers of the basin are: the upper Quaternary and Lower Pliocene aquifer, the Continental Terminal, and the Cretaceous lower aquifer. These aquifers are principally charged by surface water from Lake Chad through infiltration. For example, the quaternary aquifer comprises two aquifers: The Phreatic aquifer and the Artesian Pliocene aquifer. The water found in the Phreatic aquifer is suitable for household uses and livestock farming through boreholes and dug wells (Huneau, 2017).

The Artesian Pliocene Aquifer has highly mineralized waters, which are mainly used in Nigeria and the extreme northern region of Cameroon. The amount of water in the artesian aquifer has greatly been reduced and the artesian pressure is currently lowering due to over-pumping. The middle aquifer comprises terminal continental rocks that alternate between sandstone and clay layers (Huneau, 2017).

Lake Chad's water is fresh. The low salinity content of Lake Chad makes it an important source of drinking water for riparian populations. The reasons for this low salinity can largely be attributed to the following:

- The absence of limestone content in the watershed and the low ionic load of the feeding rivers;
- The occurrence of biogeochemical sedimentation in the lake reduces salt content to about 45%;

- The presence of a considerable amount of infiltration facilitates the leaching of the salt (especially in the northern part of the basin);
- The presence of molluscs facilitates the regulation of calcium ions by shell formation.

The presence of macrophytes and diatoms regulates silicate and potassium by plant growth (Bdliya and Bloxom, 2012).

2.1.2. Political and institutional evolution

Empires around the 18th century made the first attempt towards the political management of the basin. During this period, the lake was managed by Muslim rulers from Kanem-Bornu, Baghirmi, Waddai, Mandara, and Sokoto empires, it was highly militarized. At the end of the 18th Century, the control of the basin changed. The European powers that is Britain, France, and Germany ended the empire's rule of the basin and divided the basin among themselves on equal basis. These powers administered their share of the basin in ways that guaranteed their best interest. The British used the system of indirect rule, and the French and the German Direct rule. After this partition, Lake Chad was opened to European navigation and gained the status of international space. Following the defeat of the Germans during World War One, the basin was further partitioned between Britain and France. France's occupational policy aimed at consolidating economic and political power to facilitate goods transportation from Chad to the Douala port in Cameroon at a low cost. This was because France's last transit of goods was through the Nigeria and Congo routes, which was lengthy and costly (Njeuma and Malanquais, 2004).

Further, regarding the institutional arrangement of the Lake Chad region and its management, a Lake Chad Basin Commission was created in 1964 under the Fort Lamy Convention. The LCBC is an intergovernmental cooperation among states surrounding the LCB. The founding fathers were Cameroon, Chad, Niger, and Nigeria. These states agreed to come together to enhance the basin's resources to develop their territories. In this regard, on the 22nd of May 1964, the Fort Lamy Convention (former capital of Chad, today N'Djamena) and its statutes were signed. The Fort Lamy convention is often regarded as one of the oldest post-colonial African cooperation in Africa regarding basin management (Njeuma and Malaquais, 2004).

The institutional arrangements in the management of the Lake Chad Basin contributed to the creation of a conventional basin that is different from the active watershed. The

conventional basin of 1964 covered an area of 427,300 km², shared between Cameroon, Chad, Niger, and Nigeria (Bdliya and Bloxom, 2012).

Today, the conventional basin is estimated to be 967,000km², primarily due to the ratification of the Central African Republic in 1994 and Libya in 2008. The admission of Sudan as the seventh member state has been expected since 2000. The portion of the basin covered by Sudan is 69,000 km². If Sudan ratifies the convention, the entire conventional basin will be 1,053,445 km² (Lemoalle and Magrin, 2014). Other countries, such as the Democratic Republic of Congo (DRC), the Republic of Congo, and Egypt, were granted observers status.

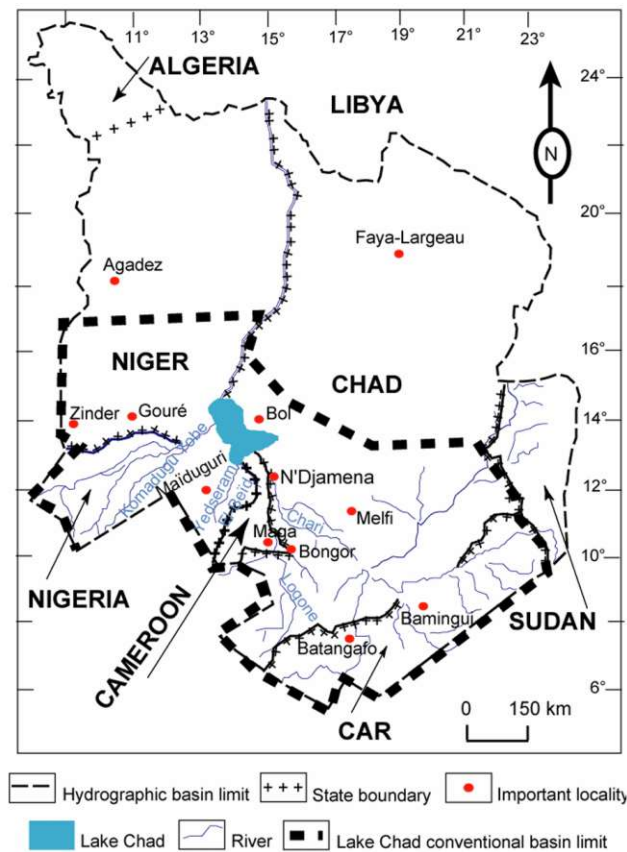


Figure 4: Lake Chad Conventional Basin. Source Ngatcha, 2008.

Regarding the aims and objectives of the LCBC, the LCBC aims to coordinate the development and promote cooperation among its member states in the Lake Chad basin by managing its water resources effectively. To achieve these aims, the following objectives were formulated:

- Regulating and controlling water resources and other resources in the LCB;
- Promoting and coordinating projects and research concerning the LCB area;
- Examining complaints brought concerning the basin area brought to the commission;

- Providing a conducive framework for the settlement of disputes among member states;
- Promoting cooperation among member states in the LCB region.

2.1.3. Socioeconomic and geostrategic evolution of the basin

The Lake Chad basin is a pole of attraction for thousands of people in the Sahel. Over the past decades, there have been varying tendencies in population growth. For instance, in the 1990s, the total population in the basin area was estimated to be about 25.5 million (UNEP, 2004), 30 million in 2015 (FAO, 2015), and 45-50 million people today (UNDP, 2023). There are about 70 ethnic groups in the Lake Chad basin. The present ethnic composition of the basin can largely be attributed to the past Islamic empires that ruled the basin. These empires were: Kanem, Borno, waddai, Baguimi, and the Peul Empire of Sokoto. Most of the Western part of the basin was under Borno rule.

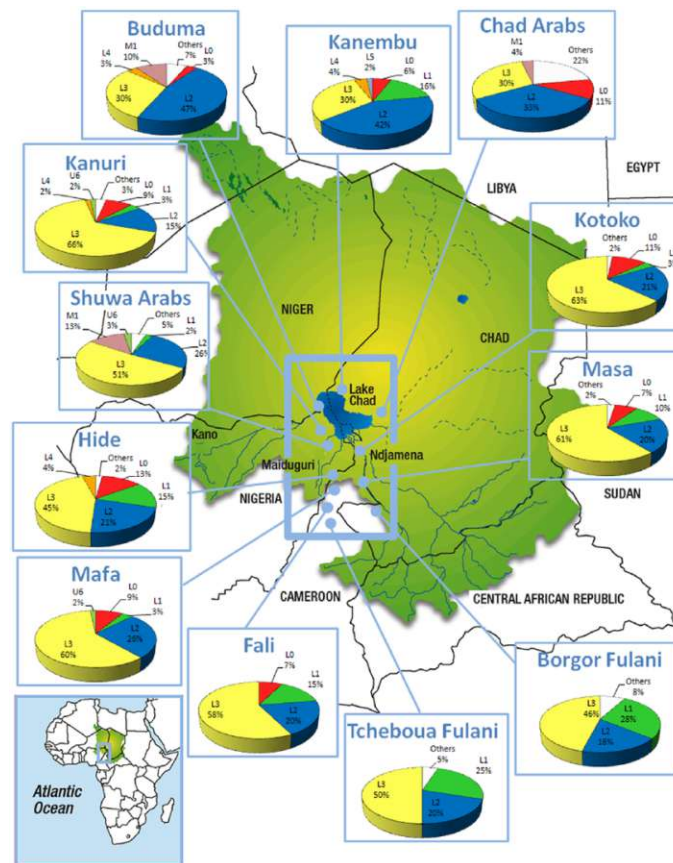


Figure 5: Lake Chad Basin Ethnic Composition. Source: Cerezo and Salas, 2011.

The ethnic groups living in the Lake Chad Basin are Kotoko, Maba, Kanuri, Hausa, Buduma, Kanembu, Baggar, Kotoko, Manga, Haddad, Kuri, Fulani, and Mangaq

The spoken languages in the region are Kanuri spoken mostly in Niger and Nigeria; Fulfulde spoken in Cameroon, Niger, and Nigeria; and Arabic spoken in Chad. Coupled with these common languages there exists a wide range of ethnolinguistic groups specific to each country. For instance, Nigeria has about 394 linguistic units, Cameroon has more than 250 units, and Niger and Chad each have more than 200 units. The legal and administrative languages used in the basin are those inherited from colonization being “*English*” and “*French*” (Wolf, 2004).

Further, the dominant age group in the basin is the young particularly in the southern part of the basin. As an illustration, about 50% of Nigerian population is below 15 years and 2% is above 65 years (WB, 2002). Countries such as Sudan, Libya and Algeria located in the Northern part of the basin have a larger proportion of older than younger populations. The States with the largest cities in the basin area are Nigeria (Kano and Maiduguri region), Cameroon (Maroua), Chad (N'Djamena), and Niger (Diffa), (Bdliya and Bloxom, 2012).

As far as the literacy level is concerned, the level of literacy is relatively low. About 62% of children living in the area are not attending school. The average size of a class for primary school children is about 75 per class and about 95% of adults in the region have a low literacy level. The region is also affected by poverty. Riparian states are trapped in a vicious poverty cycle that impedes development. In the Extreme Northern region of Cameroon, closer to the basin, the rate of poverty is about 59% which is about three times more than in other parts of the country with a poverty rate of about 19%. In the Nigerian part of the basin, the poverty rate has been estimated to be about 72%, two times higher than the other parts of the country which are at around 38%. Chad, exceptionally, has the lowest rate of poverty around the lake with about 31% lower than other parts of the country having 40%. This can be justified by the fact that the Chadian region found closer to the lake is closer to its capital, thus consequently having higher rates of urbanization (Albright, 2016).

Further, in terms of health, huge disparity exists between countries located in the Northern part of the Basin (Algeria and Libya) which tend to have high standards, and those in the Southern part (Niger, CAR, Nigeria, Chad, and Sudan) with low standards. This disparity is also seen at the city (high standards) and rural level (low standards) of each state (Bdliya and Bloxom, 2012). The population in these areas suffers from severe malnutrition and food security with children underweight at about 57% (Albright, 2016).

In the economic domain, activities such as fishing, agriculture, livestock farming, and transport are a mainstay in the region. Fishing was once identified as the economic

attraction in the basin because of the high demand of fish in local markets. In the past when the lake was still at its full capacity, that is the "Large Lake Chad", it provided great fishing opportunities to fishermen and this activity was considered a noble and respected profession. Lake Chad's capacity was estimated to be about 120,000 tons of fish per year (UNEP, 2004). However, with climate change and the overexploitation of the lake waters, fishing lost a certain notoriety in the region.

Additionally, another widespread activity in the region is agriculture. Agriculture is one of the most reliable sources of food security in the Lake Chad basin. Agriculture is mainly traditional, the villagers grow maize, peanuts, onions, rice, and even cotton. Residents accumulate significant income from farming, which is often reinvested in animal husbandry to multiply sources of income. Animal husbandry is also an essential economic activity in the region. According to the LCBC, the Lake Chad area has a potential of around 204 million tropical livestock units (Bdliya and Bloxom, 2012). In addition to these economic activities, cross-border trade, transport, and mining are also two activities that generate significant revenue in the region. There has been an increase in illegal trade in goods such as sugar, rice, vegetable oils, and other agri-food products. As far as mining is concerned, the basin is rich in gold (present in CAR) and oil (in Nigeria), and there is the alleged presence of Uranium in the Chadian region of Aouzou.

2.2. CHALLENGES OF WATER RESOURCES MANAGEMENT IN LAKE CHAD

"The biggest challenges when it comes to water resources management are humans" (Loucks and Beek, 2017).

Water resource management is "the process of planning, developing and managing water resources, in terms of quantity and quality across all water uses" (WB, 2022). Loucks and Beek, in "Water Resources Planning and Management: An Overview" (2017), highlight the importance of water resources management. These reasons are: "too little water" (excess demand over supply); "too much water" (excess supply over demand); "too polluted" (discharge of waste by household and industry into the water); "too expensive" (the cost of adequate water infrastructure implementation, operation, and maintenance); and other management issues like "navigation" (river beds dredging); "river bank erosion" (caused by water infrastructures); and "reservoir related issues" (which acts as ecological barriers to migrating fishes). Several factors have been

advanced as challenges for water resources management in the Lake Chad Basin case. These factors can be grouped into socio-economic, political, institutional, and environmental reasons.

