

Hydro-conflicts in the Nile Basin:  
An Analysis of the Grand Renaissance Dam (GERD) Project

Master's Thesis in  
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Spring 2021

## Abstract

**Aim:** The study analyses the ongoing water conflict between the three Nile Basin Riparian countries Ethiopia, Sudan and Egypt over the Grand Ethiopian Renaissance dam (GERD).

**Method:** Three conflict analysis tools have been applied to conduct the conflict analysis, the conflict wheel, INMEDIO's conflict perspective analysis (CPA), and Glasl's conflict escalation model.

**Results:** Lack of trust and transparency between the three conflicted countries is one of the main reasons that led to the escalation of the conflict and turned it from a possible win-win situation into a lose-win situation. Other stakeholder states, such as China, Turkey, and Gulf countries could play a positive mediation role in the conflict since they enjoy close ties with the upstream country Ethiopia. The GERD is not only relevant in economic and development terms, as it has the potential to change the geopolitics of the Middle East and North Africa.

**Conclusions:** The GERD could be a great opportunity for cooperation and development instead of escalated conflict and potential war between the three riparian countries if they manage to agree on a cooperative framework that can benefit each country and do no harm to the other countries' interests.

*Key Words:* Water conflict, Nile River, the GERD, hydro diplomacy, Nile Basin Riparian countries, Ethiopia, Egypt, Sudan

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# 1. Introduction

## 1.1 Aim of the Study

This study aims at analysing the current water conflict between the three Nile Basin riparian countries Egypt, Sudan and Ethiopia over the construction and operation of the Grand Ethiopian Renaissance Dam (GERD) using number of conflict analysis tools, such as the conflict wheel, INMEDIO's conflict perspective analysis (CPA), and Glasl's conflict escalation model. The analysis provides a deep insight at this transboundary conflict and generates a number of potential solutions that would allow each country to reach a mutual and satisfied ground which serves its interests without infringing upon the neighbouring countries' stakes.

Disputes over the Nile River water have existed for decades. Since the late 1990s, with the assistance of the international world powers, several agreements have been signed between the Nile Basin countries to ensure each country's share of water and to protect their water security. However, tension escalated when Ethiopia announced in March 2011 its intention to build a large dam on the Blue Nile River around 40 kilometers east of Sudan. The dam was known as the Millennium Dam at that time, and has been later referred to as Grand Ethiopian Renaissance Dam (GERD) (Kimenyi & Mbaku, 2015).

The dam construction announcement came without any prior notice or negotiations between the major riparian countries, Ethiopia, Egypt and Sudan. Thus, the Egyptian government responded aggressively with verbal attacks on Ethiopia over its great concerns of reducing Egypt's water share since Ethiopia is an upper stream country that can potentially control the amount of water flowing to the downstream countries (Sudan and Egypt). Due to the fact that more than 90% of Egypt's supply of fresh water depends on the Nile River, the GERD is perceived by Egypt as a threat to the country's agricultural and economic development.

The following sections will discuss water conflicts in general to contextualize and understand this particular conflict within broader patterns and then will consider the history of the water agreements that have been made within the Nile Basin countries, along with the Nile water initiatives that have been signed to date to assist in water management cooperation between these countries. These provide some insights on how water conflicts have been managed (or mismanaged) in the past.

## 1.2 Global Water Conflicts

Fresh water is a vital and indispensable element to all aspects of human life. It is one of the paramount resources for all environmental and collective activities, such as, food, energy generation, waste processing and development in all possible ways. In addition, water access is an immense national security issue to many countries (Gleick, 1993). Therefore, not only is the increasing water scarcity aggravated by climate change regarded as a colossal threat to billions of disadvantaged countries, it is also becoming a source of conflict. However, water is not the only principal variable of water conflicts in international politics. The asymmetric power relations, the unequal distribution of water resources and the unhindered construction of dams have accounted for major conflicts that have occurred to date. Hydro-hegemony has played a predominant role in shaping the cooperation framework between countries sharing the same water resources, in which the main political question is which country receives what share of the water, why and how (Zeitoun & Warner, 2006).

Research about the causal relationship between water and conflicts has been done through three main epistemological stages. The first stage was between the 1970s and the early 1980s in which the main focus was on the environmental consequences of wars. Scholars considered that there was a strong nexus between the availableness of the natural substances, such as soil, water and security. They discussed that high consumption of resources incites a dilapidation of the water resources; causing scarcity of water which leads to violence and the possibility of wars (Galtung, 1982; Westing, 1980).

The second stage started from mid- 1980s and continued to the beginning of the 1990s. In this phase, the focus changed to studying conflicts related to water in the broadest sense and it was highlighted that environmental changes can lead to conflicts and wars (Zeitoun & Warner, 2006).

