



CASE REPORT

Integrated Water Resource Management Policy in Africa: Case Study of the Nile Water and Its Politics

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Abstract

The rational management of freshwater resources is one of the main concerns of human societies. The waters of the Nile, with a course of 6,671 kilometers, and a watershed that covers nearly 3 million square kilometers, is formed by the confluence in Khartoum, Blue Nile and White Nile. The White Nile has its source in Lake Victoria, a huge 69,485 square kilometer freshwater reservoir. But it is the Blue Nile, originating in Lake Tana (or Tsana) in Ethiopia, which, along with the other rivers of Ethiopia, contributes the most, by far, the flow of the Nile: 84% in average and not less than 95% during the flood season. All this water is shared by ten countries, mainly Egypt, Sudan, Ethiopia, Uganda, Tanzania and Kenya, but also Eritrea, Rwanda, Burundi and Congo-Kinshasa. For historical reasons, Egypt has always exploited most of the flow of the river. The size of its population and its almost absolute dependence on the waters of the Nile for its water supply makes this country particularly nervous about the attempts of the downstream countries to question the established sharing of water or to build new infrastructures. The Nile basin is experiencing recurring political tensions, but also many initiatives in the direction of joint management between all the countries concerned.

Therefore, the objective of this work is to understand the problems related to the governance of the water resource and to define first of all what a resource is and more particularly its use, the related activities as well as the possible conflicts. This article looks in more detail at water management by analyzing the different types of rights and duties that come into play such as the development of multi-sectorial regulation and a watershed management approach.

Keywords: Water Resource Management, Policy, Africa, Nile Water, Trans-Boundary, GERD Grand Ethiopian Renaissance Dam

Introduction

With 40% of the world's population living at the banks of rivers worldwide (UN, 2008) we are once again given a clear understanding of how vital free flowing bodies of water are to human development. Hydro resources are amongst the most vital resources on earth. They play a vital role on how the state governs its populous as well as how states interact with other states and non-state actor bodies politically, socially, economically etc... From a historical prospective the earliest known human settlements and city-states that prospered at one time or another were situated on the banks of what are today free flowing trans boundary rivers.

The existing 263 trans-boundary lake and river basins cover nearly one half of the earth's land surface and accounts for an estimated 60% of global freshwater flow. Continued high to very high risk of environmental and human water stresses, due to decrease in renewable freshwater resources and higher water demand from increased population and irrigation, as well as risks resulted from climate change impacts and pollution are important factors in increasing risks of hydro-political tension among countries sharing trans-boundary river basins, due to political context, disagreement on river's water allocation, etc. These are some examples of trans-boundary river basins in

the Middle East: Orontes, Jordan River, Euphrates and Tigris. The countries significantly affected by these river basins are: Lebanon, Syria, Turkey, Iraq, Palestine, Israel, and Jordan. Regarding the Nile River, which is the subject of this study, it is an international river as its water resources are shared by eleven countries, namely, Tanzania, Uganda, Rwanda, Burundi, Congo-Kinshasa, Kenya, Ethiopia, Eritrea, South Sudan, Sudan, and Egypt. In particular, the Nile is the primary water source for Egypt and Sudan.

At present Trans's boundary river basins are under increasing pressure due to population growth, agricultural developments, industrial developments, climate change, as well as river pollution. Water scarcity has been on the increase due to the increasing gap between water supply and demand. From a political standpoint states and their resources are under surmountable pressure to sustain their populations which have the propensity to lead to inter and intra state conflicts. The

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disputes and tension over natural water ways continue to prove to be a source of discontent leading to disputes, conflicts, and deadlocks in negotiations over water distribution as well as the length of time it takes in regards to the filling of reservoirs, allocation and a whole host of other major issues.

The Grand Ethiopian Renaissance Dam

The Grand Ethiopian Renaissance Dam (GERD) is a project being undertaken by Ethiopia on the Blue Nile. The Blue Nile is one of the main sources/ tributaries of the Nile River. The Blue Nile has its source in the lush Ethiopian highlands where a seemingly endless stream of water continues to flow from. The (GERD) is situated only a few Kilometers from the border between Sudan and Ethiopia. With a hydropower capacity of 6,000 MW the GERD total has been at an estimated cost of \$ 4.8 Billion United States dollars. This dam is the largest of its kind in Africa Dwarfing the Aswan Dam in Egypt. From the projects inception regional arguments and disputes have arisen in regards to Ethiopia's dam project. The main nations that have taken to question and oppose Ethiopia's construction have been the downstream countries (Sudan and Egypt). At present with the project nearing its completion Sudan has become less vocal in its criticism of the project and has adopted a more conciliatory approach towards the (GERD) project. The Blue Nile River is a source of around 85% of the Nile River water. Egypt claims that GERD will reduce the flow of water in the Nile by about 25 to 40%. The real scale of the environmental impacts of GERD under construction is underlined by the mainly upstream nations of the Nile River. Their concern of the project is exacerbated by rising sea levels due to climate change leading to saltwater intrusion downstream. What is clear is that for Ethiopians GERD is an empowering development and potentially a great contribution to their future and possibly their neighbors that stand to benefit from the potential sharing of electricity.