2.2.1. Socio-economic challenges

The increase in population around Lake Chad has led to the growth of uncoordinated socio-economic activities. These activities have contributed significantly to the shrinking and pollution of the lake. For instance, the local production of rice and cotton for urban markets led to the use of inorganic chemicals affecting not only aquatic lives but also water quality as well as the surrounding fauna and flora. In Chad, the quantities of pesticides used by the local cotton industry between 1999 and 2000 were about 4.5m³ (UNEP,2004). In addition, using insecticides and fertilizers for rice production has increased water pollution. This is because contaminated water from irrigated land percolates into the lake. Heavy lake contamination by agrochemical products is largely attributable to the absence of regulatory frameworks on pollution in the basin. Another issue related to the use of chemicals around the lake is eutrophication.

Enriching water with high nitrogen content can lead to high algae growth, which, when decayed, might reduce the oxygen content in water. Cases of Eutrophication were identified around the Komadugu-Yobé River basin. This is detrimental to fish and other aquatic animals depending on high oxygen levels for survival. In Lake Chad, the phytoplankton, macrophytes, and blue-green algae (spirulina) are in abundance. In this regard, Lake Chad is considered one of the few areas in the world possessing blue-green algae. The presence of blue-green algae in the lake is mainly because of its low PH level (UNEP, 2004).

Moreover, the population's dependency on irrigational farming significantly led to water losses around the 1960s. Though the amount of water lost around this period was insignificant because of favourable climatic conditions, during the 1980s, with the prolonged droughts which affected the region, irrigation became a serious threat to water availability. In 1997, FAO estimated the basin's water requirements to be about 16.5km³/year. This was mainly because there was a change from low-water-required agricultural practices (wheat cultivation) to high-water-required agricultural practices (rice cultivation). A critical irrigation project was the SEMRY project in the northern region of Cameroon. This project aimed at opening large areas for rice cultivation in the northern region of Cameroon. To realize this project, a dam of about 30km was constructed to provide water for the irrigation of farm rice and fish farming in 1979 (Claude, 1989). This

was the Maga dam in the floodplain of the Waza-Logone. This project significantly changed the floodplain regime, accelerating environmental degradation and droughts that affected the region during this period.

Furthermore, other economic activities in the region that substantially affects water are animal husbandry, transportation, and mining. These activities have triggered the presence of suspended solids in the lake. Animal faeces in the lake as well as the discharge of waste by the population due to the poor wastewater management and sanitation provisions, have led to a decrease in the potability of the water. Exploiting oil in the region, which is a lucrative activity, has led to an increase in oil leakages, contaminating the underground water and surface water during wind erosion and transportation.

In addition to the above mentioned, the low level of literacy and awareness of environmental practices is also a fundamental challenge to sustainable water management in the region. The population must know sustainable methods or techniques for exploiting natural resources. Coupled with this, the laxity of riparian governments concerning sustainable methods of exploiting natural resources makes most of the population rely on basic goods (Bdliya and Bloxom, 2012).

2.2.2. Political challenges

One of the key political challenges of water resources in Lake Chad is the difference in political systems. This makes riparian states differ in their approach of managing the basin's water resources. Each member state's colonial history is a perfect reason for differences in basin management approaches. Nigeria was colonized by the British, who administered the territory using the indirect rule system; Chad and Niger were colonized by the French, who opted for a more paternalist approach to administering their colonies through the direct rule system. Cameroon is midway between these two systems of administration, as both powers colonized it. Difference is not only visible in terms of colonial history but also in their adherence to Regional Economic groupings. This can be seen with Chad and Cameroon, which are members of the Economic Community of Central Africa (ECCAS), and Niger and Nigeria are part of the Economic Community of West African States (ECOWAS). This usually diverges opinions concerning the basin's future (Ibrahimou, 2022).

Another critical issue concerning the political challenges of water resources management is the issue of national interest which can be evaluated in terms of the

geopolitical and geostrategic importance of Lake Chad to its member states. In terms of geostrategic potentials, though considered an essential source of food security for its population, the basin is yet to have the same importance for riparian governments. For Cameroon and Niger, Lake Chad is located on the extreme periphery of the political capitals, and issues regarding the basin are of little interest regarding public policies. As such, the water management in the basin was extended on the side-lines of national development projects. On the other hand, Chad has no access to the sea, which is an almost desert country; Lake Chad then represents a possibility for developing fishing and farming and an efficient and reliable means of transportation. In the case of Nigeria, with a growing population of more than 200 million inhabitants, Lake Chad is seen as a pioneering area, on the national and regional scale (Ibrahimou, 2022).

Further, there is the issue of political instability. In early 2013, the Lake Chad Basin region was confronted with violent extremist attacks from Boko Haram terrorist group. This led to the displacement of thousands of people all over the LCB and to a total disruption of economic activities in the region. Between 2013 and 2014, the crisis was geographically expanded to Lake Chad. The Boko Haram insurgency took a new dimension in the region after the death of the leader Abubakar Shekau. As of the 17th January, 2022, the Boko Haram terrorist attacks led to about 2.8 million people being displaced and 265,000 refugees (UNDP, 2022).

Coupled with this, Chad, the host country of the LCBC, has also been witnessing internal instabilities, particularly in the northern part of the country, which led to the assassination of its former president Idriss Deby on May 20th, 2021, by rebels. There have been significant instances of insecurities in the area due to the power transition. CAR has also been facing a political crisis and this has significantly influenced the ratification of the Water Charter, which has not yet been deposited to Chad's Foreign Ministry.

In addition to these political challenges, a series of conflicts have erupted between LCBC member states. For instance, the alleged presence of uranium in the Chadian region of Aouzou led to conflict between Libya and Chad. The 1973 Chadian-Libyan Conflict ended with Libyan leader Muhammad Ghaddafi withdrawing his troops owing to United Nations Security Council (UNSC) resolution 926. Another conflict was that of Cameroon and Nigeria over the Bakassi peninsular. Bakassi is an area rich in found between Cameroon and Nigeria. Both had ties with the area, so each state claimed its rights over the territory. In 2002 International Court of Justice ruling was in favor of Cameroon. Though the decision was not welcomed by Nigerians, Obasanjo, the former president of Nigeria, respected the International Court of Justice (ICJ) ruling in 2006 and withdrew its

forces. Other conflicts around the lake are primarily between farmers, fishermen, and cattle rearers concerning their occupation of the lake (Njeuma and Malaquais, 2020).

2.2.3. Climate change

Climate change significantly affects water resources management in the Lake Chad basin. Erratic decreases in rainfall, as well as high levels of temperature, have led to the evaporation of Lake Chad's waters. Since the 1960s, temperatures have increased by about two °C and have been significantly affected by climate change. For example, between 1970 and 1980, Lake Chad receded because of the prolonged droughts which affected the region. Excessive rainfall in the region leads to flooding. For example, the rainy season, which started in May 2022, led to floods that caused the displacement of thousands of people living around the lake. This was mainly the riparian population of Cameroon and Chad living around the Logone and Chari rivers, (acaps, 2023). This frequent variation in the lake's size caused by excessive replenishment during periods of abundant rainfall and excessive decline during droughts has dramatically contributed to creating climate refugees and conflict over natural resources in the region.

Climate variation is a serious threat to food security in the region. High temperatures in the Sahel significantly impact agricultural production as it generally affects seed growth. This usually leads to conflict among riparian populations scrambling near the lake to access water during intense dry seasons (Interview 5, 2023).

Furthermore, food insecurity and population migration in the region caused by climate change have significantly increased the rate of terrorist attacks around Lake Chad. This is due mainly to extreme temperatures reducing people's livelihood in the region, especially the young who live to themselves and decide to join such groups for survival. Coupled with this, during migration, populations unconsciously mingle with terrorists, which further destabilizes the host territory.

2.2.4. Institutional challenges

One of the critical problems facing water resources management in the Lake Chad Basin is the issue of hydro-hegemony. Since the creation of the LCBC, which is about sixty years today, the position of Executive Secretary of the Commission though rotative, has been occupied by Nigeria. This is due mainly to the fact that Nigeria is the most potent economic state in the region. This can be seen in terms of population, as Nigeria has more than half of the population in the region (50%), followed by Cameroon (25%), Chad (17%), and finally, Niger (3%) (Ibrahimou, 2022).

Further, another institutional challenge is funding (Interview 3, 2023). As far as the funding of the Commission is concerned, Nigeria takes the lead by contributing more than half of the budget. That is Nigeria at 52%, Cameroon at 26%, Chad at 11%, Niger at 7%, and CAR 4% (Ibrahimou, 2022). Unfortunately, most of the time, there are delays in the contribution, which retards the development of activities in the Commission management (Interview 3, 2023).

The absence of funds has also jeopardized the hiring and training staff and qualified water experts. As a result, the Commission primarily relies on funding from significant projects with milestones (Interview 3, 2023). When the project ends, the following up and maintenance of infrastructures emanating from the project becomes a tedious task because of lack of funds. As a result, since the creation of the Commission, there has been several organizational restructurings (Interview 2, 2023).

Another institutional challenge is the lack of transboundary water management mechanisms to prevent the shrinking and flooding of the lake. Most member states continue to build dams in their share of the territory for irrigational purposes. Over the past decades, the lack of disciplinary measures and responsibilities in water use has led to a considerable shrinking and depletion of the lake's resources (Odada and Oyebande, 2005).

3. WATER RESOURCES MANAGEMENT POLICIES IN LAKE CHAD: FOUNDATIONS AND APPROACHES

“The challenges of the Lake Chad basin transcend borders and go beyond unilateral responses. Under government leadership we need to join forces and scale up our collective engagements” (Steiner, Former UNEP Executive Director and Director of UNDP, 2018)⁷,

3.1. FOUNDATIONS OF SUSTAINABLE WATER RESOURCES MANAGEMENT

For centuries, the term water resources management was primarily attributed to altering water flows for human benefit. It involved implementing infrastructural projects geared towards storing, treating, and controlling water flows for navigation and electricity generation efficiency. In the long run, this definition was reshaped by incorporating new terms such as sustainability. Sustainability is defined as, “meeting our own needs without compromising the ability of future generations to meet their own needs” (UNCED, 1987).

3.1.1. Evolution of international water policies regulation

Until the beginning of the twentieth century, international water laws on the use of watercourses were only subject to a few rules, mainly focused on navigation guided by the "no harm rule." The no-harm rule is an International Customary law stipulating that the use of a country's population share of a lake should not jeopardize that of other parties (Dellapenna, 2001). Another rule was navigation priority, enshrined in international resolution regulations on the use of international watercourses, issued by the Institute of International Law in 1911 in Madrid (Zheng and Spikers, 2021).

In 1961, due to the increased exploitation of "river basin" waters, the Institute of International Law adopted the Resolution on the Use of International Non-Maritime Waters, also known as the Salzburg resolution. The Salzburg resolution applied to the use of waters which are part of a watershed or hydrographic basin over the territory of two or more states (Article 1 of the Salzburg Resolution).

⁷ UNDP administrator speech at the High-level conference on the Lake Chad region on the 3rd of September in 2018

In 1966, a first attempt was made to codify the norms governing the law of international watercourses for navigation purposes and other uses. It was done through the Helsinki rules established by the International Law Association. According to the Helsinki Rules, each state within a given territory is entitled to share international watercourses equitably and reasonably. This equitable and reasonable utilisation of shared watercourses had to consider the basin's geography and hydrology, the dependent population, the socioeconomic needs, the water uses, and the ecological and climatic factors.⁸ The Helsinki Rules equally introduced the term "Basin State" for the first time in water management. The term Basin State referred to respecting the physical unit of a basin by considering all the sectors and institutions concerned when managing it (Katta, 2021).

Furthermore, in 1977, the international community, at the United Nations Conference in Mar del Plata, explicitly recognized limited territorial sovereignty in water matters. It also recognizes the need for cooperation in water management. This conference drew up an action plan implemented by the United Nations Environment Program (UNEP) and with the cooperation of other international, global, regional, and local organizations. The 1977 Mar del Plata, Argentina conference and the 1992 Dublin statement significantly contributed to the Integrated Water Resources Management (IWRM) concept foundation.

In this outburst of concerns about the Protection of the environment, the United Nations Economic Commission for Europe issued two documents around the 1980s that significantly contributed to transboundary waters management. These two documents are the declaration of Policy on Preventing and Controlling Water Pollution and the Principles of Cooperation in Transboundary Waters Management. Based on these two documents, the Convention on the Protection and Use of Transboundary Watercourses and International Lakes emerged⁹. It was signed on the 17th of March 1992, in Helsinki, on behalf of the European Community. This Convention was established to prevent and control the pollution of transboundary rivers and international lakes through the development of international cooperation, while ensuring rational use of water resources in the perspective of sustainable development (Rahaman and Varis, 2005).

The Helsinki Water Convention stands as a unique instrument that provides binding legal instruments geared towards the sustainable management of transboundary water

⁸ Article V of the Helsinki Rules, Article 6 of the UN Watercourses Convention and Article 13 of the Berlin Rules

⁹ The Helsinki Convention of 1996

resources and the implementation of SDGs. According to article 1(1) of the Convention, the term transboundary waters mean:

"Any surface or ground waters which mark, cross or are located on boundaries between two or more states; wherever transboundary waters flow directly into the sea, these transboundary waters end at the straight line across their respective mouths between points on the low water line of their banks" (Helsinki Water Convention, 1992).