In the third phase, starting in the mid-1990s, researchers focussed on the effect of water scarcity on human security and tried to examine a number of factors to strengthen their assumption. One finding highlighted how ecological deterioration does not necessarily have to result in conflict, but cooperation can also happen in some cases. Although this hypothesis contradicts the popular causal relationship between water and conflicts, it also offers a broader image of certain cases that managed to follow cooperation strategies of sharing transboundary water such as, the Nile Basin Initiative (NBI) between the Nile River riparian countries (Stetter et al., 2011).

It is an unarguable fact that not all water disputes lead to wars or violent conflicts. Most of them are managed through agreements, discussions, negotiations, and resolutions. However, history also presents cases of disputes and conflicts over shared water resources where water has been used as a tool of war. Many rivers, seas, and lakes are shared by more than two countries. Geography has conditioned geopolitical conflicts over transboundary waters, such as, the Nile River, the Euphrates, and the Jordan Rivers in the Middle East region; the Ganges, the Indus and Brahmaputra Rivers in Southern Asia; and the Rio Grande, Parana and Colorado Rivers in the United States.

In some regions, (e.g. the Middle East, Central and Southern Asia), water is an extremely scarce resource that is fundamental for development and is becoming a deeply strategic matter that threatens the national security of these countries. According to the World Resources Institute (WRI), 12 out of the 17 countries that are most water-pressured in the world are based in the MENA region (World Resources Institute, 2019). Therefore, the possibility of water-related violent conflicts is growing and the likelihood of changes in the international water treaties also exists (Gleick, 1993).

### 1.3 History and Geopolitics of the Nile River

The Nile River is a significant feature of the Northeast Africa region and it is one of the longest rivers in the world with a length of 6670 kilometres (4132 miles) with an approximate flow ratio  $2810 \text{ m}^3 \text{ s}^{-1}$ , 89 billion  $\text{m}^3$  per year (Said, 2014). The Nile flows from the south towards the north through 11 countries in Eastern Africa; Burundi, Rwanda, the Democratic Republic of Congo, Kenya, Tanzania, Uganda, Eritrea, Ethiopia, Sudan, South Sudan, and Egypt (Swain, 2011).

The Nile River has two principal tributaries; the White Nile and the Blue Nile. The two rivers meet north of Khartoum, Sudan's capital, forming the river's major stream that flows north to Egypt before it drains into the Mediterranean Sea. The White Nile begins in Burundi and flows through Victoria Lake in Tanzania, then moves across the Sudd floods of Sudan, whereas the Blue Nile originates at Lake Tana in Ethiopia. More than 80% of the Nile's stream flow is provided by the Ethiopian highlands in the rainy seasons through the Blue Nile (Swain, 2011).

The history of water rights at the Nile River can be understood through three main periods of Egyptian history; the pre-colonial, colonial, and post-colonial periods (Abteu & Dessu, 2018).

### *1.3.1 Pre-colonial Period*

The Egyptian civilization would have never existed without the Nile River. Amidst the Sahara Desert and the extremely dry weather in north Africa, the Nile was flowing supporting life to flourish when ancient Egyptians discovered the flooding period of the Nile which is six months annually. When the Nile water dwindles, it leaves a brown layer of sediment full of nutrients that enabled growing different kind of crops; such as, cotton, beans and wheat, and later on papyrus and flax. Ancient inhabitants then started to dig canals linked to the Nile and irrigate the fields in order to have access to fresh water for the whole year. Since then, agriculture has started and paved the way for the civilization along the Nile valley. For millennia, Egyptians developed their agriculture techniques and produced items such as wheat beer or cotton clothes (Mark, 2017).

Concerns over control of the Nile water date back to over 700 years ago, sometimes for reasons much more different from water and agriculture. In 1321 A.D, the Ethiopian emperor Amda Seyon threatened Egypt that he would divert the Nile route if Sultan Al Nasir did not release the Christians he had arrested (Abteu & Dessu, 2018), evidencing the early geopolitical role of the Nile.

### *1.3.2 Colonial Period*

Egypt was under the British occupation from 1882 to 1956, while the colonial period in Sudan expanded over the 1889-1956 period. During these periods, the attention towards the Nile water value and its security had been recognized and the British made efforts to secure large shares of Nile water for both Egypt and Sudan to keep the flow for cotton irrigation; the most significant crop that Egypt was known for. The British government signed a treaty with the Ethiopian emperor Menelik II in 1902 which emphasized that Ethiopia would not do any construction work on the Blue Nile or Lake Tana that could obstruct the Nile flow to both Egypt and Sudan without the consent of the British colonial government. However, later on Ethiopia denounced the treaty arguing its disagreement on the change in the colonial circumstances and its ending (Abteu & Dessu, 2018).

In 1929, the British colony made a water agreement that favoured Egypt's share and control of the Nile water, in addition to providing Egypt with veto powers regarding any project to be built on the Blue Nile that might threaten the Nile water flow (Abteu & Dessu, 2018).