The Grand Ethiopian Renaissance Dam (GERD), which is under construction on the Blue Nile River near the Ethiopian-Sudanese border, has been looked at by some as a potential trigger point for conflicts among Ethiopia, Sudan, and Egypt. The idea of a dam on the Nile River in Ethiopia, and the threat that this would pose for Egypt, has been on the minds of the people of the Nile Basin for centuries. Ethiopia has long claimed a right to use Nile waters, but it was only in 2011 that Meles Zenawi (the former Prime Minister of Ethiopia from 1995 to 2012) announced that Ethiopia would begin construction of a large dam on the Blue Nile River, near its border with Sudan. The advantages of storing water in the Blue Nile gorge for hydropower generation and flood control have been recognized for decades. But until recently Ethiopia did not have the political or financial strength to pursue this economic development strategy, without assistance from major powers such as the USA and Israel. According to Kenawy (2013), the issue of the Nile water for Egypt is the issue of "life or death". This issue has proven to be a major sticking point in regard to Egypt and the other Nile Basin countries. This issue has contributed to Egypt's reluctance and absence

from engagement in African affairs for the past three decades. In addition the entry of the USA, Israel, and the World Bank into the Nile Basin countries affairs and the politicization of the issue of water security from all sides, and the launching of new concepts including water pricing, water privatization, and the exchanging of water by these forces all possess the potential of increasing conflict among Nile basin countries in the coming years.

On March 23, 2015, leaders of Egypt, Ethiopia, and Sudan met in the Sudanese capital of Khartoum to sign an agreement that was expected to resolve various issues arising out of the decision by Ethiopia to construct a dam on the Blue Nile. The Khartoum declaration, which was signed by the heads of state of the three countries Abdel Fattah al-Sisi (Egypt), Omar al-Bashir (Sudan), and Halemariam Desalegn (Ethiopia), has been referred to as a "Nile Agreement." This agreement was expected to be one that would help resolve conflicts over the sharing of the waters of the Nile River. However, this view was later looked at by many as misleading because the agreement that was made public only dealt with the Blue Nile's Grand Ethiopian Renaissance Dam project (GERDP) and did not tackle the broader, still contentious issues of the sharing of the Nile River waters among all riparian states. Thus, the new agreement does leave the conflict over the equitable, fair, and reasonable allocation and utilization of the waters of the Nile River unresolved.

With a lot of present day reflection about our environment and the implications of an ever deepening climate change It has become ever so important that we reflect upon the importance of natural resources such as the Nile and gain an understanding of why these resources are so vital, especially for Africa and its long-term development. In fact, 160 million people rely on the waters of this important river for their livelihoods. Thus, preserving, maintaining, and using the waters and resources of the Nile River efficiently and sustainably is a goal that should be shared by all.

Nile Water Agreements (Historical Synopsis)

Disagreements over the use of the Nile are not a recent development; a lengthy history of disagreement has been documented. This history gives insight into the importance that the Nile possesses to all dependent parties. In 1929, an agreement was concluded between Egypt and Great Britain regarding the utilization of the waters of the Nile River; Britain was supposedly representing its colonies in the Nile River Basin.

The Anglo-Egyptian Treaty covered many issues related to the Nile River and its tributaries. Of particular relevance to the present discussion is that it granted Egypt an annual water allocation of 48 billion cubic meters and Sudan 4 billion cubic meters out of an estimated average annual yield of 84 billion cubic meters. In addition, the 1929 agreement granted Egypt veto power over construction projects on the Nile River or any of its tributaries in an effort to minimize any interference with the flow of water into the Nile.

In 1959, Egypt and an independent Sudan signed a bilateral agreement, which effectively reinforced the provisions of the 1929 Anglo-Egyptian Treaty. The 1959 agreement increased water allocations to both Egypt and Sudan. Egypt's water allocation was raised from 48 billion cubic meters to 55.5 billion cubic meters and Sudan's from 4 billion cubic meters to 18.5 billion cubic meters, leaving 10 billion cubic meters to account for seepage and evaporation. Finally, the agreement stipulated that in the case of an increase in the average water yield, the increased yield should be shared equally between the two downstream riparian states (i.e., Egypt and Sudan). The 1959 agreement, like the 1929 Anglo-Egyptian Treaty, did not make any allowance for the water needs of the other riparian states, including even Ethiopia, whose highlands supply more than 80 percent of the water that flows into the Nile River.

Over the years, especially as the populations of the other countries of the Nile River Basin have increased, and these countries have developed the capacity to more effectively harvest the waters of the Nile River for national development, disagreements have arisen over the fact that Egypt has insisted that the water rights it acquired through the 1929 and 1959 agreements (collectively referred to as the Nile Waters Agreements) be honored and that no construction project be undertaken on the Nile River or any of its tributaries without prior approval from Cairo. In fact, various Egyptian leaders have threatened to go to war to protect these so-called "acquired rights." Upstream riparian states such as Kenya, Tanzania, Uganda, and Ethiopia, have argued that they are not bound by these agreements because they were never parties to them. In fact, shortly after independence from Great Britain in 1961, Tanganyika's (now Tanzania, after union with Zanzibar in 1964) new leader, Julius Nyerere, argued that the Nile Waters Agreements placed his country and other upstream riparian states at Egypt's mercy thus forcing them to subject their national development plans to be under the scrutiny and supervision of Cairo, and that such an approach to public policy would not be compatible with the country's status as a sovereign independent state. All the upstream riparian states have since argued in favor of a new, more inclusive legal framework for governing the Nile River Basin.

The Cooperative Framework Agreement

The Nile Basin Initiative (NBI) was signed in 1999 by all Nile river riparian states except Eritrea. This agreement was aimed at a concerted effort to enhance cooperation on the use of the "common Nile basin water resources." This agreement functioned with the intent of the NBI states to work on developing what they believed would be a permanent legal and institutional framework for governing the Nile River Basin. The Cooperative Framework Agreement (CFA), as this agreement is called. This agreement formally introduced the concept of equitable water allocation into discussions about Nile governance, as well as a complicating concept called "water security."