The Helsinki Water Convention was originally a Pan-European framework, but in 2016, membership was opened to all UN member states. The first African states to accede to the Convention were: Chad and Senegal (2018); Ghana (2020); Guinea Bissau and Togo (2021), Cameroon (2022), and Nigeria (2023). In the Middle East, Iraq's accession in March 2023 made it one of the first countries in the region. The benefits this Convention provides to parties is the possibility of having access to international funding for implementing projects related to the sustainable management of transboundary water resources (article 17, paragraph 2(c) of the Helsinki Water Charter). The Convention provides for a "thrust fund," which is under the management of the UNECE secretariat. Contributions of parties to this thrust fund are voluntary.

Moreover, the 1997 New York Convention on the Law of Non-Navigational Uses of International Watercourses is also worth considering in the evolution of international water management policies. The Non-Navigable Uses of International Watercourses applies to the uses of international watercourses for purposes other than navigation and for measures aimed at conserving and managing the uses of those watercourses and their waters (Article 1(1) of the New York Convention) (Katta, 2021). This law emphasizes on the need for member states to protect ecosystems, prevent different forms of pollution, and protect the environment. The Convention finally came into force on 17th August 2014 following the ratification of 35 countries, 17 years after its adoption. Among the signatories there is Chad, Niger, and Nigeria.

In addition to the above, the UN Millennium summit 2000 led to the creation of the Millennium Development Goals (MDGs). These were eight goals to be achieved in 2015 (Dupraz, 2005). Among these goals is the MDG7 on "environmental sustainability," which focuses on improving access to "safe drinking and basic water" (MDG7c). Following this, in 2016, there was the formulation of Agenda 2030, with its Sustainable Development Goals, adopted in September 2015. The SDGs are seventeen goals to be achieved by 2030. Goal number six and fourteen are related to water management, focusing on "Clean Water and Sanitation" and "Life Below Water," respectively.

3.1.2. Regional regulations

Among the regional initiatives on the foundation of water management policies is the European Union Water Framework Directive (WFD). The WFD has since 2000 guided a series of world water management policies. It presents an innovative and ambitious approach to water management. The WFD applies to both the underground and the surface. Its central aim is to ensure ecosystem protection, maintenance, and enhancement to ensure quality water supply in an amount sufficient for all future legitimate water uses (O. Fritsch et al., 2020).

The WFD opened a new horizon for the European Union's external water actions. The EU's external action on water management has been possible through initiatives such as the EU Water Initiative (EUWI), created in 2002. The EUWI is considered the centre of WFD because it has contributed to the development of projects between EU and non-EU member states on water management. Through the EUWI, the WFD achieved a network of partnerships across the globe with other non-EU countries; most notable among these partners are African countries (O. Fritsch et al., 2020).

As far as Africa is concerned, the EUWI was founded when Africa had challenges in meeting the MDGs of reducing by half the proportion of people lacking access to basic sanitation and safe drinking water by 2015. The EUWI has, through this partnership, contributed to finding practical solutions to water policy problems related to pollution, and inequality. In 2008, an Africa-EU Statement was issued as a remedy to the situation. This Africa-EU Statement was made possible because of the involvement of civil society organizations and non-profit organizations in achieving policy responses at the local and regional levels. The EUWI, in its approach, integrates common notions related to the IWRM (O. Fritsch et al., 2020).

Also, another regional initiative on water management is the AMCOW commission of Africa. The African Ministers' Council on Water (AMCOW) was created in 2002 in Abuja, Nigeria, to promote cooperation, security, social and economic development, and poverty eradication among member states by effectively managing the continent's water resources and providing water supply services. One of the key achievements of the AMCOW is the creation of groundwater (transboundary or not) commission. The decision on the creation of the ground water commission was made at the ordinary session of AMCOW held in Brazzaville and was approved during the African Water Week held in Tunis in March 2008 (Scheuman and Neubert, 2006).

Another successful achievement of AMCOW is the eThekwini Declaration, adopted in February 2008 by AfricaSan (Africa Sanitation). It is one of AMCOW's path-breaker

initiatives born out of the recognition that investment in sanitation has historically been neglected in Africa and that addressing Africa's sanitation challenges involves mobilizing facts and arguments and helping agencies and governments shape strategies for action (eThekwini Declaration and AfricanSan action Plan, 2008).

3.1.3. Other attempts at the national and institutional levels

Beyond the fact that most African States have ratified international conventions, they have also shown much enthusiasm towards bilateral and multilateral agreements on managing shared aquifers. At the national level, several bilateral agreements have been concluded between African states, all geared towards the enhancement of shared water resources and to consolidate peace and security around these shared aquifers. A perfect illustration of such agreements is the agreement on navigation and transport over the river Niger of November 1964 (FAO, 1964)¹⁰. The signatories of this agreement were Benin, Cameroon, Chad, IVORY Coast, Guinea, Mali, Niger, Nigeria, and Burkina Faso. It was aimed to ensure the sustainable use of river Niger for agricultural, industrial, and maritime activities. In addition, riparian states undertook to establish close cooperation concerning the study and the execution of any project likely to have an appreciable effect on certain features of the river regime.

Furthermore, the African Ministerial Conference on Meteorology (AMCOMET) is worth considering. AMCOMET was initiated as a response to weather and climate challenges in Africa. Its first Ministerial conference was in 2010 in Kenya Nairobi. AMCOMET actively sought to contribute to the achievement of the MDGs in Africa by promoting the use of weather and climate information and services, building bridges between weather and climate knowledge and disaster risk reduction, and developing weather and climate products for users at various levels.

Within the same range, the Environmental Action Plan Initiative of the New Partnership for Africa's Development (NEPAD) was also instrumental for Africa water resources management. This Action Plan endorsed in 2003 during the Maputo conference aims to respond to the interests and needs of the African continent and not those of a country or a group of countries. The Action Plan actively seeks to find sustainable solutions to land degradation, drought and desertification, wetlands, all invasive species, marine and coastal resources, transboundary conservation of natural resources, climate change, and cross-cutting issues.

¹⁰ FAO , FAOLEX. (1964). Act regarding navigation and economic cooperation between the states of the Niger Basin done at Niamey on 26 October 1963

Among other efforts geared towards the implementation of sustainable policies for the management of water resources in Africa, the role of international institutions is worth considering. The International Commission on Large Dams created in 1928 serves as a meeting place to promote discussions and the exchange of knowledge and experience in dams. It also provides engineers and all the other specialists for hydraulic installations. Its objective is to improve techniques in the field of dams' construction in all aspects and at all stages of the design, project, construction, and operation of dams and ancillary works. It has offices in Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Mali, and Nigeria.

3.2. APPROACHES OF SUSTAINABLE WATER RESOURCES MANAGEMENT IN LAKE CHAD

Several approaches have been developed geared towards the sustainable management of shared watercourses. Among such approaches is the one developed by the International Network of Basin Organizations (INBO), created in 1994. The INBO is an international network that supports the implementation of integrated water resources management at the river, lake, and aquifer basins scale. It connects basin organizations and other government agencies responsible for basin management to promote the exchange of experiences and develop practical tools for better management of water resources at transboundary, national, and local levels. INBO is organized into regional networks of basin organizations in Africa, Latin America, Central, and Eastern Europe, and the Mediterranean region. It also leads the Network of international commissions, transboundary basin organizations, and the Euro-INBO group of European basin organizations responsible for facilitating the implementation of the European Water Framework Directive. It identifies different categories of basin organizations and their respective function. These different categories are:

- *Basin Commissions or Authorities*

International commissions or authorities in charge of transboundary basins and aquifers have been created for many years by treaties, conventions, or multilateral between riparian countries. Basin commissions can be purely consultative (advice, training, and monitoring). Nevertheless, they can still also develop the various actors' actions and work towards achieving the objectives of a water charter or an international agreement.

- *Agencies*

In general, a Basin Committee is created simultaneously when decisions are prepared or taken, and a Basin Agency implements them. Agencies and committees may make

planning decisions or have jurisdictional responsibilities. They can establish and promulgate regulations or consider the development of infrastructures. They often have a mission of public interest and benefit from a certain degree of autonomy following the national legal framework. Basin agencies and committees are generally responsible for medium-term planning and setting and collecting fees related to the abstraction of raw water or the discharge of used water to finance the investments necessary to achieve objectives.

- *Basin associations*

A basin association can be formal or informal, comprised of representatives of government, parliament, municipalities, users, and NGO members, who come together to address issues relating to water management. These associations advise the authorities but have no regulatory powers. Generally, these associations can play several roles, such as advising, raising awareness, educating, and promoting the exchange of information on managing natural resources in the basin. They can also play a monitoring role.

- *Companies or Enterprises*

In addition to the different types of basin organizations described above, another category of water actors is companies or enterprises that ensure infrastructure construction in the basin. These companies often benefit from a time-limited concession the government grants to construct and manage the infrastructure for a fixed period. They extract raw water and generally provide services that they can manufacture, such as navigation, flood control, irrigation, or hydroelectric production. These actors are not basin management organizations. They generally have a private status and do not play a role in the management of water resources.

These different categories of stakeholders have greatly inspired the present-day configuration of the Lake Chad Basin management. The LCBC belongs to the Commission type of basin management. However, traces of other categories can be identified in its approach to managing Lake Chad Water resources.

3.2.1. Concerted approach

Defined as a planned and determined way of action done by more than one person, country, or government (Oxford University Press, 2023), the concerted approaches are the most widely used policies of water resources management in developing countries. For instance, in Sub-Saharan Africa, water disparity has led to greater interdependence between states. The latter has made most African States seek cooperative solutions with

those upstream of major rivers. Under these conditions, institutions have been created to manage basins with a strategic dimension. Among the prominent basin institutions in sub-Saharan Africa, the oldest is the Joint Commission of the Nile River, created in 1959 with Egypt and Sudan as member countries. Also, there is the Lake Chad Basin Commission of 1964, the Organization for the Development of the Senegal River of 1972, the Gambia River Development Agency of 1978, the Niger Basin Authority of 1980, the Joint Commission of the Orange River of 1986, and the Zambezi Basin Authority of 1987 (Kamto, 1990).

These institutions correspond to three possible levels of commitment: consultation, cooperation, and integration. The first stems from an essentially diplomatic logic, which aims to find possible arrangements between States within the framework of equitable resource sharing. The second is considered a superior stage: consultation deals with the association of States for the achievement of joint projects the construction of infrastructures (Kamto, 1990). The Lake Chad basin management system is based on the "Commission," which limits the actions of the LCBC. This has contributed significantly to making the commission's actions non-existent in the LCB except for a few infrastructures (Odada and Oguntola, 2005). This situation highlights the problem of supranationalism that has been one of the challenges of most African institutional organizations, as most states are unwilling to confer all their power to a single entity.

Further, Government decisions generally create these commissions and may have a permanent secretariat depending on the case (Kamto, 1990). In the case of the LCBC, the executive secretariat, as the name implies, is responsible for implementing the orientation and decisions of member-states. The commission often produces standard rules (for example, for navigation) and, when necessary, decides on the distribution of available resources between categories of users, regions, and (in the case of transboundary basins) between riparian countries. They can also have a coordinating role concerning flood and drought prevention and pollution control measures. They can, in addition, draw up and implement multi-annual plans to develop and expand the necessary activities at the basin level (Kamto, 1990).

Thus, in this light, there have been a series of projects and programs that have been developed and concluded on behalf of member states under the leadership of the Executive Secretary of the LCBC. One of the contributions of this approach to water management is enforcing security around Lake Chad. A regional strategy for the stabilization and resilience of Boko Haram affected areas of the Lake Chad Basin was

set up in 2018. The development of this regional strategy can largely be attributed to consultation among LCB member states.

Although the statute instituting the LCB gives a wide range of powers to the Executive Secretariat, it is limited by articles nine and fourteen. The role of the executive secretary is to Coordinate and implement decisions and resolutions of higher organs. It does not possess executive powers in the sense of decision-making (Bertoncin and Pase, 2017).

3.2.2. Multi-donor approach

The Sahel region, especially the LCB, is one of the poorest regions in the world. Moreover, this region experiences a series of economic crises, making it difficult for states, especially member-states of significant transboundary cooperation, such as the LCBC, to actively contribute to the organisation's functioning and sponsoring significant activities. It is in this light that, to sponsor activities for the region's development, member-states of the commission oriented their policies towards a multi-donor approach for the management of the basin resources. This led to the creation of the Lake Chad Basin Development Fund in 1972 (Odada and Oguntola, 2005).

Among the decisions that prompted the creation of this Fund was, on the one hand, the need to attract investors in the region and, on the other hand, to secure access to loans needed for the organization's functioning. Thus, an account was opened at the African Development Bank with a starting capital of 500,000,000 FCFA, and the sustainability of this account was to be ensured by a contribution of 1/1,000 from the annual budget of member states, as stated in Article III of the Lake Chad Basin development fund. But however, the creation of this Fund though salutary for basin management, created a lot of confusion. The problem was that the provision concerning the use of the Fund needed to be more specific. Reference was made to a development fund; but not to the type of development projects the Fund was to finance (article IV) (Njeuma and Malaquais. 2020).

The Fund also posed a problem for the recipient. Areas that were to benefit from the funds needed to be specified. Cameroon and Nigeria were the countries with the highest contribution as far the basin management was concerned. Both countries had towns closer to the lake, but these towns were not really affected by the lake's problems, and thus, N'djamena was chosen as a priority state, leading to tensions (Njeuma and Malaquais, 2020). Seeing the challenges experienced by the LCBC by 1977, member-states realized there was a need to open the cooperation to international donors. This was primarily open to donors having integrated projects concerning the Lake Chad Basin (Odada and Oyebande, 2005). Since then, several projects have been implemented

geared towards the saving of Lake Chad as well as its population, these projects will be later discussed in this thesis.