### *1.3.3 Post-colonial Period*

After the Second World War, Britain started to lose its hegemony worldwide and in 1956 it pulled out from Egypt and Sudan marking the end of the British colonization. The presence of Britain in East Africa was no longer significant and by 1960, most of the colonized Nile riparian countries gained their full independence. Under the leadership of colonel Gamal Abdel Nasser, the chief of the Revolutionary Command Council (RCC), who was elected president in June 1956, Egypt decided to build the Aswan High Dam (AHD) within the Egyptian borders and 17 km south of Aswan city (Samaan, 2017).

The dam was expected to benefit Egypt with numerous advantages, such as producing hydroelectric power, averting possible damages due to floods, increasing constant irrigation along the Delta and Nile valley, and reducing the amount of water being released into the Mediterranean Sea. In addition to developing agriculture and creating more job opportunities to the increasing population. The dam construction initially started in 1959 and was completed and made fully operational in 1971 with the financial assistance of the Soviet Union after the United States refused to finance it (Samaan, 2017).

Aside from the dam benefits, it also had a number of social, environmental and political impacts. Hindering the Nile flow reduced the fertility of the land around the Nile valley, while blocking the sediments contributed to erosion and water contamination in the Delta. Furthermore, filling the reservoir caused the displacement of more than 100,000 Nubians from Aswan. The construction of the AHD faced disagreement from the other upstream riparian countries and pushed Egypt into the Cold War game (Samaan, 2017). In the meantime, Sudan proposed plans to construct the Roseires dam on the Blue Nile in 1954 and after several attempts to reach mutual agreement with Egypt on managing the Nile water, the World Bank financially assisted Sudan to complete the Roseires dam building in 1966. (Kitissou, 2004).

Another significant event during the post-colonial period was the formation of the Nile Basin Initiative (NBI) in 1999 which was signed by all the Nile riparian countries except Eretria. The aim of this initiative was to form a cooperative platform between the Nile Basin countries in order to achieve an equitable and fair utilization of the water resources (Abteu & Dessu, 2018).

## 1.4 The Nile River Basin

Challenges of managing water resources increase when water is shared through transboundary rivers. The best example of this case is the Nile Basin countries and their sharing of the Nile River water (Yihdego, Rieu-Clarke & Cascao, 2017). The eleven riparian countries sharing the Nile River are called the Nile Basin countries and have a population of over 430 million inhabitants. This population is expected to double within the upcoming two to three decades (International Crisis Group Report, 2019). The rapid population growth means that around one billion people will be relying exclusively on the Nile water which is already facing scarcity due to climate change and the building of dams, including the GERD.

Many of the Nile Basin countries are among those with lower income in the world. Their economies mainly depend on agriculture which is complicated due to the unpredictable rainfalls and dry seasons. The agricultural sphere represents 75% of the Nile Basin countries' consumption. Thus, in all the basin countries irrigation is pivotal in securing food supply and meeting the demands of the increasing population. However, the water situation is affected by different factors depending on each country's political and geological circumstances (Swain, 2011). Comparing to the major rivers in the world, the Nile accounts for moderately little amount of water; (*e.g.* it only accounts for 5% of the River of Congo). Considering the growing populations, the foreseeable problems induced by climate change and the present geopolitical conflicts to gain control over the Nile's water, the Nile River is a potential candidate for generating escalated water conflicts (and even a water war that would prove catastrophic to the whole region). However, the Nile also has the potential to articulate a broader peace system to build "water peace".

## 1.5 Hydro-Politics of the Nile basin

The strong nexus between water and its influence on politics has been witnessed since water scarcity became a threatening issue to the security of many countries especially in the Middle East, North Africa and South Asia where people suffer from insufficient supply to their needs. Although, transboundary rivers cover up to 60% of the African continent, one third of the population suffers from water scarcity. Considering the ongoing civil wars, rapid population growth, drought and famine in some parts of Africa, it is expected that by 2025, more than half of the African countries will undergo severe water shortages. In addition, failures for sharing and managing water can potentially create interstate conflicts (Kitissou, 2004).

The expected average of population growth in northeast Africa is 3.2 % in Ethiopia, 0.8% in Sudan, and 3.5% in Egypt. This means Ethiopia's population will nearly grow to 212 million by 2050, and Sudan's population will rise to reach 66 million, while the population number of Egypt will increase to over 160 million by 2025. According to this rapid growth rate, the total expected number of the Nile Basin population is 859 million by the year of 2025, which is problematic in terms of the water scarcity situation that Nile Basin countries will go through in near future (Tafesse, 2001).

Comparing to the other ten riparian countries, the situation of Egypt needs peculiar attention since 98% of the country is desert and the expeditiously increasing population is condensed in only 2% of the land around the Nile valley. Furthermore, being considered a regional power, Egypt has favoured attempting control over the Nile water rather than pursuing cooperation with neighbouring countries. Consequently, the history of Egypt's utilization of Nile water has been a compilation of distress, commination, and intimidation (Kitissou, 2004).