By May 10, 2010 The CFA was ready to be signed. Burundi, Ethiopia, Kenya, Rwanda, Tanzania, and Uganda all became

signatories and the Ethiopian parliament ratified it. However, Egypt and Sudan immediately argued that their "acquired rights" to the waters of the Nile River would not be protected, Egypt and Sudan immediately registered their intention not to sign the agreement because they objected to the wording of Article 14(b): "Nile Basin States therefore agree, in a spirit of cooperation: . . . (b) Not to significantly affect the water security of any other Nile Basin State." They then proposed an alternative wording for Article 14(b): "Nile Basin States therefore agree, in a spirit of cooperation: . . . (b) Not to significantly affect the water security and current uses and rights of any other Nile Basin State," (emphasis added). This wording was rejected by the upstream riparian states, who argue that "the current uses and rights" phrasing would entrench the concept of prior rights, including those created by the Nile Waters Agreements and effectively retain the inequity and unfairness that has characterized the allocation and utilization of water in the Nile River Basin since the 1920s.

With such an agreement being signed and ratified by Ethiopia's parliament Then prime minister of Ethiopia, Meles Zenawi, laid the foundation for the construction of the Grand Ethiopia Renaissance Dam on April 2, 2011. The dam is situated on the Blue Nile, in the Benishangul-Gumuz region of the country. Not long after the pronouncement, authorities in Cairo immediately launched a campaign of words against what they believed was an attempt by Addis Ababa to interfere with Egypt's water needs. Then Egyptian president, Mohamed Morsi, angrily stated that while he was not "calling for war" with Ethiopia, "Egypt's water security cannot be violated at all," that "all options are open," and that Egyptians would not accept any projects on the Nile River that threatened their livelihood.

With the Nile, no longer existing as an Egyptian monopoly due to dictates and forced agreements made by Britain during the colonial era, Egypt and its people are faced with major issues that as of yet, have not been resolved. Furthermore the gradual disappearance of the Nile Delta into the Mediterranean Sea has not made things much easier in relation to the Nile dispute for Egypt. With the disappearance of the Nile Delta it is clear that millions of Egyptian people will inevitably need to look elsewhere for a sustainable and viable future.

A more affective institutional arrangement for common sharing of pooled water resources and the management and cooperation to resolve and address present and future disputes has revealed its self as the most viable option to ensure an avoidance of crises. Therefore, the adaptation of a more effective institutional arrangement such as one similar to the Rowland-Ostrom Framework linked with a cooperative approach to resolve and address past, present and future disputes, which in other cases have included various common trans-boundary resources (oil/gas, forestry and minerals).

Some have referred to the contrasting concepts of "nationalism" as one of the key factors that need to be addressed in regards to reconciling the complex issue of integrated water resource management. The issue of nationalism should be addressed

and realized in a traditional and integrated water resource management apparatus that includes social, cultural and political complexities of the whole region including all the Nile River riparian states such as Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, Uganda, Egypt, and South Sudan.

One of the key factors in ensuring regional stability and the equitable sharing of the Nile will definitely be centered on reconciling the political complexities of the GERD as well as the reconciling of contrasting concepts of nationalism. There is undoubtedly a need for the expansion of traditionally integrated water resource management strategies to better include cultural, social and political complexity when implementing the sharing of water resources such as the Nile. The contrasting concepts of “nationalism” and “regional hydro solidarity” are key factors that will make or break the future partnership in regards to the sharing of one of the world’s greatest wonders.

Different ideas have been proposed in regards to ensuring consistent water flow that will ensure Egypt’s concern over water security downstream such as connecting the Nile and Congo water systems, through the diverting of water by digging a 600-km canal together with pumping stations and other massive infrastructure to transport water from the Congo Basin to the Nile Basin. Furthermore as part of mitigation measures, Egypt needs to invest in the desalinization for fresh water, water-saving drip irrigation, and come up with an Aquifer Storage Recovery (ASR) scheme, artificial recharge and scheduled water extraction, to minimize the cumulative effect of the Grand Ethiopian Renaissance Dam and seawater intrusion downstream along the Mediterranean coast.

Trans boundary Areas of Contention; Globally

The situation is more destabilizing in the Trans boundary river basins. When one takes a look at the Great Lakes of the United States and Canada; Lake Victoria of Africa, Lake Malawi, Lake Tanganyika, and the rivers: Nile, Amazon, Rhine, Congo, Danube, Mekong, Indus, Jordan, Tigris-Euphrates, and the Brahmaputra, to name a few; Experience has shown that such disputes can be resolved through mutual cooperation on sharing water.

Legal agreements on water sharing have been negotiated and maintained even as conflicts have persisted over other issues. Thailand, Vietnam, Laos and Cambodia have been able to cooperate since 1957 within the framework of the Mekong River Commission. Hydroelectric dams are increasingly popular in water-rich countries of Sub-Saharan Africa, especially those less endowed with oil. For example, a 250-MW dam was completed in 2012 on the Nile in Uganda. A 300-MW dam was also built by China and completed in 2009 on the Tekeze River in Ethiopia. A smaller, 120-MW dam was completed in 2012 on the Wele River in Equatorial Guinea, to mention a few. On the other hand, the Jordan River and its tributaries, for example, have been considered as a tension point between the sharing countries of the River, namely: Lebanon, Syria, Jordan, Palestine, and Israel [1].