3.1.3. Project base approach

As far as Lake Chad water resources is concerned, one of the most widely used policy of water management in the region is the project base approach. This approach has long been used by the LCBC as well as its member states to provide a sustainable amount of water in the region. Though the target and the approach used in developing such projects may differ, the aim remains somehow the same as it is geared towards enhancing development in the region. Unilateral actions taken by states regarding the management of Lake Chad water resources have as a foremost objective enhancing development in their respective territories.

This thus involves the implementation of projects such as dams to protect populations from floods and to ensure a quantitative supply of water for irrigational, industrial, navigational and consumption purposes. Such projects are undertaken by riparian governments, regardless of the repercussion it might cause to their neighbours sharing the same watershed. As perfect illustration there is the Lake Chad irrigation Mega-projects of Nigeria and the Chari-Logone Maga-Dam project (the Semry project).

3.1.3.1. The Lake Chad irrigation mega-projects

These were a series of projects undertaken by the Nigerian government from 1970-1984. It consisted of intensive irrigational schemes and programs developed around the Borno state of Nigeria: The Baga-Polder and South Chad irrigational Schemes. These irrigational schemes were sponsored by the excessive gains generated from Nigeria's petroleum production (Bertoncin & Pase, 2017). The reason which prompted the implementation of these irrigational projects were intertwined. The first reason was to use agriculture to decongest and resettle the increasing populations in the south. The second reason was the intensive period of droughts that affected the Sahelian region between 1973 and 1984; this equally accounted for the migration of people to other towns leading to population congestion. The combination of these factors led to an ambitious program in the north-eastern part of Nigeria as an immediate response.

The South Chad irrigational project (SCIP) was one of the most significant Lake Chad water irrigation projects signed in 1972. An irrigation scheme was to be built in a plain composed of thick layers of clay having irregular lime and clay strands. This area was affected by floods annually from small Lake Chad and small tributaries lakes of

Yesdseram and Ebeji. The SCIP aimed to maximize Lake Chad's irrigational potential by keeping suitable lands within the perimeter. In addition, it was to increase agricultural harvesting. The primary harvests were cotton, rice, and wheat. In addition, the project entailed the construction of irrigational channels, a pumping system station, and the installation of a product processing system. Coupled with this, a settlement plan and a road transport network connected the surrounding villages to the Borno state capital, Maiduguri. As far as the Baga-Polder scheme is concerned, it began in 1977. The result of this project was the construction of a 32km long sheet of iron aimed at protecting the area from seasonal floods from Lake Chad, a 13.5km channel to conduct water from Lake Chad to Borno (Bertoncin & Pase, 2017).

3.1.3.2. The Chari-Logone Maga-dam project (the Semry project)

The World Bank financed the SEMRY project. Between 1967 and 1983, the World Bank was highly active in developing rural areas in Cameroon. To enhance development in these areas, the World Bank financed 18 agricultural projects in Cameroon. Most of these projects were oriented toward crop (cocoa, rubber, coffee, and palm oil) exportations. Among such projects was the SEMRY project, which was instead funded to serve the internal markets, that is, rice production for local consumption. It was aimed at the internal development of Cameroon and not at the internal growth of rice production in Cameroon. As a result, the SEMRY project represented one of the rare successful rice farming projects in Africa (Claude Dominique, 1989).

An earthen 30km Maga Dam was constructed on the upper side of the Waza-Logone flood plain in 1979 to provide the irrigated rice scheme of the SEMRY and fish farming with an abundant water supply. This dike of about 80km was belted along the edges of the Logone. These dikes extended 20km downstream from the Maga-Dam to protect the irrigated rice fields from flooding. This project was quite beneficial to the Logon-Chari population as it intended to reduce the local community's dependencies on the unpredictability of floods and rain patterns and as a solution for food security in the region. Seen to its importance, it was thus given priority funding.

The funds for the construction of this scheme were generated from taxes. However, the SEMRY project has significantly affected Lake Chad and northern Cameroon's populations. The project negatively affected the hydrological regime of the Waza-logon flood plain. Water diversion from the Chari River led to a decrease in the stream flows and discharges of waters of Lake Chad (UNEP, 2004).

Conversely, as far as institutional projects are concerned in the LCB, project geared towards the management of the lake aims at the sustainable supply of water to the region, which, however, tend to be challenging in terms of the decision-making process. Among such projects, the most widely debated is the inter-basin project of water transfer (IBWT) from the Ubangi River, one of the main tributaries of River Congo to the Lake Chad, “the Trans-aqua” project (Caner S. & Ndihi N., 2020).

3.1.3.3. Trans-aqua project

The idea of transferring water from the River Congo basin was proposed in the 1930s, “the Atlantropia utopia.” The Atlantropia utopia was first proposed by the German architect Herman Sorgel (Lemoalle et al, 2011). The idea resurfaced during the periods of severe droughts which affected the Sahel, leading to the Small Lake Chad regime. In the 1970s, an Italian company Bonafica proposed a project of water transfers to the Heads of State of Central Africa, then to the LCBC. A total number of two proposals were formulated. The first proposal aimed at constructing a long canal of 2400km between the Congo basin and the LCB, and the second entails the construction of a shorter canal of 1350km. The aim was to divert water from the Ubangi reservoir to restore the Middle Chad. In addition, such a transfer would catalyse economic development and regional integration by enabling large-scale irrigated agriculture, hydroelectricity production, and water connection between the Congo Basin, the Chad Basin, and the Niger Basin via the Bénoué, thus enhancing trade.



Figure 6: The Trans-aqua Project. Source : Lemoalle et al., 2011.

After a series of consultations and negotiations that took place among the member states of the LCBC around the mid-2000, as well as a feasibility entrusted in the hands of a Canadian consultancy firm (CIMA International), a Memorandum of Understanding was signed between Power China¹¹ and Bonifica in 2017. In the following year, that is, in 2018, during the Lake Chad International Conference, which was held in Abuja, Nigeria, under the auspices of UNESCO, the LCBC approved the first proposal concerning the Lake Chad revival. A roadmap was approved by the LCBC member states, who unanimously agreed that the IBWT was “*a necessity (...), not an option*” (Caner and Nagabhatla, 2020).

However, though the project succeeded in getting a unanimous response from parties concerned as it was seen as a strategic approach to enhancing development in the region, some other parties were disenchanted with this fact seen to the projected repercussions it might have not only on the Lake but it also its neighbouring populations. Amongst those who were against the project are the French scientists, who, through a historical analysis of the LCB climatic variability, explained that water decline from Lake Chad was a natural phenomenon. This idea was strongly supported by the French, who made several publications on the climatic specificity of the region (Lemoalle and Magrin, 2014). The ideas propounded by Lemoalle and Magrin (2014) were because around 2010, Lake Chad’s water level stabilized to about 8000 to 10,000 km² and reached a higher level in 2013 with a surface area of 13,000 to 14,000 km².

Moreover, DRC politicians and scientists strongly opposed the ITBWT due to its environmental repercussions. It was said that the Trans-aqua project of the Congo River would lead to biodiversity loss, rainforest and national parks destruction, and UNESCO World Heritage zones would not be spared either. Further, population displacement was a threat, and the Ubangi River flow was destabilized, causing siltation. Therefore, the ideas of the DRC scientist received the support of most of its politicians who opposed the project. The most potent opposition came from politicians such as Modest Mutinga of DRC, who said: “We should not try to solve a problem in a corner and create it here in Congo” ((Caner and Nagabhatla, 2020)). Added to this, there is the opposition from the current DRC president Felix Tshisekedi who gave an explicit environmental discourse on the ITBWT:

¹¹ An international company which plays an important role in the implementation of international infrastructural investments.

“There is a way to capture this River waters and send it via pipelines to countries who need it rather than go to what was proposed at a given moment in Chad to divert the Ubangi River, which can have consequences (...) (on) peatlands (and rainforests) that serve (...) (the world by) absorbing carbon. Therefore, we believe other solutions exist” (Tshisekedi, 2019).

Another downside of this project is that it prevents stakeholders to think about other options available to meet the challenge of Lake Chad water resources and population growth balance. It also presents significant geopolitical risks because it first involves maintaining good relations and respecting agreements between many states belonging to the two basins, which leads to chronic political fragility (Caner S. & Ndihi N., 2020).

In addition to the above-mentioned projects, the project base approach to water resources management has also been highly supported by international organisations and institutions. These organisations have developed a series of projects aimed at ensuring the sustainability of water resources. These include environmental and security base projects aimed at promoting peace, security, and alleviating poverty in the region there by enhancing development. Among such projects are:

3.1.3.4. The Lake Chad Region recovery project (PROLAC) (2020-2025)¹²

It is a newly implemented project in the LCBC. Its aim is to contribute to the Lake Chad Region the recovery by supporting regional coordinating and crisis monitoring, connectivity, and agricultural livelihoods in selected provinces of the Republic of Cameroon, the Republic of Chad, and the Republic of Niger. The overall Lake Chad Region Program development objective (PROLAC) is to support the national and regional coordination platforms and local capacity building, contribute to restoring sustainable rural mobility and connectivity, and strengthen the recovery of agricultural livelihoods in selected provinces of Cameroon, Chad, and Niger. In addition, the project promotes knowledge sharing and regional dialogue with a data platform hosted at the Lake Chad Basin Commission while strengthening community empowerment through citizen engagement, social cohesion activities, and labour-intensive public works.

PROLAC contributes to the rehabilitation of rural and small transport infrastructure and promote productive investments by helping and encouraging agricultural producers to increase productivity in Chad polder areas, the oasis areas farming in Niger, and in areas closer to the shore of the Lake Chad in the Far North of Cameroon.

¹² Lake Chad Basin Commission . (n.d.). Home. LCBC. Retrieved 2023, from <https://cblt.org/>

Considering the environmental crisis caused by climate change and political instabilities in the region as well as terrorism, PROLAC aims at improving the enabling environment for mitigating risks, preventing conflict, and reducing poverty around Lake Chad through a regional coordination and knowledge/monitoring platform. It also improves the connectivity of remote and underprivileged areas through sustainable investments in rural road rehabilitation works and small transport infrastructure. It enhances community empowerment through citizen engagement, social cohesions activities, and Labour-Intensive Public Works (LIPW).

The essential activities of PROLAC are as follows:

- The establishment of the LCBC PROLAC Project Implementation Unit (PIU) that will provide overall support for coordination, improving the capacity of regional and national actors, and a policy and operational dialogue for the Lake Chad Region;
- The operation and maintenance of a strategic, analytical, and monitoring platform to foster knowledge exchange, collaboration, and partnerships.

PROLAC uses an integrated approach that encourages women's participation in overall development. To support women's inclusion, the project facilitates ad hoc training to provide women with the needed skills and knowledge.

3.1.3.5. The applied water resources management project of the LCB (2019-2022)¹³

It is a project of the Federal Ministry for Economic Cooperation and Development (BMZ) of Germany, which ended in 2022. This project aims to support the LCBC in its mission of ensuring water resources' sustainable, integrated management. The areas of intervention are Cameroon and Chad. In this light, the project contributes to climate change adaptation and food security and indirectly finds active measures to resolve regional conflict. The achievements of the project are reportedly:

- The distribution of agricultural seed and materials to farmers to about 1,250;
- The training of LCBC workers on the use of the Lake Chad Information System (LIS);

¹³ Ibid.

- The conduction of the first annual monitoring report on the LCB transboundary problems.

This document is instrumental for water resource management improvement in the region. In addition, a survey of households was conducted in Chad and Cameroon to increase incomes and agricultural adaptation measures for the populations.

3.1.3.6. The sustainable management of water resources in the Lake Chad Basin project (2019-2022)¹⁴

This co-joint project was undertaken by the Federal Institute of Geosciences and Natural Resources (BGR); it ended in June 2022. It was divided into two modules, the adaptation to climate change module managed by GIZ) and the groundwater management module managed by the BGR, which is the technical module. The module managed by GIZ provides essential contributions towards the achievement of the SDGs, particularly concerning SDG5 on "Gender Equality," SDG13 on "Climate Change," SDG16 on "Peace, Justice, and Strong Institutions," and SDG12 "on Responsible Consumption and Production." This module aims to improve water resources management to increase agricultural productivity while considering the effects of climate change and other transboundary measures which the LCB is implementing in the intervention zones.

3.1.4. Conventional approach

As the name implies, the conventional approach refers to the use of legal texts or norms. This approach though existing in the Lake Chad area since the creation of the Commission in 1960s with the Fort Lamy convention and statute, was not sufficiently well framed as far as water resources management are concerned. This was because its provisions did not provide for legally binding rules and principles concerning water uses and water resources management. Though bilateral attempts were made between states, the non-binding nature of such agreements contributed to a chaotic instead of a regulatory response to water resources management. A case in point was the in 1970 Moundou Agreement to specify changes in water level limits in the Logone River. But however, this agreement was non-binding and did not provide for abstraction limit level leading to the observed chaotic exploitation of the lake's resources (Odada and Oyebande, 2005).

¹⁴ Ibid.