This can be understood from the statement of former Egyptian president Anwar El Sadat in 1979, after ratifying the peace treaty with Israel when he said: "*The only matter that could take Egypt to war again is water*". Later in 1988, the Egyptian minister of foreign affairs, Boutros Boutros Ghali stated "*The next war in our region will be over the water of the Nile, not politics*" (Kitissou, 2004). These statements explain how the Nile water is regarded as a matter of national security to Egypt and any threat to its share could dwell the country into a turmoil.

## 1.6 History of Nile Water Agreements

### 1.6.1 Anglo-Egyptian Treaty in 1929

Egypt and Sudan were under British colonization from 1882 to 1937, and from 1899 to 1956 respectively. However, Britain has always tried to protect Egypt's share of water for political and strategic reasons. In 1929, the British government signed the first treaty regarding sharing the Nile's water with the Nile Basin neighbours. The treaty was in favour of Egypt since it was given the right to use 48 km<sup>3</sup> of water annually, whereas Sudan was given the right to use only 4 km<sup>3</sup> per year. In addition, the treaty stipulated that no construction of dams or any irrigation development projects should be structured in any of the upper stream countries, along with granting Egypt the right to veto any of those projects that could affect its interests. The Anglo-Egyptian treaty did not consider any of the Nile Basin neighbour-countries and ignored their water needs. The unfair distribution and the Egyptian water hegemony sparked the anger of the

riparian countries- especially Sudan- leading to severe disagreements. Most of the Nile Basin countries announced that they were not adherent to this treaty. Consequently, a new water agreement was reached in 1959 (Swain, 2011).

### *1.6.2 1959 Agreement between Egypt and Sudan*

In a bid to reach a common ground for water sharing and to improve the deteriorated relationship between the two countries, Egypt and Sudan decided to sign a bilateral agreement stipulated at increasing water allocation for both countries. The 1959 agreement set out to grant Egypt 75% of the Nile's water (55.5 billion m<sup>3</sup>), while Sudan's share was increased to 25% (18.5 billion m<sup>3</sup>), the remaining 10 billion m<sup>3</sup> was left for evaporation possibilities (Richard C, 2004). The agreement managed to promote the political relationship between the downstream countries Egypt and Sudan. As a result, Sudan approved the establishment of Aswan High Dam on the Nile by Egypt, and Egypt agreed on Sudan's construction of Roseires Dam over the Blue Nile. Egypt received financial and political support from the USSR and the construction of the dam was officially completed in 1971 (C. Tucker, 2010). However, the 1959 agreement only satisfied the needs of Egypt and Sudan, ignoring the upper stream countries' needs just as the 1929 Anglo-Egyptian treaty did. Since the mid-1950s, Ethiopia started to seriously consider constructing a dam on Lake Tana to exploit the Nile water to its benefit (Brookings, 2015).

### *1.6.3 Nile Basin Initiative (NBI) and Escalated Conflicts*

The exclusive utilization of the Nile's water by Egypt and Sudan, along with the unequitable allocation of water resources among the other riparian countries pushed the upper stream neighbouring countries to call for a new fair agreement for managing the Nile water without ignoring any country's needs.

After several failed trials since 1960, the riparian countries managed to sign the Nile Basin Initiative (NBI) in 1999. The Basin states started to cooperate in order to develop institutions that could manage allocating the Nile water equally. They reached an agreement called The Cooperative Framework Agreement (CFA) in which a set of principles and obligations are outlined to enhance the cooperative and long-term development of managing the Nile's water resources (Brookings, 2015). The CFA treaty has evolved through the years and established the Nile River Basin Commission (NRBC), an institution to deal with the legal-based management of the water ("Cooperative Framework Agreement", 2020).

The NBI tried for the first time in Nile Basin history to unify the riparian countries and to ease the tensions among them. The initiative also gained a significant international support

and funding from the World Bank and other funding agencies. In 2001, the World Bank formed an International Consortium for Cooperation on the Nile (ICCON), enabling donors to support the initiative through various investment programs. Later, in 2003, due to the demand of the Nile Basin ministers, the Nile Basin Trust Fund (NBTF) was launched.

In spite of the wide popularity that the NBI gained through the years, member states were not satisfied with the actual framework of the benefit of sharing the Nile water among them. Each country expected a considerable investment in the Nile basin for its development projects. However, very little effort has been made by the NBI to resolve the dispute between the three riparian countries of Ethiopia, Egypt and Sudan over their control of the Nile water.