With an introspective view of the Tigris and Euphrates Rivers both rivers are trans boundary sources of water among Turkey, Iraq, Syria, Saudi Arabia, and Iran. Although Saudi Arabia and Iran are considered as drainage basin states, they are usually not included in studies of the basins of the two rivers. The Tigris River is approximately 1,840 km long, while the Euphrates is between 2,700 and 3,000 km long, making it the longest river in south-west Asia. Both rivers originate in the mountainous region of southern Anatolia in eastern Turkey. The drainage basin of the Euphrates is located 28% in Turkey, 17% in Syria, 40% in Iraq, and 15% in Saudi Arabia. Meanwhile, the Tigris Basin is stretched into Turkey (12%), Syria (0.2%), Iraq (54%), and Iran (34%). Both rivers merge in their last 190 km, forming the Shatt Al-Arab before flowing into the Arabian (Persian) Gulf. Water flow is roughly estimated at around 32 BCM/yr for the Euphrates River, while it is roughly around 43 BCM for the Tigris River [2]. With economic growth, population increase, and urbanization, the demand for water and water use has steadily increased in the region. Iraq, for instance, was especially keen to bring more water for irrigation, and, hence, it built several dams on both rivers. The first dam which Turkey built on the Euphrates was the Keban Dam, which was built by the Soviet Union in 1973 to generate hydroelectric.

Running parallel to the Tigris River the Euphrates River has proven to also be a vital source to millions of inhabitants. The Bozova in the Sanliurfa Province of the Anatolia region of south-east Turkey was built to supply water for irrigation and to generate hydroelectric power. It is the largest dam in Turkey and ranks sixth amongst the largest earth-and-rock fill embankment dams in the world. It was undertaken in the years 1983-1992 with a total cost of US\$ 1.25 billion. The central core of the Dam has a crest length of 1,820 m and height of 184 m, and a storage capacity of around 85 MCM (Technology Net, 2016). The project of the Turkey’s Ataturk Dam has been receiving strong political resentment from Iraq and Syria and other riparian countries as it significantly reduces the flow of Euphrates. In 2009, however, the three countries (Turkey, Iraq, and Syria) initiated talks to establish a water institution to resolve issues related to sharing of the Euphrates and Tigris waters. Likewise the Jordan River has had a contentious background with the basin of this Trans boundary river existing in a greatly troubled area in the Middle East, and it is shared by Jordan (40%), Syria (37%), Israel (10%), Palestine (9%), and Lebanon (4%). The basin of the river encompasses millions of inhabitants that belong to the River Basin’s five countries.

Due to low average annual precipitation of less than 400 mm/yr and the semi-arid to arid climate conditions throughout most parts of the River’s Basin it has resulted in a lack of available freshwater resources [3]. As climate projections indicate further acidification of the region, available freshwater resources will continue to decline in the future while demand on water is dramatically increasing, which is due to the high rates of population growth and the rising standards of living, as well as the rise of development and urbanization. Securing adequate access to water resources in the region is considered

by decision makers as integral to the national security of each of the riparian countries of the Jordan River.

The Jordan River's Basin and its water are central issues of both the Arab-Israeli conflict and the Israeli-Palestinian conflict. The Jordan River is more than 360 km in length, but because its course is snaking its way across terrain the actual distance between its source and the Dead Sea is less than 200 km. Over most of its distance, the Jordan River flows at elevations below sea level. Its waters originate from the high precipitation areas in and near Lebanon's mountains in the north, and flow through the Tiberias Lake (Sea of Galilee) and the Jordan River Valley, ending in the Dead Sea at an elevation of approximately 400 m below sea level, in the south. The current annual discharge of the Lower Jordan River into the Dead Sea is estimated at 20-200 MCM which is highly polluted, compared to the historic 1,300 MCM of good quality. Further details on the Jordan River can be found in Salem, 1994; Salem and Isaac, 2007; Isaac and Salem, 2007; Salem, 2009; and Salem, 2011.

With a view further east the Brahmaputra River is another river that has been a source of conflict and may potentially continue to be one in the future. The Brahmaputra River has an origin in China and then flows through India and Bangladesh before entering the Bay of Bengal. China and India have fought a war over contested territory through which the River flows. Bangladesh faces human security pressures in the River's Basin that has and continues to be magnified by upstream river practices. Controversial dam-building activities and water diversion plans could threaten regional stability; yet, no bilateral or multilateral water management accord exists in the Brahmaputra Basin. The three riparians have taken modest steps at the bilateral level to cooperate in the Brahmaputra Basin, mainly due to limited water data sharing and government dialogues among technical experts.

In the Shan State of Bura there is a planned multipurpose dam on the Salween River. The Tasang Dam also known as the Mong Ton Dam has a location that will be 480km northeast of Rangoon and 52.8 km west of Mongtong. It will be the first dam on the Salween River and will be the largest hydroelectric dam in Burma and the tallest dam in Southeast Asia when completed. Substantial domestic and international controversy surrounds the Tasang Dam project. Thailand's MDX Group agreed in 2002 to develop the project. Thailand is the main investor in the Dam project and the trade of the Tasang's electricity is expected to help relations between Thailand and Burma. 85% of the hydro-electricity produced is expected to be transmitted to Thailand. The Tasang concrete-faced rockfill dam is designed to be 228 meters tall and house a hydro- power station with a 7,110-MW capacity to produce 35,446 GWh

The Indus River, which has originates in Tebet, flows through India, Pakistan, and finally drains to Arabian Sea. The Indus Waters Treaty is a water-distribution treaty between India and Pakistan, negotiated by the World Bank in 1960. The Indus system of rivers comprises three western rivers the Indus, the

Jhelum, and the Chenab and three eastern rivers the Sutlej, the Beas, and the Ravi.