In 2012, there was the institution of the Lake Chad Basin water charter as a regulatory framework for managing water resources in the Lake Chad Basin. The aim of the LCB Water Charter is to ensure the sustainable development of the LCB through an integrated, equitable and concerted management of shared water and environmental resources; to promote good governance, cooperation, and solidarity in the management of the basins' resources. The parties to the LCB water charter agree to be bound by a certain number of principles which have been inspired from general principles of law such as:

- The Sustainable development principles: This is since the management of the LCB must be done in a way that provides for future and present needs;
- The pollution prevention and control principle: This calls for an assessment of plan projects concerning the basin management before implementation. That is the human and environmental impacts of projects must be assessed and appropriate measures for the elimination or at least the mitigation of such plans must be designed;
- The polluter pays principle: The uses of water for domestic and non-domestic requires polluters to bear consequences of the environmental and social cost of their actions.

The charter also provides parties with series of obligations such as equity in the use of water resources, limits on the amount of water which can be withdrawn from the basin and the respect of environmental flows from the preservation of aquatic ecosystems and services they provide.

However up to date, not all the countries have ratified the convention, those who have ratified are riparian states directly in contact with the lake, not instruments of ratification have been submitted to the chad's foreign ministry (Interview 1, 2023).

4. A HOLISTIC FRAMEWORK FOR THE SUSTAINABLE MANAGEMENT OF WATER RESOURCES IN LAKE CHAD

“More than half of the world’s population depends daily upon water resources shared by more than one country, both surface water of transboundary rivers and lakes or groundwater contained in aquifers extending over several countries. As the needs for this precious resource continue to increase, the imperative for cooperation between countries for better managing this resource has never been greater. How we agree to share the beneficial uses of transboundary water resources in ways that meet economic, social, and environmental demands in terms of growing uncertainty and financial instability might be one of the greatest challenges of all” (GWP and Basin Organisation, 2009).

4.1. EVOLUTION OF THE HOLISTIC APPROACH TO WATER RESOURCES MANAGEMENT

4.1.1. From a fragmented to an integrated approach to water resources management

One of the most widely used frameworks regarding water resource management is Integrated Water Resources Management (IWRM). An integrated approach to water resources management is a more robust version of a part-by-part or fragmented approach to water resources management. This is because, past water management frameworks on basin management were mainly a one-directional approach, solving one problem at a time, such as irrigation, navigation, flooding, which was generally cumbersome. This made decision-makers adopt new approaches, such as the River Basin Development Plan approach (RBDPM), to provide a multipurpose approach to water management. However, though this approach successfully managed land and water resources, it did not address other dimensions of water management, such as social development. This instigated the search for new approaches to water management. Among such techniques is the IWRM approach, which is a more robust version of the RBDPM (Swetapadmadma & Ojha, 2017).

Integrated water resources management is a cross-sectional approach based on understanding water's integral components (natural and human dynamics). It can be said to have originated in 1933 with the Tennessee Valley Authority (TVA). This constitutes one of the earliest initiations of the IWRM. The TVA created to manage floods also

extended its activities in managing issues related to erosion, recreation public health and welfare. Furthermore, in 1957 the UN report on integrated River Basin Development” can also be seen as a significant move towards the creation of the IWRM (UN, 2021).

Despite these early attempts the materialisation of the IWRM framework was mostly attributed to an international agenda that started from Mar del Plata 1977 to Kyoto in 2003. Within these two conferences, a series of other conferences, such as the Dublin, Ireland conference of January 1992, on water and the environment is worth considering. The Dublin conference was instrumental in planning the Earth Summit, or the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992. Most of the Dublin conference recommendations were consolidated in agenda 12 of the UNCED. Though its remarkable contributions are considered a success, the Dublin conference was highly criticized for various reasons. Among such reasons are:

- The conference highly solicited experts' interventions, thus making it be criticized as an expert meeting rather than an intergovernmental meeting;
- The lack of active participation from developing countries;
- The fourth principle on the economic recognition of water was highly criticized by developing countries' decision-makers because it failed to indicate how this principle could be implemented in developing countries' complex scenarios (Rahaman and Olli Varis 2005).

Seen to these shortcomings, during the Second water conference of 2000 and the concurrent Ministerial Conference, which took place the same year, the flaws of the Dublin conference were addressed. The second water conference, unlike the Dublin and Mar del Plata conferences, gathered intergovernmental participants, experts, and a wide range of stakeholders from the developed and developing world. This conference advocated for the use of IWRM as a fundamental approach to solving water-related problems such as food security, protecting the ecosystem, population empowerment, and the like. The challenges of IWRM were addressed; these were to be countered by collaboration and partnership, institutional, technological, and financial innovations.

In 2002, a world summit on sustainable development (WSSD) was held in Johannesburg, South Africa. This summit placed IWRM at the top of international Agenda priority. The WSSD was vital because it emphasized the need to consider IWRM as a critical component for achieving sustainable development. Other, World Water Forums (WWF), such as that of Kyoto, Japan, in 2003, also recommended using IWRM. The ministerial

declaration of the Kyoto WWF also emphasized the need to support developing countries to enable them to achieve the MDGs 2015 (Rahaman and Varis., 2005).

4.1.2. Understanding the concept of holistic framework for water resources management

The IWRM entails a four-dimensional approach which includes:

- An understanding of water resources; that is a distinction between blue waters (ground and surface waters) and between green waters (run-off water from precipitation) as well as grey water (polluted water);
- An understanding of water users; the socio-cultural, environmental, and legal frameworks;
- An understanding of the spatial scale; at the local, national, regional, and international level;
- Understanding the temporal scale; droughts, flooding patterns and the like (Savenijie, 2000).

The tackling of these different dimensions of IWRM comes with a holistic package to water management that entails a thorough understanding of the entire water system, from uncertainties to conflict resolution. Implementing this holistic package will constitute the focus of our analysis as far as Lake Chad's water resources management is concerned.

The holistic approach to water resources management combines both economic and social dimensions of water resources management into a single entity for a unified approach within ecological system. This approach has proven to be effective in water scared regions having a combination of socio-political, economic, and environmental issues (Swetapadmadma & Ojha, 2017). The basic elements of a holistic approach are:

- Providing an account of water flows and storage, diversion in each sector, water users, consumption patterns by location and sectors and return flows to the river system;
- An integrated account of pollutant flow and generation;
- Assessing the demand and economic benefit of water uses in each sector, its contribution to pollution both at the soil and water levels;
- Considering the in and out stream uses of water;

- The incorporation of water allocation rules and regulations at the local, regional, and/or at the institutional level.

4.1.3. The implementation of a holistic approach for water management

The implementation of a holistic approach for water management entails an understanding of the entire hydrological network and inter-relationship with the other processes surrounding it. This has to do with the different dynamics surrounding the river or lake basin concerned. Among such dynamics are climatic, economic, and social. This will facilitate an understanding of the number of abstractions for irrigational, industrial, hydropower generation and consumption purposes. All these components are interlinked to various economic, and social activities surrounding water resources. Furthermore, the implementation of a holistic approach to water management necessitates the issuing of rules, regulations, and policies as well as the participation of measure stakeholders in the decision-making process. This will include stakeholders at all levels of the society, that is both at the national and international level (Swetapadma and Ojha, 2017).

Nevertheless, though the implementation of a holistic approach is considered as beneficial for water management, it is not a straightforward approach which simply entails a combination of social and economic components. Holistic approaches are also fraught with series of complexities as well as uncertainties which might hinder the implementation process. Among the challenges encountered while implementing such an approach are:

- Data requirements: this approach usually entails a large amount of data. On the one hand there is meteorological data linked to water quality and on the other hand there is data linked to water uses. Thus, the handling of such a data base might be quite challenging especially in areas with limited number of experts and technology. Among these data, there are certain variables which are difficult if not impossible to control s such as climatic variations;
- Institutional engagement: the implementation of a sustainable holistic approach to water management requires the formulation of strong regulations which can only be possible through institutional involvement and the participation of various stakeholders in policy formulation and implementation;
- Financial resources and political will: Limited financial resources allocation and lack of political are fundamental challenges of holistic approach implementation. A holistic approach requires substantial investment, which can only be achieved

from the determination and commitment of policymakers to contribute to such initiatives. The absence of political will hinder, if not lead to, the complete abortion of holistic frameworks implementation.

Though this approach is confronted to some challenges, series of researchers have proven it to be beneficial for complex systems. For instance, in an article published Swetapadma and Ojha on “River Basin Management and Planning”(2017), the holistic approach is used as a key recommendation for Indian rivers such as Ganga and Krinsha, which are amongst the country’s largest rivers. These rivers have also been declining due to population growth, creating excess demand and pollution caused by industrial sewage discharge of about 75%. For instance, the Ganga River constitutes about 26% of India in terms of catchment area passing through several eight states and feeding more than four hundred million¹⁵ people. Coupled with these, there has also been the eruption of conflict caused by the need for equity in water allocation and opposition to hydro-projects. The implementation, of this framework can be seen as valuable to water resources management in Lake Chad, because these two Indian rivers basins are surrounded with complex socio-economic problems which are to an extend representative of the Lake Chad situation.

4.2. IMPLEMENTING A HOLISTIC FRAMEWORK FOR THE MANAGEMENT OF LAKE CHAD'S WATER RESOURCES

4.2.1 Assessing Lake Chad's Water Resources: Availability and Demand

"Water is a finite and vulnerable resource , essential to sustain life, development and the environment" (IWRM, principle 1).

Assessing water resources implies providing an overview of water resources situation and the different interactions surrounding its use in the basin. This can be assessed in terms of water availability and demand (GWP, 2000). The term water availability refers to the amount of water that can be exploited by human beings without posing a threat to the ecosystem (New Jersey sustainability summit, 2013). On the other hand, water demand can be defined as the quantity of water required by users to satisfy their needs (EEA, 1999).

The objective of assessing water resources is to address both surface and ground occurrences in time and space. A thorough assessment will require technology, experts

¹⁵ Ganges River Basin-National Geographic Society, 2022.

and associated scientific information to assess the water quality (GWP, 2000). Likely, an assessment of demand will require an understanding of the different variables which influences its use, which can be done by assessing historical data.

Among the frameworks which can be used to provide an assessment of the Lake Chad area is the Drivers-Pressures-State-Impact-Response (DPSIR), (Soboyejo & Bankole, 2021). DPSIR provides indicators needed to provide feedback to policymakers on environmental issues and the outcome of resulting political choices made or to be made. It assumes a chain of causal links:

- The 'driving forces': economic sectors, human activities;
- The 'pressures': emissions, waste;
- The state: physical, chemical, and biological;
- The 'impacts': on ecosystems, human health, and functions;
- The responses: political 'responses' which usually entail prioritization, target setting, indicators.

Drivers Human and climate driven	Crop farming, livestock farming, domestic use, navigation, rainfall variations, temperature rise, dry and hot wind circulation (high evaporation)
Pressures	Intensive irrigation, water diversion or dams construction, river modification and population growth
State	Loss of biodiversity, the decline of land marks birds, loss of wintering or nesting birds, fresh water shortages, extinction of wildlife, invasive species, navigation problems and sedimentation
Impacts	Disputes over emerging. Land and water resources, loss and change of occupation, loss of cultural heritage, loss of income source, conflicts and terrorism
Responses	Fort Lamy convention, Lake Chad Basin Water Charter and saving Lake Chad Basin project implementation

Table 1: Lake Chad DPSIR. Source: Author 2023

Taking the case of Lake Chad, a transboundary diagnostic was issued in 2012, to assess the environmental problem of the LCBC. This project was financed by the Global

Environmental Facility (GEF), "reversal of land and water resources degradation". This project provided a thorough understanding of the different dynamics influencing water demand and availability in the region among which was climate change, population growth, institutional and political. Coupled with this, eight years (2004) before, under the GIWA project of UNEP "Global International Water Assessment", in partnership with the GEF, an assessment of the region was conducted to have a clear understanding of water resources management in the region.

Though this approach facilitates the understanding of the different dynamics of the region, its implementation in the LCB was limited compared to other parts of Africa where it was conducted. For instance, the transboundary diagnostic conducted between June 2006 and March 2007 in Lake Victoria registered a certain degree of success thanks to the massive participation of Kenya, Tanzania, and Uganda stakeholders in the decision-making process. Among the achievements of Lake Victoria Transboundary Diagnostic was the reduction in fish pressure which was one of the main challenges of water resources management identified during the diagnostic. Following the diagnostic, a Beach Management Unit (BMU) was established to reduce illegal fishing. The institution of the BMU led to the reduction of illegal to about one-third. Coupled with this, there was the harmonization of fisheries regulatory and legislative frameworks in Kenya, Tanzania, and Uganda. Moreover, fishing Gazetted areas were established with community Conservation committees.¹⁶ Though the Lake Victoria diagnostic was effective in fish pressure reduction, some resolution of the diagnostic such as the closed fishing season which was instituted were not enforced¹⁷.

Contrarily in the Lake Chad region the implementation of measures geared towards the improvement of threats detected during the diagnostic such as pollution, excessive irrigation, and fish exploitation as well as dams' constructions was somehow tricky because of the development of new threats in the region such terrorism as well as political crisis which still continuous to affect the region.

¹⁶ Transboundary Diagnostic Analysis and Strategic Action Program Development for the Lake Victoria Basin-Results (2011).

¹⁷ Ibid.

4.2.2. Lake Chad basin water allocation plan (WAP)

“Water has an economic value in all its competing uses and should be recognised as economic good” (IWRM, principle 4).