These three countries are those that rely most heavily on the Nile compared to the other eight riparian countries. Ethiopia is the major supplier, while Egypt and Sudan are highly consuming countries. The climate of the two downstream riparian countries is always dry, hence over 90% of Egypt is desert and the availability of rainfall is extremely rare. Therefore, the main source for agriculture, and fresh water is the Nile River, whereas, the upper stream countries rely not only on the Nile water, but also on the rainwater in their water consumption. Among the eleven riparian countries, Egypt and Ethiopia have the largest population; as of 2020, Egypt's population reached over 102 million people, whereas Ethiopia's population exceeded 114 million inhabitants (Africa news, 2020).

## 2. The Grand Ethiopian Renaissance Dam (GERD)

### 2.1 Historical Background

Ethiopia has long opposed Egypt's hegemony of Nile water which was stated in the Anglo-Egyptian Treaty during the British colonial period and which was the major motivation for Ethiopia to take an individual step towards constructing the GERD. In 1958, Ethiopia's government sent a statement to the government of Egypt addressing their vision on sharing the Nile water. It stated: "*Ethiopia may be prepared to share this tremendous God-given wealth of hers with friendly neighbour nations, but it is Ethiopia's sacred duty to develop the resources it possesses in the interest of its own rapidly expanding population and economy*" (Arsano, 2012).

Since 1958, plans for constructing a dam on the Blue Nile have started. The United States Bureau of Reclamation (USBR) conducted several geographical surveys between the period of 1956 to 1964 until it offered four potential dam sites in 1964, Mabil, Karadobi,

Boarder and Mendia (Saeed, 2018). However, Ethiopia could not proceed with the project due to its then ongoing civil war, along with the war with Somalia and Eritrea. After nearly half century, planning for the dam resumed owing to the political and economic stability under the regime of the Ethiopian People's Revolutionary Democratic Front (EPRDF) and its Prime Minister Meles Zenawi (Abteu & Dessu, 2018).

The EPRDF seized power in 1991 with a determination to create a national consent by enabling the people to share a vision for a prosperous future while respecting domestic affairs and establishing a democratic structure (EPRDF, 2005). Thus, the dam project symbolises a major switch from “politics of deviation” accompanied by ethnic-based federalism, since Ethiopia is divided into nine regional states, to ensuring the “unity in differences”. The dam is intended to unify Ethiopia's more than 80 different ethnic groups and unite them (Abdelhady et al., 2015).

After considering the four proposed construction sites from the USBR, Prime Minister Zenawi's government appointed French and Dutch companies to update the USBR studies in 1998. The government proceeded with the dam's planning and designing covertly and the construction was shown as a national milestone to represent the government success economically and politically, along with uniting the different society members through patriotism (Abteu & Dessu, 2018).

Zenawi's government named the dam at the beginning ‘Project X’ to keep its secrecy, then the name changed to “The Millennium Hydro-electric Nile Dam” (Meles Zenawi Memorial, 2013). Ethiopia publicly announced the dam project on the 12<sup>th</sup> of March, 2011 and made the contract with Salini Costruttori, the Italian construction company which started constructing the dam in April 2011 for ETB 80 bn (\$ 4,7bn) under the supervision by the Ethiopian Electric Power Corporation (EPCO) which owns and operates the dam (Saeed, 2018). On the 15<sup>th</sup> of April, 2011, the Council of Ministers in Ethiopia changed the name of the dam to be the Grand Ethiopian Renaissance Dam (GERD) (ENA, 2011).

## 2.2 Zenawi Speech to encourage Ethiopians to fund the GERD

For Ethiopians, the dam is a symbol of national pride and therefore millions of Ethiopians contributed in funding the GERD by investing their own savings in its construction, buying bonds that Ethiopian government issued for Ethiopians inside the country and for the Ethiopian community abroad. Patriotic songs and advertisements were used to mobilize the raising of

funding. In addition, the Development Bank of Ethiopia started to offer loans with minimal interest to encourage businessmen and individuals to invest in the dam (Abteu & Dessu, 2018).

This reaction of the Ethiopian people came after the speech of Prime Minister Zenawi at the time of the official commencement ceremony of the GERD on 2<sup>nd</sup> April, 2011 (Meles Zenawi Memorial, 2013) (Samaan, 2017)

Zenawi Said:

*“Honourable peoples of Ethiopia! We have gathered here today at the largest of our rivers to witness the launch of this great project. It is rightly called the Millennium Dam. It is the largest dam we could build at any point along the Nile, or indeed any other river. More importantly the project takes the pride of place, representing an incomparable addition to our national plan for expanding power production. It will not only raise our own power generating capacity and meet our domestic needs. It will also allow us to export to neighbouring countries ... “*

At the time of his speech, Zenawi was fully aware that constructing such a large dam for the first time on the Blue Nile would not be achieved without risks and challenges. Therefore, it was necessary for the dam to be established and portrayed as the largest national hydroelectric power project in Ethiopia’s history that would not only mitigate the electricity shortages and blackouts but would also shift the country’s economy by exporting energy to neighbouring countries. Thus, such a project would certainly be a source of pride for all Ethiopians (Samaan, 2017).