According to this agreement, control over the three "eastern" rivers (the Beas, the Ravi, and the Sutlej) was given to India, while control over the three "western" rivers (the Indus, the Chenab, and the Jhelum) to Pakistan. More controversial, however, were the provisions on how the waters were to be shared. Since Pakistan's rivers flow through India first, the treaty allowed India to use them for irrigation, transport, and power generation, while laying down precise regulations for Indian building projects along the way. The treaty was a result of Pakistani fear that, since the Source Rivers of the Indus Basin were in India, it could potentially create droughts and famines in Pakistan, especially at times of war. Now India is building hydropower projects on Indus River to meet its growing energy demands which is elevating tension between the two countries.

With a synopsis and examples of other contentions trans-boundary water ways it is clear to understand the growing complexities of water resources and how modern day nationalism has politicized perhaps the earth's most valuable resources. The approach followed in this study is mainly to review the recent studies related to the Grand Ethiopian Renaissance Dam (GERD) in relation to the environmental impacts and the shared Nile River resources management. This study further aims at also shedding light and pin-pointing the intersection of politics and environmental issues hence a keener look at the effect of politics on hydrology and vice versa.

Complexities of the Nile

The Nile River Basin is complex, and because of this, the discharge at any given point along the mainstream of the River depends on many factors including weather, diversions, evaporation and evapotranspiration, and groundwater flow [4-5]. The Nile River is 6,853 km long, and, thus, it is considered the longest river in the world. The Nile has two major tributaries, the White Nile and the Blue Nile. The White Nile is considered to be the headwaters and primary stream of the Nile itself. The Blue Nile, however, is the source of most of the water. The White Nile is longer and it rises in the Great Lakes region of central Africa, with the most distant source still undetermined but located in either Rwanda or Burundi. It flows north through Tanzania, Lake Victoria, Uganda, and South Sudan. The Blue Nile begins at Lake Tana in Ethiopia and flows into Sudan from the southeast. The two rivers (White and Blue) meet just north of the Sudanese capital of Khartoum. The northern section of the Nile River flows north almost entirely through the Sudanese desert to Egypt, then ends in a large Delta and empties into the Mediterranean Sea. Egyptian civilization and Sudanese kingdoms have depended on the Nile River since ancient times. Most of the population and cities of Egypt lie along those parts of the Nile Valley north of the city of Aswan (where the Aswan High Dam was built in the 1950s, as it was a key objective of the Egyptian Government following the Egyptian Revolution of 1952), and

nearly all the cultural and historical sites of ancient Egypt and ancient Sudan are found along the banks of the Nile River.

The Grand Ethiopian Renaissance Dam (GERD) will possess the Blue Nile River in the Benishangul- Gumuz region (1°12'55"N and 35°05'35"E) of Ethiopia and is about 15 km from the borders of Sudan. It was previously called as the Millennium Dam and occasionally referred to as the Hidase Dam. As previously stated the GERD will be the largest dams on the African continent with a main purpose of producing hydro- electric power. Similar dams have been built by the Ethiopian Government but none on such a scale as the GERD [6]. The Maximum planned installed capacity of the GERD dam is 6,000 MW making it among the highest output capacity dams. The construction of the Dam and its potential impacts has led to severe debates in the region. Egypt and Sudan are located downstream and depend heavily on the Nile River for agricultural, industrial, and domestic purposes. The Government of Egypt has previously demanded Ethiopia to terminate the project. Egypt had planned a diplomatic initiative to seek support in the region as well as from other global players that have previously shown support for the project such as China, Italy and Norway, along with the USA, Israel, and the World Bank (as mentioned earlier).

Sudan has accused Egypt of mishandling the dispute. Sudan's sudden shift over the Dam project could be motivated by factors such as Sudan potentially benefiting from the regulation of upstream flow on the Blue Nile that will irrigate croplands in Sudan as well as the potential for Sudan to benefit from cross border electric power that could greatly alleviate Sudan's power shortage. Furthermore the prospect of increased trade with Ethiopia has greatly changed opinions in regards to the GERD project and has greatly isolated Egypt in its stance against Ethiopia and its upstream partners [7]. Ethiopia has rejected claims made by Egypt of an impending negative environmental impact that the GERD project will have on down stream flows. Ethiopia has gone further to ensure that the project will rather increase the water flows downstream, which will greatly be in the favor of downstream nations such as Sudan and Egypt.

The site for the Dam was identified by the United States Bureau of Reclamation (USBR) between 1956 and 1964 while conducting the Blue Nile survey. Subsequently, the Government of Ethiopia carried out survey at the site in October 2009 and later in August 2010. The design of the Dam was submitted in November 2010. The project was made public on 31 March 2011. The contract for the project was awarded to Salini Costruttori (an Italian construction company) at the cost of US\$ 4.8 billion. The finance for the Dam comes from the Government's bonds and private funds. The foundation of the project was laid on 2 April 2011 by

The then Prime Minister (Mr. Meles Zenawi) of Ethiopia. The project is owned by the Ethiopian Electric Power Corporation (EEPCO). The planning phase of the project was carried out under the name called Project X, which was later changed to Millennium Dam and finally to the present name (Grand

Renaissance Dam, or just Renaissance Dam). The total estimated cost of the GERD project is US\$ 4.8 Billion (as mentioned earlier). The Government of Ethiopia has indicated to self-manage all the costs of the project. For this purpose bonds were issued targeting Ethiopians both inside and abroad. Chinese banks funded the turbines and associated electrical equipment for the hydel power plants at the cost of US\$ 1.8 Billion. The remaining US\$ 3 Billion will be managed by the Ethiopian Government. The total cost which does not apparently include the cost of power transmission lines is less than 15% of Ethiopia's GDP (Gross Domestic Product), which was US\$ 41.906 Billion in 2012.