Water allocation plan deals with granting individual abstractors entitlements. It involves a wide range of engagement at the national and regional level. National water allocation process involves determining the amount of water which will be shared among citizens whether at the rural or local level. Regional water allocation process entails a wider range of decision-making process especially for shared water courses as can be seen with Lake Chad. The WAP is usually implemented after a thorough assessment of water availability, uses and demand in the region. The provision of this information facilitates the development of scenarios which can be examined based on their socio-economic and environmental impacts. The main objectives of the WAP are to achieve equity, environmental protection, priority development, balancing supply, and demand, and promoting the efficient use of water.

The operative method of implementing a successful water allocation plan is through the definition of entitlements. Entitlement can be defined as mechanisms which guarantees the long-term rights of water use within a particular region. Water entitlement can be done through different approaches:

- Establishing a minimum volume of water to be supplied in all conditions;
- Providing abstraction caps, that is upper limits on abstractions regardless of the amount of water available per year;
- Estimating the transboundary flow of water either daily, monthly, or annually;
- Sharing water according to tributaries.

Taking the case of Lake Chad, the water allocation plan is the sole responsibility of member states regulated by the LCBC. Each member state has a ministry responsible for fixing water entitlement for urban and local communities. These ministries usually set up or work with agencies to ensure water supply. These agencies oversee water collection, treatment, distribution in rural and urban areas. Nevertheless, despite this system of organisation, the population is still confronted with the problem of poor-quality water supply and water shortages. This has often made states to hand over the management of water to private companies. A case in point was in 2005 with the privatization of the National Water Cooperation Company of Cameroon created in 1967.

This was mainly because of poor quality water supply and water shortages, coupled with high water bills (Bdliya and Bloxom, 2012).

More also, in some other countries riparian to Lake Chad water allocation in some instance is linked to the services provided by NGOs. For instance, in Niger, NGOs such as CARE international have heavily contributed to water allocation in the region through the supply of wells and pumps in rural areas. However, one of the challenges of such initiative is the issue of maintenance as some of the pumps have already been degraded. Thus, there is an uncoordinated approach to water allocation in the region. Water allocation in the region is more theoretical than practical (Bdliya and Bloxom, 2012).

Case of successful implementation of WAP can be seen in South Africa with the passing of the Water Act of 1998. This water act requires Ministers to ensure the equitable allocation of water for public interest while promoting environmental values. Amongst the mechanism used to achieve such goal is Compulsory licensing. Compulsory is a mechanism of the instituted in the Water act which enables the South African department of Water Affairs to review all water uses in catchments and relocate them if necessary (Kidd, 2016). According to the South Africa Water Allocation Reform and compulsory licensing guide compulsory licensing ensures that:

- Water is shared fairly;
- Everyone, especially women and HID, have fair chances to benefit from water uses;
- Water is used in a way the ways that best satisfy the public and the nation;
- The protection of water resources.

4.2.3. Stakeholders' participation

“Water development and management should be based on a participatory approach, involving users, planners and policy makers at all levels” (IWRM principle 3).

The participation of stakeholders is essential for the implementation of holistic approach to water management. The stakeholders can be defined as individuals, groups, or representatives of groups of individuals who may significantly impact or be impacted by the issue of concern. Stakeholders' involvement in decision making process raises a

wide range of practical and theoretical issues. According to the World Bank (2000), this can be expressed into four exclusive levels:

- Information sharing, involving a one-way communication;
- Consultation which entails a two-way communication;
- Collaboration, entailing sharing the control over decision making and resources;
- Empowerment, a total transfer of decision-making power and control over resources.

Thus, it is important to identify key stakeholders in the society to avoid non-productive groupings leading to unnecessary waste of resources. Agenda-21 of RIO 1992 identifies the following major groups: indigenous and non-indigenous groups, business and industrial workers, governmental and non-governmental organisations, women, and youths, trade unions, farmers, and local authorities. The involvement of these groups of people is essential for decision-making process as far as water management is concerned (GWP, 2000).

In Lake Chad, the stakeholders identified are divided into Extractors, Beneficiaries, Affected, Influencers and Regulators.

Countries	Extractors, Beneficiaries, Affected	Influencers	Regulators
Nigeria	Fishermen, farmers,	Media, NGOs, IOs,	Local actors,
Cameroon	herdsmen, traders,	Regional Bodies, Colonial	national actors,
Chad	investors (private and public), households, water	countries, External	regional actors
Niger	vendors, Tourists	countries	

Table 2: Lake Chad Stakeholders. Source: Newton and Eliot, 2016.

These groups of people play an essential role in the lake's management. Thus, it is important for policy makers, either at the local, national, regional, or international level, to include them in the decision-making process. For a region to change its water management system to a more holistic approach which will include all societal stakeholders, water policy review is needed. According to Sandra Postel (1992), a successful policy involves three main principles (three E's):

- Equity: this refers to the recognition of water as a necessity for human life which needs to be defended and conserved for public interest;
- Ecological integrity: dealing with the sustainable management of water resources for present and future generations;
- Efficiency: this considers the need for the institutional arrangement to ensure the supply of sustainable infrastructures, but this should not jeopardize the principle of equity.

The successful implementation of these principles can only be possible when there is actual participation. Real participation entails the involvement of all the stakeholders in the decision-making process. This is because reducing water pollution, excessive exploitation, and enduring equity in the water supply can only be achieved through dialogue, cooperation, and collaboration. It entails the creation of platforms for communicating and decentralizing the decision-making process.

Stakeholders' participation, especially women and youths, is meagre in the Lake Chad region. Participation is mainly seen at the institutional level. There needs to be stronger involvement of local and village associations in the management of the lake. In other areas, such as in the Tana River Basin, Kenya, local community associations, such as the Madogo Water Resources Users Association actively participate, and this has significantly improved sustainable livelihood and environmental practices in the region. They developed sub-catchment plans, which are used as guides for their activities. The 2020-2025 Lake Chad Recovery and development project (PROLAC) of the World Bank is crucial for successfully implementing a stakeholder-base-holistic approach to water management in Lake Chad. This is because the project promotes women's participation and provides them with training opportunities to occupy ad-hoc positions in the project implementation process. It also creates a platform to foster knowledge exchange, collaboration, and partnership among stakeholders.

4.2.4. Monitoring & evaluation and capacity building

Monitoring is the continuous function that uses systematic data collection on clearly stated indicators to provide the principal stakeholders of an ongoing intervention or project with indications on progress and/or achievement of objectives. In contrast, evaluation is the process that determines the worth or significance of an activity, project, program, or policy to determine the relevance of objectives, efficacy of design and implementation, efficiency or resource use, and sustainability of results (WBG, 2023). In

addition, an evaluation should facilitate incorporating lessons learned in the decision-making process.

Monitoring & evaluation are synergistic. Data monitoring is essential, but more input is needed for rigorous evaluations. Whereas monitoring data can be collected and used for system management purposes, other than just relying on such data, more is needed to avoid distortions because it usually covers only some dimensions of the activities of a project or program. The careful use of such information is crucial to avoid unwanted behavioral incentives. Contrarily, evaluation can provide more balanced interpretations of performance. Nevertheless, evaluation tends to be a more detailed and time-consuming activity. This is because it entails higher costs, thus the need to be conducted sparingly. Therefore, one approach primarily used in the evaluation is to rely on monitoring data to identify potential challenges requiring more detailed investigation through an evaluation (WBG, 2023).

As far as water management is concerned monitoring and evaluation is done following a project base approach. Among the organizations that have been influential in adopting such approaches in M&E practices and management is the Global Facility Environment (GEF). The GEF, developed in 1972, developed programs for effective M&E of development and the environment. According to the project base concept, M&E refers to the acquisition of data on executed activities, analysing these data against a wide range of anticipated milestones of project stages or programs, and communicating the different activities changes to provide adequate responses to unforeseen occurrences (Thornton et al., 2022).

Thus, sustainable implementation of water resources management in Lake Chad will entail Monitoring and evaluating the different projects undertaken in the region. The Monitoring of such projects usually deals with the tracking of achievements of milestones, which usually involves a series of elements (Thornton et al., 2022):

- Financial element: the costs in terms of budget and budgetary expenditure;
- Activities: a sequence of actions to meet the expected results;
- Output: this deals with documentation, reporting, and organizing meetings and checking what has been accomplished;
- Outcome: that is, responding to output to a higher level of needs that is, achieving higher objectives that the output.

Taking the case of Lake Chad, several monitoring networks had been put in place by riparian states: research institute agencies, agro-industrial and hydrological companies. In addition, particular organs have been instituted at the LCBC level to monitor the different dynamics of the basin, the department of basin observatory, and a project base department with a monitoring and evaluation division. However, these approaches still need to be improved due to lack of finance to have access to technological and transportation facilities to different zones for data collection, and payment of staff (Interview 4, 2023).

Capacity building is crucial for the sustainable implementation of water resources management in the Lake Chad. This is because, the region has long been confronted with floods, droughts, and terrorism which has heavily altered the populations mode of living. Coupled with this fact, there has been the implementation of series of project which necessitates community commitments for sustainable implementation and future management. Thus, introducing capacity as a major step for a holistic implementation of sustainable management in the region is worth considering for the future of the Lake's Chad resources.

“The main barrier to progress at this point is not a lack of technology: what is holding us back is a lack of capacity at all levels - the individual, organizational and institutional” (Moors, 2021).

Capacity building can be understood as the ability of human systems to perform, survive, and self-renew (Fowler et al, 2015). In the context of the water sector, Marten (2010) defined capacity building as 'the capability of a community or a society to identify and understand its development issues, to act to address these, and to learn from experience and accumulate knowledge for the future.

UN-Water SDG 6 Capacity Development Initiative (CDI) enables the UN system and its multi-stakeholder partners to merge efforts in supporting countries to develop capacities to accelerate the water and sanitation goal for 2030. The capacity development initiative includes the following:

- Education, research, and innovation;
- Improvement of organizations such as utilities, ministries, non-governmental organizations, and community-based organizations, and, to a lesser degree, private sector organizations;

- Working with communities and civil society, creating awareness and better governance;
- Sector-wide development (policies, legal frameworks).

Building and strengthening knowledge across the board in multiple governmental institutions, private sectors, and research institutes remain challenging. Pfeiffer & Leentvaar (2013) examine the concrete function of knowledge in transboundary river basin management by drawing on the experience of an existing river commission, the International Commission for Rhine's Protection (ICPR), which is widely perceived as a reference for successful trust and knowledge-based collaboration. The paper tests a phenomenological approach based on actor accounts. The results suggest that active stimulation of knowledge-based cooperation can substantially influence policy processes but that the direction of such force is ambiguous.

5. RECOMMENDATIONS

The following recommendations have been subdivided into different components addressing the challenges and opportunities of implementing a sustainable water resource management framework in the Lake Chad region. These recommendations have been inspired by various projects developed in the Lake Chad Basin, desk study research and analysis made during the study trip to Chad.

Component 1: *Promoting effective transboundary management of the Lake Chad water resources by strengthening the Lake Chad Basin Commission and its subsidiary organs*

1.1. *Strengthening the LCBC can be achieved by an enforcement of its legal texts. Among these legal texts is the Fort Lamy Convention, the founding treaty of the LCBC, its Vision, and most importantly, its Water Charter. Strengthening these legal texts will contribute to the:*

- Development of a comprehensive monitoring plan and guidance document for appropriate evaluation methods, including defining objectives and targets, choosing indicators and means of verification, identifying data sources and methods collections, improving data and information management, undertaking special assessments, and facilitating reporting and review. It can be developed with the participation of basin stakeholders (water managers, users, and decision-makers). It will facilitate the prioritisation of monitoring issues concerning the Charter provisions;
- Development of a disaster relief and response plans related to flood and drought to ensure the protection of people, the environment, and water resources. The Water Charter, in its article 38, stipulates that " In order to prevent and control emergency situations, the State Parties shall, in cooperation with the Commission, jointly develop and enforce emergency plans and disaster response plans to attenuate, eliminate or reduce the damage likely to be caused to the population, the environment and the water resources in the Basin by such emergency situations".

1.2. *Assess and improve the effectiveness of managing protected areas*

The Lake Chad basin covers at least twenty protected areas for biodiversity conservation. The legal status of protected areas varies (national park, wildlife reserve and biosphere reserve to name but a few). There have been a series of shortcomings in

biodiversity conservation at the level of the countries and the sub-region. This situation is manifested by poaching, the pressure of deforestation of pasture, parasitic animals, the multiplication of fishing channels, the problematic relationship between communities, and the like (Bdliya and Bloxom, 2012). The existence of the shared problem should encourage the identification of joint management solutions concerning the management of protected areas. Protected areas can only contribute significantly to conserving Lake Chad's biodiversity if managed effectively.

Component 2: *Establishment of national mechanisms for effective governance and financial assistance*

The development of the Lake Chad Water Charter is a clear indication of the willingness of the countries of the region to address issues related to the sustainable management of the lake and its reserve basin. Individually, member states have also acceded to many other international agreements and conventions relating to joint international action to solve the problems of water resource depletion in the region. However, like all legal documents, the Charter is a simple phrase that can only be effective if properly implemented and enforced at the national level.

The Water Charter is not sufficiently backed up by the national legislation required for effective implementation. There is also limited coordination between ministries monitoring basin resources to support the integration process and discussing issues relating to regional integration, including progress, challenges, and solutions. In addition to the limited coordination between ministries, there is a disconnect between ministries implementing LCBC decisions and critical stakeholders who should be part of the mainstreaming process. Finally, several countries do not have a special budget for regional programs and activities. Accordingly, the actions undertaken can be:

2.1 Developing a roadmap for the translation of the Lake Chad Water Charter into national policy, legal and regulatory frameworks.