Zenawi was certain that relying on national funds was the only possible way at that time to construct the dam, instead of waiting for the international donors to finance it after having Egypt and Sudan’s consent. Thus, he managed to persuade Ethiopians of the necessity to make difficult choices and to sacrifice, if necessary, for the sake of their country’s future (Samaan, 2017):

*“Indeed, the current disposition is to make attempts to undercut Ethiopia’s efforts to secure funding to cover the cost of the project. We have, in fact, been forced to rely on our own savings alone to cover the expense. The estimated cost will be 3.3 billion Euros, or 78 billion Birr. As we will be financing several other projects in our plan, the expense will be an additional and heavy burden on us. All our efforts to lighten this have been unsuccessful, leaving us with only two options. Either to abandon the project or do whatever we must to raise the required funds. I have no doubt which of these difficult choices the Ethiopian people will make. No matter how poor we are, in the Ethiopian traditions of resolve, the Ethiopian people will pay any sacrifice. I have no doubt they will, with one voice, say: ‘Build the Dam!’ “... (Samaan, 2017).*

### 2.3 The GERD Location

The GERD is considered to be the first significant dam on the Blue Nile, which originates at Lake Tana in the north-western highlands of Ethiopia and travels for nearly 1,450 km to join the White Nile in Sudan. The Blue Nile contributes up to 80% of its water to the Nile River during the raining season and it is the major supplier of the Nile water ("The Grand Ethiopian Renaissance Dam (GERD) Hydroelectric Project", 2020). The Grand Renaissance Dam is being established on the Blue Nile at the Benishangul-Gumuz region, approximately 40km east of Sudan, upstream of the Ethiopian-Sudanese border and 500km north-west of the Ethiopian capital Addis Ababa (Fig.1) (Abteu & Dessu, 2018).

The structure of the GERD combines a main gravity dam built with roller compacted concrete (RCC) which is 1.8km long and 175m high, as well as, a saddle dam structured from concrete faced rock fill (CFRD) which is 5km long and 60m high, with three spillways between both the main and the saddle dam (International Hydropower Association, 2020). The reservoir of the GERD will cover around 1874 km<sup>2</sup> with an active and total storage volume up to 74 billion m<sup>3</sup>. The GERD is expected to generate more than 6000 megawatts annually becoming the largest hydroelectric power plant in Africa (Samaan, 2017).





Fig. 1.

Fig.1 The location of the GERD on the Blue Nile and the Ethiopian-Sudanese border (Samaan, 2017).

For the GERD's construction site, Ethiopia chose the Border dam, which is one of the four proposed sites by the USBR studies and considered in all the designing plans back then. However, the size and the generation capacity of the new dam is significantly larger than the

previously proposed ones (Samaan, 2017). Considering Ethiopia's announcement that the only purpose behind constructing the GERD is generating hydroelectric power for domestic use and for exporting to Sudan and Egypt, Ethiopia reasoned its selection of the site to be in the nearest point to Sudan so that it can diminish the possible loss in power transportation as well as reducing grid costs. In addition, by selecting this site, Ethiopia presented its good will to cooperate with the downstream riparian countries in operating the Nile water since the GERD location is exceedingly distant from any possible irrigation lands (Abteu & Dessu, 2018). On the other hand, constructing the dam on the Ethiopian-Sudanese border and exactly where it has been built is regarded as a hindrance and protection at the same time for the GERD since any possible attack on the dam after being filled would cause immense floods over Sudan, Egypt's partner against building the dam. Thus, Egypt or Sudan would think twice before initiating any military action against the dam in case of tension escalation between the three countries (Whittington et al., 2014).

## 2.4 Technical Background

As mentioned earlier the GERD consists of four parts.

### 2.4.1 Main Gravity Dam

The main gravity dam is 1.8km long and 175m high built from roller-compacted concrete (RCC) on the main channel of the Blue Nile. The roller compacted concrete has a number of advantages over the normal concrete hence it does not require much time to be cooled and formed, along with its reasonable cost. The main gravity dam is built between two hilltops on the river and it has three segments; two power stations, one on the right bank of the river and the other on the left bank, and the central block in the middle which contains two supplementary spillways, one gated and the other ungated (Figs: 2 and 2.1) (Abteu & Dessu, 2018). The two gates' purpose is discharging the amount of 2450 m<sup>3</sup>/s of water in case of any flood arising (Water Technology, 2021).

### 2.4.2 The Saddle Dam

The second dam is 5km long and 60m high concrete faced rock fill (CFRD) supporting saddle dam. It is a crucial part to keep up the necessary water surface rise and profundity at the general level of the dam site. The saddle dam height is about 600m above mean sea level (amsl); thus, it raises the natural features of the land from 600m amsl to approximately 646m amsl keeping

the water level of the reservoir as designed. Due to the topography of the GERD site, the saddle dam needed to be 5km long in order to cover the existing gap between the two hills (Abteu & Dessu, 2018).