The main characteristics of GERD (Source: III, and Tana Beles. It is estimated that the project will Wikipedia) consume 10 Million metric tons of concrete to be produced locally. Diversion of the Blue Nile River was completed on 28 May 2013. Nearly 32% of the project was completed in April 2013 [8]. The contract for supply of low- and high-voltage cables for the Dam was awarded to the Italian firm - Tratos Cavi SPA - in March 2012 by Salini Costruttori. Alstom (a French multinational company) has provided the eight 375 MW Francis turbines for the first phase of the project at a cost of €250 Million (approximately US\$ 264 Million). Over 9,000 workers (including 400 foreigners) have been working on the construction of the Dam. An overview of the Dam on July 31, 2016 is shown in (Table 1)

Construction & Benefits

The Italian company (Salini Costruttori) was awarded the project, which has already worked on other projects such as the dams of Gilgel Gibe II, Gilgel Gibe. The main benefit from the project is hydel power production which is 6,000 MW (6 GW). The electric power will not only be supplied to domestic consumers but will also be sold to neighboring countries, including Sudan and possibly Egypt. This will require construction of major electricity transmission lines to major consumption areas, such as the Ethiopian capital (Addis Ababa) and the Sudan's capital (Khartoum), both of which are located more than 400 km from the Dam's site. The GERD will improve the electric availability in Ethiopia by 200% with full utilization of the power [9]. The benefits of the project is not limited with power supply, it can also benefit the downstream countries, mainly Sudan and Egypt, by removing silts and sedimentation, as a result of regulating the water flow [10].

The GERD is the biggest project in the history of Ethiopia. So far, the Government of Ethiopia has not produced any document about the environmental and social impacts of GERD. Thus, little is known about the impacts of the Dam.

Type of Dam	Gravity, roller-compacted concrete
Impounds	Blue Nile River
Height	175 m
Length	1,800 m
Elevation at crest	645 m
Spillway Type	Controlled overflow

Table 1: An overview of the Dam on July 31, 2016.

Impact of a Dam requires detail assessment of the site and its surroundings (Yihdego 2016a, Yihdego, 2016b). The major concern is that the project will alter the flow of the Blue Nile River which will affect the neighboring countries (Sudan and Egypt), which are located downstream and which rely heavily on the water from the River. The volume of the Dam's reservoir is almost 1.3 times that of the annual discharge of the Blue Nile. The Dam construction has begun without any mutual consultation between Ethiopia and downstream nations (Sudan and Egypt). Critics have asked Ethiopia for more transparency on the impacts of the project. Because of the little information available, the NGO International Rivers hired a local research to conduct a field survey of the Dam's site and adjoining area. A giant dam, such as GERD with a cost of approximately US\$ 5 billion, really deserves an environmental and socio-economic impact assessment study with a cost of a few millions of US\$. According to Swanson (2014), GERD will reduce sediment loads that travel downstream and interfere with the performance of dams in Sudan and Egypt. Also, silt accumulation in reservoirs and dams can reduce reservoir capacity, lead to power failures, and reduce hydropower output overall. For dams that also serve irrigation purposes, sediment buildup can block irrigation channels and reduce agricultural production. Dredging and maintenance costs to address these challenges can escalate quickly.

Previous studies highlighted some issues that require more attention, which resulted in the following findings: 1) At least 5,110 people living downstream will be resettled. Villages located near the Dam (home to 7,380 people) will also be resettled. This estimate is higher than the official presentation of around 800 people to be resettled. Also, the project's planning did not involve participation of the affected people; 2) the high lands of Ethiopia are most sediment-prone and, thus, will pose a big risk for sedimentation of the reservoir and, consequently, will affect the Dam's power generation capacity and life span. Currently no watershed management practices are taken to deal with this problem. Climate change could increase the rates of sediments' flow to the reservoir and the rates of sedimentation; 3) The Benishangul-Gumuz region, where the Dam is located, is one of the few places comprise 90% of the forest area. Construction of roads to the Dam's site will also impact the forests, which are a source of livelihood for the local community, and which represents an excellent variety of biodiversity; 4) Studies have indicated at least 150 species of fish in the Ethiopian portion of the Nile River which resulted in high consumption of fish by the local population, implying the Dam will impact the natural habitat and the fishery.

Impacts on Ethiopia

Ethiopians greatly value the project as it is considered as a sign of modernity, hope, reducing poverty, and of development [11]. The Dam is self-funded by the Ethiopians and they are proud of it as a home-grown project. It has created up to 12,000 jobs during the construction phase of the project. The Blue Nile River is highly seasonal, so the Dam will reduce

flooding downstream. The reduction of damages from floods by protecting the settlements. But contrary to this, if flood recession agriculture is practiced then those fields could be deprived of water availability. The Dam could also be used as a bridge across the Blue Nile, this will complement a bridge upstream under construction in 2009 [12]. According to an independent study field report (2013) conducted by a local researcher commissioned by International Rivers, at least 5,110 people will have to be relocated due the project. Another estimate is that 20,000 people are to be resettled [13]. According to Jennifer (2013), the Ethiopian Government has a solid plan for resettlement of the affected people. The resettled people are happy in their newly built houses and are compensated more than what was expected. Except a few elderly people, all other locals are of the opinion that the Dam is a sign of hope and prosperity for them. The area around the Dam will comprise of a 5 km buffer zone for control of malaria. Similarly, some sediment's control measures have to be taken upstream of the Dam to reduce the flow of sediments into the reservoir. Ethiopia intends to become a regional power hub by damming the Nile. The regulated flow from the Dam will improve agriculture. The impact from evaporation of water from the Dam will be minimal compared to other dams in Ethiopia, which will help in water conservation.