LCBC Member States are at the centre of regional integration, and their full commitment to implementing decisions and agreements can help make a decisive difference in realizing the provisions of the Water Charter. But this is not a simple task, and it requires strong political commitment, coordinated efforts from all stakeholders, and appropriate tools. This can be done by a review of national policy, legal and regulatory frameworks to identify gaps and deficits and organising national consultation meeting with policymakers to discuss the process to be undertaken to adjust regulations and policy adjustments.

2.2 Engaging key stakeholders in supporting the integration and implementation of the Lake Chad Water Charter and other appropriate policy and management tools (joint management of surface and groundwater).

LCB stakeholders, such as communities living around the lake, the private sector exploiting the basin's resources, CSOs, academics, and the like needs to be informed about LCBC policy instruments, because they have an essential role in instrumentalizing these decisions on field . This can be done by promoting multi-stakeholder participation and consultation mechanisms. Accordingly, the actions undertaken can be:

- The translation of the Water Charter into 11 dialects (such as Kanuri, Mobber, Buduma, Hausa, Kanembu, Kotoko, Shewa Arabic, Haddad, Kuri, Fulani, and Manga) and the production of the booklet on the main tools of water management adapted to the needs of the communities (at least 5000);
- Awareness campaigns through local meetings and the national media, and community radios;
- Organize the national forum with local decision-makers and water users in the basin on the policy process for the domestication of the Water Charter, the benefits of implementing the Water Charter, and joint surface and groundwater management;
- Establish mechanisms for these stakeholders to monitor and present impacts of joint implementation of the Water Charter and joint management of surface and groundwater

2.3 Operationalize inter-ministerial committees to improve coordination and support the integration policy process.

The Inter-Ministerial Committees (IMCs) were set up during a project implemented by the GEF, this can be seen as a valuable tool to facilitate the integration and implementation of new policy frameworks. The aim is to provide structures for coordination between the different ministries involved in the management of water resources (for example, the Ministry of Environment, Agriculture, Hydraulics, Irrigation, Energy, Transport, Finance, Decentralization, and the like). Accordingly, the operationalization of such can be through the following process:

- Redefinition of mandate and establishment of management mechanisms;

- Organize training and awareness raising for members to build the capacity of national authorities to monitor the regulations and standards of water management provided in LCB legal texts;
- Organize regular IMCs meetings to discuss policy issues and resolve policy specifics, together with decision-makers on behalf of ministry members;
- Evaluate the contribution of the IMCs to the management of the Lake Chad Basin and analyse sustainable financing mechanisms to support its operations.

Component 3: *Strengthening the capacity of national ministries, institutions, and other stakeholders (academia and civil society) to support policy development/updating and identification of priority investments to improve management of LCB's water and ecosystem*

With the support of the German Cooperation (through GIZ and BGR), the current capacity building of LCBC's staff and water managers is being strengthened on hydrogeological methods related to collecting and analysing groundwater data, climate change, adaptation strategies, and best practices.

3.1. Develop the management capacities of the technical staff of ministries

Training will help the delivery of services (agriculture, environment and water, livestock, and the like) and monitoring daily the use of the basin's resources. The training program may include conjunctive management of surface and groundwater, environmental protection of water resources (pollution control, intrusive control), sustainable management of natural resources, ecosystem-based management, gender-sensitive management, disaster risk management, environmental water requirements.

3.2. Develop the governance capacity of decision-makers (ministries, parliamentarians, and local decision-makers).

The objectives are to support decision-makers with the capacities and mechanisms needed for better decision-making in water cooperation and integrated management of resources, and to negotiate water solutions in multilateral contexts and across national borders. Actions can be:

- Assessing basin's resource governance, critical assets including infrastructure, economic gains, short term, and long term;
- Promoting integrity and accountability in water management;

- The use of Environmental Impact Assessments in proposing infrastructure development;
- Incorporating, saving, and implementing the Legal and Regulatory Frameworks responsible for the management of Lake Chad.

3.3. *Develop basin user participation capacities*

Riparian communities are the greatest beneficiaries of LCBC activities. They are mainly stockbreeders, farmers, fishermen, associations of wholesale fish merchants, associations of women involved in the gardening market and handicrafts, traditional hunters, users of wood-free forest products, and younger sand miners who derive their subsistence and income directly from the LCB. Thus, developing riparian communities' participation will be a wonderful increment to improve water management. This is because it will promote better planning and inform more decision-makers on their aspirations. The following actions can be undertaken:

- Establish a network of Lake Chad custodians;
- Organize training and information forum to enhance understanding of Lake Chad environmental challenges and emerging issues and access appropriate tools and knowledge of Lake Chad basin management;
- Participation in statutory meetings of the LCBC;
- Develop communication tools (newsletter, media coverage) to accentuate the importance of building networks for the management of Lake Chad;
- Establish evaluation and monitoring mechanism to assess and enhance community participation.

Component 4: strengthening *the Monitoring, Modeling, and Data/Information system for the integrated management of Water and Land Resources and Basin biodiversity.*

The AfDB projects (PRODEBALT and PRESIBAL) aim at improving the hydraulic meteorological network and the capacity to produce real-time information and data sets. However, even if the framework of the monitoring system is in place, the operationalization is still low, mainly because of the low involvement of basin stakeholders in data sharing. Component 4 addresses the need to strengthen proportionate participatory data collection and sharing systems for sustainable transboundary management. Actions in this regard can be:

4.1. Establish multi-participatory data collection and sharing using the scientific knowledge of indigenous peoples

The multi-stakeholder level water management approach provides a mechanism for regional coordination and collaborative actions to enable riparian partners to harness the resources and expertise of various stakeholders and interest groups. To solve problems related to the environment and water resources. This can be done by:

- Making an inventory and analysis of existing national/regional data and information pool, including institutional analysis and training, establishing a mechanism for circulating data and information at national and regional levels;
- Assessing communities understanding of water resources;
- The creation of a Regional Working Group for Data Management comprising scientists and indigenous people.

4.2. Establish a functional database to analyse and produce appropriate information related to existing information systems.

The database system includes a set of data containing indicators on early warning and emergency, which will allow the triggering of targeted response at short notice.

Component 5: *Implement targeted community-based projects to enhance local/national/regional water resources' stress reduction*

Notwithstanding its importance, water resources and associated ecosystems in most basins are increasingly threatened by the intensified and unsustainable pressures of rapidly growing populations and cities and expansion of agricultural and industrial activities. Since the 1970s, climate change has led to variations and deficits in rainfall and surface water resources.

Moreover, to accelerate economic growth, many national water and environmental policies and basins have demonstrated clear limitations in their ability to promote equitable and sustainable resource use. The Lake Chad Basin is no exception, and this requires urgent intervention. The AfDB PRODEBALT project has set up local development funds to finance basic community infrastructure and micro-projects to diversify and promote favourable sectors. AfD's new project, PRESIBALT, supports increased employment and income generation through labour-intensive work during non-

cultivable periods and financing income-generating activities (including production development using green technologies). The GIZ Adaptation Program also develops and disseminates various adaptation measures in major production systems. Thus, there is the need to enhance such projects as they are beneficial to counter challenges especially those related to climate change. Actions can be:

5.1. The implementation of Regional Invasive Plant Species Control Project.

In the Lake Chad basin, the prevalence of invasive species is revealed as one of the seven priority environmental concerns in the transboundary diagnostic analysis of the basin (TDA). The problem is seen chiefly in the Komadugu-Yobe sub-basin, the Chari Logone sub-system, and the lake. There are two notable invasive species, the club reed, and the grain gnawing bird (weaver birds). In the Chari-Logone system, it is water hyacinth. In addition, however, Typha and water hyacinth have invaded the lake.

The significant environmental impact of bad infestations is clogging, which sometimes evens out the diversion of channels leading flooding, loss of livelihoods, poverty, and resources. Therefore, the LCBC lunched an invasive species control program as a priority investment in between 2013-2017. The enhancement of such projects is beneficial for the region as it has significantly affected water access and navigation in the lake. Actions can be:

- Introducing approaches for invasive species monitoring, including marketing and training communities. This is an integrated approach which ensures close involvement of local communities in the monitoring process. Local community members can be trained in natural resource management and provided with inputs to support their horticultural cultivation, using fertilizer from harvested weeds;
- The approach can also enable the training of communities in club reed grass and other agricultural wastes conversion to biomass for energy production;
- Also Monitoring and assessment of environmental and socio-economic impacts of such activities needs to be implemented.

5.2. Promote sustainable financing of ecosystem-based income-generating activities.

The creation of the Community Finance Service (CFF), through existing credit and the mutual economy or other micro-finance institutions, for income-generating activities based on the rental ecosystem aimed at restoring, maintaining, and increasing its ecosystem services while reducing the living conditions of communities. The

sustainability and Performance of existing microfinance institutions, credits, and mutual savings will be improved to collect, manage, and finance priority identified by vulnerable communities. This can be enhanced by:

- Providing implementation support consisting of technical assistance for training and capacity building advice to local stakeholders to ensure the required quality and standard of sub-projects;
- Sub-project management follow-up support, including management support and advice, competency management, and replication activities;
- Sharing experiences through the development of communication tools based on gender balance. This will promote the sharing of lessons and experiences to replicate them in other communities.

Component 6: *Identify Lake Chad investment opportunities*

During the 14th Summit of Heads of State and Government of the LCBC held on April 30, 2012, in N'Djamena in the Republic of Chad, a five-year investment plan (2013-2017) was adopted. This plan aims to improve and preserve the entire ecosystem of the Lake Chad basin by:

- Implementing the water transfer project from the Ubangi basin to the Lake Chad basin;
- Sustainable use of natural resources;
- The conservation of ecosystems in the Lake Chad Basin;
- Increase the participation and quality of stakeholders;
- Implementing the Lake Chad Basin Water Charter;
- Implementation of the national action plan for integrated water resources management (IWRM) in member countries;
- The restoration of lasting peace and security in the region.

Actions can be:

- Making a detailed study of the benefits of cooperation and joint investment and see how these benefits can be shared. The riparian countries have realized short- and long-term benefits through the coordinated operation of cooperative

management of existing planned inflows and cooperative irrigation development. Engagement in the basin will depend on opportunities to build trust in cooperation at different levels and on political and socio-economic situations;

- Training national policymakers and LCBC subsidiary bodies to identify and develop bankable investment projects.

CONCLUSION

This thesis presented a comprehensive framework for the sustainable management of water resources in Lake Chad. The framework addresses the urgent need to mitigate the water crisis in the region, protect the environment, improve the well-being of local communities, and foster regional stability. By integrating environmental, social, and economic factors, this framework offers a holistic approach to water resource management, emphasizing integrated water governance, climate change adaptation, ecosystem restoration and conservation, integrated water resource management, and socio-economic development.

The challenges facing the institutional management of the Lake Chad Basin Commission (LCBC) in managing water resources were also identified. These challenges include inadequate institutional capacity, limited coordination and cooperation, transboundary water management complexities, climate change, environmental degradation, insufficient financing, and rapid population growth and urbanization. Addressing these challenges requires the commitment and collaboration of regional and international stakeholders, along with the allocation of adequate financial resources and technical expertise.

The successful implementation of the proposed framework necessitates continuous monitoring, evaluation, and adaptive management to ensure its effectiveness and resilience in the face of evolving challenges. It also requires promoting inclusive participation and engagement of all stakeholders.

By adopting this sustainable framework, the water resources of Lake Chad can be managed in a manner that ensures their long-term availability, protects the ecosystem, supports local livelihoods, and promotes regional cooperation. In addition, the framework provides a foundation for further research, policy development, and action to safeguard the water resources of Lake Chad and its surrounding areas for future generations.

In conclusion, the sustainable management of water resources in Lake Chad is crucial not only for the region's socio-economic development but also for preserving its environmental and ecological integrity. By implementing this holistic framework, we can strive towards a future where Lake Chad and its surrounding communities thrive in harmony with nature, ensuring a sustainable and prosperous future for all. It is also hoped that this framework will be an inspiration for replication in other African basins.

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APPENDICES

This section is composed of selected interviews conducted with staffs of the Lake Chad Basin Commission in N'Djamena, Chad between the 30th of January and the 7th of February 2023. The transcription of these interviews is to clarify the present status of the Lake Chad Basin water resources management.

A: Author **R:** Respondent

Brackets : Authors notes (...)

Appendix 1: Interview with the Head of the Natural Resource Management Division

A: In your opinion, is there a dying Lake Chad ?

R: (...) With what we have seen for decades, Lake Chad is not dying. Of course, Lake Chad has shrunk in size, but we have witnessed an amelioration over the past years, largely attributed to increased precipitation.

A: What do you think of the present condition of Lake Chad as compared to the previous year (1960s) in terms of water quantity and quality?

R: Using the 1960s as a base year to compare the present water condition in terms of water quantity and quality may be inaccurate, because, from the 1960s to date, the lake has undergone several changes. These changes can be seen in terms of population growth (...) leading to pressure on resources. So it is practically challenging to compare water and water resources accessibility from the 1960s and to present.

As far as water quality is concerned, around the 1960s, the population was estimated to be about ten million, which is far different from what we have today, with a population of nearly forty to fifty million. Population growth has significantly increased the demand for water resources.