#### 2.4.3 The Three Spillways

The third part of the GERD are the three spillways located between the main and the saddle dam. The objective of the spillways is to discharge flood water up to 38,500 m<sup>3</sup>/s into the Blue River before the water fluids into the neighbouring country Sudan in case of extreme and sudden floods (International Hydropower Association, 2020).

#### 2.4.4 The Reservoir

The reservoir is the fourth part of the GERD covering approximately 1874 km<sup>2</sup> with an active and total storage volume up to 74 billion m<sup>3</sup> (74 Billion Cubic Meters) (Fig:2.1) (International Hydropower Association, 2020). The GERD is expected to generate more than 6000 megawatts annually to become the largest hydroelectric power plant in Africa (Samaan, 2017). The duration in which Ethiopia is planning to fill the reservoir is considered one of the main issues that downstream countries are concerned about since the quicker Ethiopia fills the GERD, the less water flow will run to the downstream countries. Thus, Egypt urged Ethiopia to fill the reservoir within 12 years, however Ethiopia is estimating 5-6 years for the GERD to be filled (Heubl, 2020).

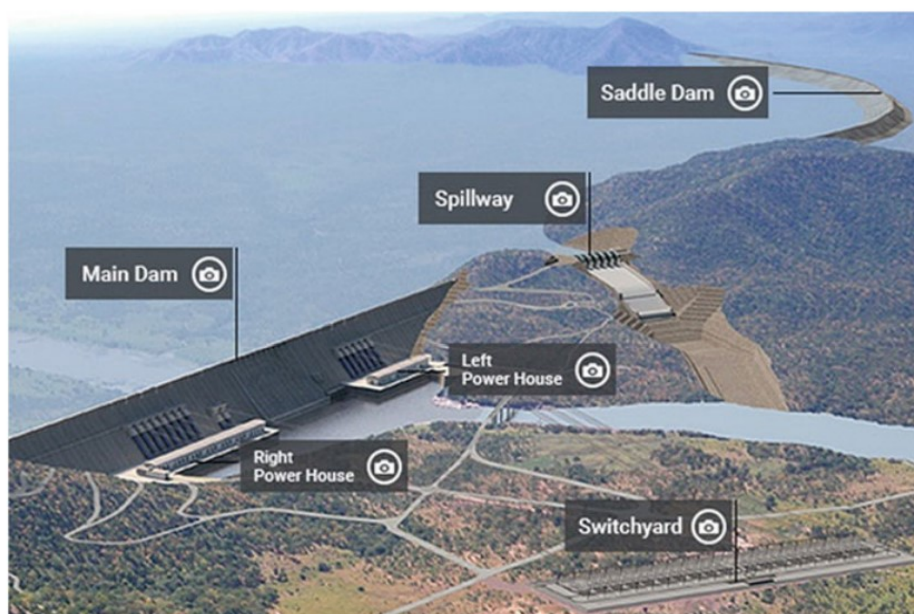


Fig. 2.1 Overview of the GERD, (Hydro World, 2016).



Fig. 2.2 Main RCC gravity dam and the supporting saddle dam (Source: Google earth, 2018).

### 3. Impacts of the GERD Project

Although the GERD will likely have immense economic, social and political impact in Ethiopia's development and some neighbouring countries, it will also have detrimental consequences on both Ethiopia and the downstream riparian countries. The GERD construction will change the Blue Nile River flow, along with its associated ecosystems (Abteu & Dessu, 2018).

#### 3.1 Impacts of Constructing the GERD on Ethiopia

##### 3.1.1 People Displacement

The major impact of constructing the GERD reservoir is the resettlement of the people living in the area where the reservoir is built. Despite being a source of pride and patriotism for the majority of Ethiopians, some reports argue that many people have been greatly affected by the construction of the GERD. The affected local communities have not been informed about nor

agreed on the project and they have been ignored by the government (International Rivers, 2012).

Around 20,000 to 122,000 people have been resettled according to different capacities of the reservoir volumes (Negm & Abdel-Fattah, 2019). Some of the relocated Ethiopians are indigenous people living in Gumuz and Berta. They originally suffer from inequality and low living standard comparing to other Ethiopians. The Gumuz and Berta communities mainly relied on hunting, fishing, farming, and other forest activities for their living. Although, according to the Ethiopian Environmental Protection Authority (EPA), displaced people have been offered adequate resources to relocate such as money, houses, and job opportunities, it is still hard for them to restart their lives again in a place far from their lands and forests. Transitions from agriculture-based activities to labour market can also be challenging given the lack of adequate education in the area (Chen & Swain, 2014). The GERD-related displaces can further instigate ethnic conflicts within Ethiopia (Legesse, 2014).