Impact on Sudan and Egypt

The Blue Nile River is a source of around 85% of the Nile River water. The Blue Nile starts from the Lake Tana in the north of Ethiopia and then enters into Sudan to join the White Nile in Khartoum then they flow into Egypt as the Nile River. Both Sudan and Egypt have concerns about the construction of GERD, as they say it will affect their share of water use from the Nile River according to the colonial era agreement, which gave them 90% of water share from the Nile River. It is believed that the Dam has already created some geopolitical impacts among the three countries affected by the Dam, which are Ethiopia, Sudan, and Egypt [14]. The Egyptians, in particular, are not satisfied with the Dam project, because the Dam means to them considerable reduction of the amount of water flows to Egypt through the Nile River [15-19]. This means a huge amount of water will be captured and stored behind the Dam. So, the question is: Will the Dam be a trigger in the future for conflicts on water among the three countries (Ethiopia, Sudan, and Egypt)?

The Dam will cut down alluvium in Sudan by 100 MCM (million cubic meter) and also facilitate irrigation of about 500,000 ha of new agricultural lands. In 2016, the population of North Sudan reached more than 41 million and of South Sudan approximately 13 million [20]. It will also reduce about 40 km of flooding in Sudan upon its completion. GERD will retain sediments which will increase the life of dams located in Sudan, such as the Roseires Dam, the Sennar Dam, and the Merowe Dam, as well as the Aswan High Dam in Egypt. The reservoir is around 200m deep and is located in the high lands of Ethiopia which will cause a reduction in evaporation of water as compared to Aswan

High Dam located on the Lake Nasser that loses 12% of its water due to evaporation.

The exact impact of the Dam (GERD) is not known, but Egypt claims that it will reduce a flow of water in the Nile River during the filling of the reservoir and due to evaporation from the Dam. Egypt, with a population of more than 94 million in 2016 and is forecasted to exceed 151 million in 2050 [21], being a dry country, is heavily dependent on the water of the Nile River. And according to experts, would cause 2 million Egyptians to lose their income [22]. This project will also interrupt Egypt's electricity supply by 25 to 40%, which would leave upper part of Egypt in darkness. The project could also lower permanently the water level in the Lake Nasser, if the flood waters are stored in Ethiopia. This would reduce the evaporation of 10 BCM/yr, but also reduce the ability of Aswan Dam to produce hydropower with a 100 MW loss of generating capacity for a 3 m decrease in the water level [23].

The Delta (particularly along the Mediterranean coast) is also subsiding (and becoming less fertile), because it is no longer replenished each year by 100 million tons of flood sediments from the Nile. Instead, those sediments now drop out where the Nile enters the reservoir created by the Aswan High Dam. Other studies have attributed increased seismic activity in the region due to the weight of the Dam and the huge amounts of water stored behind it. In addition to the loss of land area in the Delta, the combination of sea level rise and land subsidence will also increase saltwater intrusion. Egypt is already one of the poorest nations in the world in terms of water availability per capita; it has just 660 jeopardize more than a third of the freshwater volume in the Delta [24].

What options are left for Egypt?

While Egypt, Ethiopia, and Sudan are awaiting two studies being conducted by French firms BRL and Artelia on the Dam's impacts, many experts predict that the Dam will operate and start its first filling process in 2017 regardless of the report's recommendations, amid Egyptian concerns about the Ethiopian side, and whether it will be diligent in trying not to harm Egypt's interests and water resources. Hani Sewilam, Managing Director of the UNESCO Chair on Hydrological Changes and Water Resources Management at Germany's RWTH Aachen University, said that "it does not make sense that we assess the impacts of the Ethiopian Dam after its construction," referring to the three countries, especially Egypt, that are waiting for the French firm's reports [25].

The reports, which are expected to take 11 months to complete, were started in February 2016. "We have never heard of this in the history of engineering. Normally, the country intending to build a dam [Ethiopia] in consultation with downstream countries [Egypt and Sudan] carry out all the studies, design scenarios, assess the impacts (economic, social, and environmental) and then select the design scenario with the minimum negative impacts and maximum positive impacts," [25]. Sewilam said, "In our current case, by the time the two firms complete the impact studies, the construction process of

the dam will be done. What will we [Egypt] do if the studies show significant impacts on the downstream countries? Will we demolish the Dam [GERD]? Will we be able to modify the body of an existing Dam [GERD]? Or are they [Ethiopia] just consuming time because they know that the answer for all these questions is a big NO?" [25]. From a legal perspective, Ayman Salama, Professor of International Law and member of the Egyptian Council for Foreign Affairs (ECFA), articulates that Egypt does not have the right to ask Ethiopia to stop the building process under any conditions [25].