Although there has been increase in water demand, we cannot say there is water scarcity. The lake can still sustain the population. A perfect explanation to this logic is that Lake Chad waters is not only limited to the surface but also underground. Most of the water used in the LCB are the underground waters. For instance, irrigation activities depend primarily on groundwater.

There are interactions between surface and ground waters. These are natural geological processes. As an illustration, during heavy rainy seasons, surface water percolates to

recharge groundwater to a certain level. This groundwater, through transpiration, recharges surface water during periods of prolonged droughts.

Talking about quality, there have been several changes over the past sixty years regarding water quality. This can be seen with wastewater emanating from different activities developed around the lake. Though the impact of this waste discharge on the lake has affected water quality, Lake Chad water has remained fresh. We have also experienced over the past two years the development of invasive species, hyacinth, and lotus invasion, which can affect water quality.

A: What are the mechanisms implemented by the LCBC to ensure water resources management in the Basin?

R: First of all, we have the Fort Lamy Convention, which is the foundation of natural resources management of the Basin. This convention emanates from the will of States and through the commission, it provides an area of consultation on major decisions for the future of the Basin. It is a substantial achievement in terms of water management (...).

Secondly, we have the Water Charter. It has brought a lot of improvement in terms of water management. It provides regulations in terms of water uses.

Out of the six LCBC member states, four have ratified the Water Charter. The outstanding issue of concern of the LCB Water Charter is its entry into force. This is because, although the ratification was done by the four riparian countries, which is the requirement for it to enter into force, instruments of ratification have not yet been deposited with the Chad Ministry of Foreign Affairs. At the moment, the Chad Ministry of Foreign Affairs has received the instrument of ratification from three out of the four states. So we are waiting for the instrument of ratification of one country for the full implementation of the Charter.

A: What are the internal and external challenges encountered by the LCBC in managing Lake Chad's water resources?

R: Like many institutions, we also face challenges; among such challenge is finance. The Commission depends on funding from member countries; with the economic recession in these countries, it has been difficult for them to honour their engagements. However, member states actively strive to respect their engagement. It is thanks to those efforts made by member states that the LCBC is still in existence today.

A: Can the fact that some countries contribute more to the financing of the Commission be a threat to the sustainability of Lake Chad's institutional framework?

R: (...) we cannot really assume that; what characterizes this motion of support is regional solidarity which is the foundation of every regional grouping.

Another reason for this disparity in contribution is population growth, Nigeria in the LCB region has the highest population and tends to use the Lake's resources more than the other riparian states. This issue has been a reason for Nigeria's heavy contributions (...).

In addition, we also have the economic situation of States in the basin area, which explains this disparity in contributions.

A: To what extent will the LCBC consider the support of international organizations an asset to the institutional management of the Lake Chad Basin (making reference to any project)?

R: International partners have supported the LCBC technically in terms of capacity building, expertise, and resource mobilization and financially. The presence and active participation of international partners can largely be attributed to member states. Member states have actively sought to find partners to alleviate poverty (...) and enhance development in the LCBC. Among partners who have greatly supported the LCBC in the accomplishment of its missions are:

The African Development Bank; the African Development Bank is one of the leading partners as far as the basin's development projects are concerned. It has greatly supported the LCB financially. Among the projects developed by the African Development Bank, for the development of the Basin, is PRODEBALT. PRODEBALT is a sustainable development project for the development of the Lake Chad Basin. This project has significantly contributed to the overall management of the Basin in terms of biodiversity conservation, water resource management, and capacity building. Also, we have the PRESIBALT, aimed at rehabilitating and strengthening the socioeconomic resilience of the LCB. This project is a successor of PRODEBALT.

Further, we have also benefited from the support of the World Bank and technical cooperation from the GIZ (...).

Appendix 2: Interview with the LCBC Water Quality and Quantity Expert

A: what are the challenges of water resources management in the LCB?

R: One of the most significant challenge of Lake Chad's water resources management is the variation in hydrological and hydrogeological regime. This can be explained by the fact that, at times we witness water shortages and at sometimes water is in abundance.

Another challenge is the sedimentation of the lake which prevents the free flow of surface water.

Also, the uncoordinated nature of different activities developed around the lake leading to waste discharge into the lake. Another challenge is biodiversity degradation.

In addition, another challenge in the region is climate change which is transversal. When we talk about climate change, we refer to climate risk caused by the variation in annual rainfall. At times we have 100 millimetres per year, and during certain periods we are at 500 millimetres per year. Thus, these variations make the region to be confronted with excessive dryness and rainfalls. When it rains a lot, we have flooding, and when it doesn't rain, we have dryness, and in each of these cases, the lake's management is cumbersome. During periods of excessive dryness, water evaporates, and when there is excess rain, we have floods, houses are destroyed. People relocate to other areas and there is the need to allocate funds for the relocation of the masses.

A: What role does the LCBC plays in water resource management?

R: The Lake Chad Basin Commission does not intervene operationally in the field. It only intervenes functionally. It facilitates the implementation of activities carried out by member states. This is because the Lake Chad Basin Commission exist because of member states, and it is the responsibility of member states to implement the different activities or projects set forth by the Commission.

A: can you clarify this assertion?

R: The Commission is not a project, just a mechanism put in place by member states to facilitate the management of resources in the Basin. That is, the role of the commission is to mobilize resources to facilitate projects implementation; facilitate communication among member States and partners; and ensure the animation of the LCB consultation framework. That is, we don't intervene in the field to make technical Supervision, but instead, as experts, we issue recommendations.

Also, regarding the management of projects funds, it is the sole responsibility of member states not the commission. Member states have their budgets, and they are the ones to implement project activities. Therefore, the Executive Secretariat of the commission is just the administrative office of member states.

A: what is the future of water resources management in the Lake Chad basin?

R: There's a need for increased financing to facilitate the implementation of projects to meet the basins' challenges. Increase in funding will also facilitate the implementation of projects geared towards the amelioration of the living standard of the basin's population. Significant projects such as great infrastructural projects dealing with the transformation of lake Chad natural resources will be beneficial for the basin's development. For instance, if we take a

sector like fishing, we need big projects that will facilitate the transformation of fishes. This will be beneficial to women who are the most active in the sector of fish transformation. This has been an old tradition in the Basin, men usually go for fishing and women transform the fishes. Such projects will reduce the rate of lousy fishing techniques, which has been one of the most significant challenges of water resource management in the Basin.

Appendix 3: Interview with the Director of the Technical Department of the LCBC

A: what are the challenges of water resources management in the LCB?

R: The first challenge of the basin is peace and security. Unfortunately, there has been the development and growth of new terrorist groups around the lake aside from Boko Haram and transboundary conflict between member states.

A: what is the role of the LCBC in conflict management?

R: As far as conflict management is concerned, the LCBC only intervenes when conflicts are between two member states. It does not interfere in internal conflict.

To continue with the challenges of water management in the LCB, the present State of Lake Chad is mainly due to sedimentation. This has caused the division of the lake into two. That is why today we have the northern and southern Basin. But with the excessive rainfall, which started in May 2022, (...) there was a reconnection between the northern and the southern Basin.

A: Can you comment more on it?

R: on the one hand, Lake Chad is permanently fed by two main rivers that is the Logone and the Chari Rivers. More than 90% of the water which feeds the lake comes from the chair river. These two rivers are found in the southern part of the basin. On the other hand we also have the Komadougou Yobe river found in the northern part of the basin, which contributes about 10% of Lake Chad's water inflows. The reason for this low water contribution is because, in the northern part of the basin there has been the development of dams which have completely altered the hydrological flow of water into Lake Chad.

A: can you comment on the perspective of the Ubangi inter basin water transfer project being a solution to water sustainability in the LCBC, with regards to the previously enumerated challenges?

R: For the implementation of an inter-basin water transfer, there is a need for trust consolidation among the parties involved. Regarding the Ubangi inter-basin water transfer

project, we still have a long way to go, this is because there is a need for trust-building commands.

A: what are the institutional challenges of the Lake Chad Basin Commission as far as water management is concerned?

R: Every institution, or let's say the world, in general, is dynamic. Nothing is static. If we must consider the institutional organization of the Lake Chad Basin Commission, there have been new dynamics regarding the institutional management of Lake Chad. This can be seen with the present challenges (...), which are far more different from the previous ones. A case in point is the issue of demographic pressure, climate change and insecurity.

Appendix 4: Interview with the Head of Division of the Basin Observatory

A: can we have an overview of your division:

R: The division of the Basin Observatory, whose role it is to collect data to facilitate decision making process. (...) Our principal mission is to monitor and evaluate water resources in the LCB as well as its environment. So, we collect data on different changing tendencies on the LCB water resources and environment, thus, our function is to set up a regional database. Regarding water resource management, we provide information on water quality, piezometric data, environmental data, and every other information on the Lake Chad basin ecosystem. Member states have the responsibility to share this information with us so that we can update the Lake Chad Basin database. This will facilitate the implementation of decisions and projects geared towards the sustainable management of water resources in the lake. When we receive this information, we elaborate (...) decision-making tools.

A: what are the challenges of the Lake Chad Basin Commission as far as water management is concerned in the LCBC?

R: (...) One of the difficulties we encounter in terms of basin management is the ability to fully exercise our role as a basin organisation. We also have security challenges which is a real threat to water resources management in the basin. This is seen to the fact that we have monitoring station which have been installed in each of the riparian countries but because of security challenges we cannot have access to them. There is the need to rehabilitate these stations and collect data. Presently we have new monitoring station that we have acquired thanks to member states support, but because of security reasons we are still trying to figure out how to install these stations to facilitate the transmission of information at the regional level.

We also have the issue of funds insufficiency, which depend on member states contributions. Obviously, due to the internal economic challenges faced by these member states, contributions are delayed. This delay was mostly felt during the Covid pandemics. This delays in financial contributions affects the following up of hydrological station which must be done in specific period of the year after which it becomes impossible and must be shifted to the next year.

We also have the limited amount of personnel, especially in our division. Thus, we are equally in real need of personnel.

A: In your opinion is there a dying Lake Chad:

R: We cannot speak of a dying Lake Chad. Though it is true that in the past decades, the lake has considerably shrunk in size, today, there is a replenishment of the lake. The most outstanding question is whether this will be sustainable. The issue of sustainability is portrayed by the climatic challenges of the region.

A: Can you comment on the institutional changes of the LCBC in relation to water resources management in the basin?

R: The institutional change of the Lake Chad Basin Commission is primarily attributed to the different dynamics that have arisen over the past decades. Among such dynamics is climate change, which can be seen with the prolonged droughts that occurred in the 1970s and 1980s. In addition, there is the issue of insecurity with the Boko Haram insurgencies. This heavily contributed to the restructuring of the LCB organs to adapt to different these different trends.

A: What are the mechanisms put in place to enhance water resources management in the LCB?

R: We have the Fort Lamy Convention, which is the birth certificate of Commission. Every other convention which comes after the Fort Lamy Convention is there to support its implementation. Taking the case of the water Charter, it only comes to support the Fort Lamy convention to enable the Lake Chad Basin Commission to fully enjoy its role as a consultation framework for the integrated management of water resource management. The water charter is there to regulate water uses in a way that does not jeopardize its use by another member states.

Appendix 5: Interview with the Regional Coordinator of the Lake Chad management improvement support project

A: what position do you occupy and how is it related to the Lake Chad water resources management?

R: I am the Regional Coordinator of the Lake Chad Management improvement support project. A co-joint project of the United Nations Development Program and the Global Environmental Facility. This project aims at enhancing the capacities of the LCBC member states to enhance the integrated and resilient management of LBC resources by taking into consideration climate change and stakeholders' participation. The project was launched in 2019 and will end in December 2023. It is a regional project which covers five states and has six pillars, among this pillar we have capacity building and ensuring the harmonious implementation of legal texts and management policies to name but a few.

A: Comment on water access in the LCBC?

R: (...) access to water is limited for a certain number of reasons: Ecologically, the lake is heavily dependent on climatic parameters such as temperature changes, precipitation, and the like. The lake depends on demographic pressure that is there are many actors surrounding the lake with different interest. We have cattle rearers, farmers, fishermen, households and the like. The conflicting part in these different stakeholders lays on the fact that Lake Chad is the only resource, and everybody wants to control it. For instance, two years ago on the Cameroonian side of the basin, there was a conflict between Cameroonian cattle rearers and fishermen. This conflict was caused by the techniques used by fishermen to catch fishes. Fishermen around the lake usually dug holes to catch fishes and the herdsmen found their cattle being trapped in this whole and usually got drawn when trying to cross the lake. Another conflict was between farmers and cattle rearers where herdsmen with their cattle frequently destroyed farmlands.

When we talk of Lake Chad water resources management it is important to include the soil and the trees.

A: Comment on the LCBC and its approaches to water resources management?

R: The mission of the LCBC is to preserve Lake Chad and its Basin and enable a harmonious development of its members states. The principal role of the LCBC is consultation and providing recommendations. If you see other basin organisation, they have more powers compared to LCBC. For instance, if we take the example of the Senegal River Development

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Organisation made up of Senegal, Mali, Guinea, and Mauritania; they implement great projects as compared to the commission. The commission role is purely consultative, it coordinates the different activities or projects in the basin. It actively strives to find partners to enhance the basin's development.

A: for you what is best for the future of water resources management in the Lake Chad basin?

R: there is the need to conduct an environmental impact assessment of projects before implementation. This is because, the environment is like a puzzle and if you move a piece apart, you affect the whole system, that is the water, (...) the soil and vegetation. Thus, for the future of the basin there is the need for a thorough assessment of risks.