Sherine El-Baradei, Assistant Professor in the Department of Construction and Architectural Engineering at the American University in Cairo, said that both Egypt and Ethiopia can try to settle on two main things: the operational process of the Dam and the number of years dedicated to filling it. "We can make an agreement that when it's the agricultural season for Egypt's peasants, Ethiopia can't close the Dam's gate to generate electricity since we will be in need of the water flow for the inauguration process, especially that 85% of the Nile water that goes towards agriculture and the remaining 15 percent for drinking," [25]. El-Baradei went on to say that Egypt needs to persuade Ethiopia to increase the years of filling the Dam, which is set to be from 5-7 years. She said that a set period will reduce Egypt's share of water from 12 to 25% while adding more years will minimize the detrimental effects of the Dam. Sewilam [25, 26]. listed some facts that Egypt must consider while negotiating with Ethiopia, such as connecting the construction time-plan with the impact assessment time-plan, as the "construction should go hand-in-hand with thenegotiations and assessment, not 10 times faster as is the case right now." This is in addition to reducing the storage capacity of the Dam, "because Ethiopia does not need to store 74 BCM (Billion Cubic Meter), which is equivalent to the annual share of the Nile water of Egypt and Sudan combined." But for Nader Nour El-Din, Professor of Water Resources at Cairo University.

Egypt's stance on the Renaissance Dam issue is "backwards and critical" [25]. "We are still in the status of negotiating with Ethiopia and the latter started the building process in April 2011, and in March 2015 we signed a Deceleration of Principles which was a carte blanche for Addis Ababa to go build the Dam with its current measurements and storage capacity" [25]. "In July 2017, Ethiopia will start the first process of generating electricity and by October 2017 the Dam is expected to operate in its full capacity and options and this means that a very large amount of water will be retained behind the Dam" [25]. Nour El-Din argues that Egypt should negotiate with the Ethiopians on reducing the height of the project's smaller side Dam (or Saddle dam), which is currently set at 45m high, and try to reduce it to between 20 to 22m, as the current height would allow the Dam to hold 60 BCM of water. The main Dam, although 145m high, will only retain 14 BCM of water, as it is surrounded by 16 electricity generating turbines.

According to Horn Affairs (2016), Prime Minister of Egypt

Sherif Ismail said that the other regulations and policies Egypt is willing to implement as alternatives to Nile water are treating sewage water, which can provide 4 BCM, and using new irrigation methods to save water. The Government will resort to linking some canals, providing between 1 and 1.5 BCM of water. Egypt is coordinating with other African countries on a regional project aiming to link the Victoria Lake with the Mediterranean Sea, helping to divert more water to the Nile River. Sewilam asserted that some Egyptian researchers are currently working in different concentrations, such as water treatment, water recycling, increased irrigation efficiency, and desalination. El-Baradei also said [25]. that the Government of Egypt needs to consider using groundwater wells as a water resource, but only after treating the saltwater. Sewilam, however, believes that the solution ultimately lies in greater cooperation between the Nile Basin's countries to secure water and other natural resources [25].

"There should be an integrated Water-Energy-Food Nexus plan for all the Nile Basin countries. We should be thinking of self-sufficiency of resources by complementing each other, as for example, we need to identify the countries in the Basin which can generate energy and other countries which can supply water and also the countries that can make use of water and energy to produce enough food for the whole basin" [25]. "I think the lack of trust, cooperation, and participatory long-term planning between all the Nile Basin's countries are the main reasons for the current situation" [25]. "The main Dam is allocated for generating electricity while the side Dam is just for water reserves and it won't affect the power generation process of Ethiopia if the amount of the reserved water is reduced" [25-29]. The GERD's both main and saddle dams are shown in (Table 2).

Turbines	16 x 375 MW Francis turbines
Saddle Dam Height	45 m
Saddle Dam Length	4,800 m

Table 2: An overview of the Turbines in Saddle Dam.s

Conclusion

Indeed, the waters of the Nile represent an important resource for the different countries that share the watershed of this river. Today, water management is facing new challenges such as climate change or the consequences of human activities. Public or private actors in this field must develop new skills to better manage the water cycle "as a whole", identify the main issues and strategies for managing water resources; and acquire reading keys to understand the variables (environmental, institutional, and political) influencing the resource and requiring adjustments in terms of management.

Despite a tense and potentially explosive situation, many initiatives and many joint projects counterbalance the disagreements and the reasons for conflict, reflecting an undeniable constructive will on the part of the countries concerned, but also the importance given by the international community to the Nile question. This river has always been one of the most important routes of communication and

exchange between North and South of the continent. The countries concerned are now grouped together in a cooperative river management and conflict resolution body, the Nile Basin Initiative (NBI), based in Nairobi, Kenya, and Kampala (Uganda). Technical talks have been underway for several years with the aim of a new treaty.

Egypt, for its part, does not show absolute ill will towards the upstream countries; on the contrary, it tries to take the lead (while keeping control of the situation) by launching various cooperation initiatives. It has launched a policy of technical cooperation with downstream countries, called Endugu policy (Swahili agreement). It is also cooperating with Sudan on the Merowé dam project, 350 kilometers north of Khartoum. The Bujagali dam project in Uganda, at the exit of Lake Victoria, is also supported by Nile Basin Initiative and therefore by Egypt (it is however strongly criticized by environmentalists). According to some observers, this is the key to the problem: Egypt could reach an agreement that does not call into question its share of the Nile against the fatherland of an increase in its technical and financial aids to the countries of upstream.

The support of the international community is critical to encourage and consolidate cooperation among the Nilotic countries. This concerns, of course, financial support. The establishment of the NBI undeniably made it possible to unblock more international aid, as shown by the case of the Bujagali dam. The World Bank theoretically refuses to invest in Sudan because of the country's political situation, but does so through the NBI. However, technical support and expertise are equally important, and the common features of all countries are also a way to strengthen their collaboration and to get them used to working together.

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