### *3.1.2 Biodiversity Impacts on the GERD Location Area*

Constructing the GERD will change the nature and the characteristics of the Blue Nile River water. For instance, water temperature, levels of solvated Oxygen, and salinity. Consequently, it will change the existing ecosystems of the reservoir area and the surrounding territory into an aquatic one. This means that all the forests will be destroyed, while birds, animals, insects will be forced to migrate to other areas. In addition, large numbers of fish species will be affected since the GERD will obstruct their migration through the river and even when they try to swim upstream, they will get bewildered due to the slow flow and the warm water. Some other fish are expected to die when passing directly through the hydroelectric turbines of the dam (Handiso, 2018).

On the other hand, when the reservoir is filled-up, forests and plants located upstream will be destroyed. Consequently, they will no longer be functioning as carbon sinks since the decomposed plants will release dissolved methane, a potent greenhouse gas. The amount of carbon emissions related to the reservoir volumes have been estimated as ranging from one to eight million tons of carbon dioxide (Handiso, 2018).

## 3.2 Impacts of the GERD Construction on the Neighbouring Downstream Countries

Comparing to other Nile Basin riparian countries which have alternatives for obtaining water resources, both Egypt and Sudan are highly dependent on the Nile River water. For instance, more than 90% of Egypt's fresh water supply comes from the Nile, in which more than 86% originates from the Ethiopian highlands and the Blue Nile River. Thus, the diversion of water flow in the upstream and being controlled by Ethiopia through the GERD is a threatening issue for Egypt (Swain, 2011).

### 3.2.1 Water Share Reduction

Egypt's concerns over constructing the GERD can be explained in the following points. First, the major issues are the duration of filling the reservoir and the operation of the GERD in times of drought. The proposed duration of filling the reservoir is from 5-7 years. However, Ethiopia insists on their capability of filling it in only three years, so that it can benefit from generating electricity as soon as possible. In case of filling the reservoir in 3 years and due to stocking the Blue River water for filling the reservoir, Egypt is expected to lose around 10-15 billion m<sup>3</sup> of its annual share, which is 55.5 billion m<sup>3</sup> according to the 1959 agreement between Egypt and Sudan (Handiso, 2018).

The decreased amount of water supply will directly affect the agriculture sector in Egypt and all its related activities from food production to employing large numbers of people since agriculture alone consumes 80% of the Nile's fresh water. It is expected that agriculture lands will be diminished by 29.47% in Upper Egypt and by 23.03% in the Nile Delta (El-Nashar & Elyamany, 2018). Thus, the longer Ethiopia will take to fill the reservoir, the less amount of water will be decreased from Egypt's annual share (Donia & Negm, 2018). In addition, experts expect around 12 billion m<sup>3</sup> to be wasted annually due to evaporation and water descending from altitude to run the turbines, which will have a direct effect on the quality and quantity of the Nile water by accelerating its salinity (Noureddine, 2018).

### 3.2.2 Decrease in Power generated from Aswan High Dam (AHD)

The second crucial issue is the impact of the GERD construction on Aswan High Dam and its Nasser Lake. Nasser lake is regarded as one of the largest dam's reservoir in the world with a total length around 500km, the lake extends with 350km in southern Egypt and 150km in southern Sudan, where it is called Nubia Lake. The lake capacity is  $160 \times 10^9$  m<sup>3</sup> and it has

been used for water storage for irrigation and agriculture purposes, in addition to power generation since the construction of the High Dam in 1960 (Donia & Negm, 2018).

When Ethiopia starts filling the GERD reservoir, Egypt is expected to rely on the stored water at Nasser Lake to compensate the reduced share, thus, the water level in Nasser Lake will be diminished resulting in a severe reduction in the power produced at the High dam. The reduction is predicted to range from 20% to 30% if the reservoir is being filled during drought periods.

The Aswan High Dam is designed to operate with Egypt's annual share of water which is 55.5 billion m<sup>3</sup>. The minimum rate of power altitude is 31.9 billion m<sup>3</sup> and the elevation rate averages from 121 to 167 billion m<sup>3</sup>. This amount is basically reserved for any emergency or flooding operating management. Therefore, the risk of water and power generation reduction depends on three main aspects:

- The initial water storage level in Nasser lake,
- The environmental conditions when the GERD reservoir is being filled,
- The agreed amount of water that will be released to downstream countries

(Donia & Negm, 2018).

### *3.2.3 Elevated Salinization in Egypt's Agricultural Lands*

The GERD construction resulted in withdrawing large amounts of upstream sediments and nutrients, which caused the increase of salinization of agricultural lands downstream. Given the fact that the Nile water is being recycled numerous times before being discharged into the Mediterranean Sea, this recycling process makes the water even saltier. Consequently, Upper Egypt agriculture lands will be reduced by 29.47%, whereas the Delta farmlands will be decreased by 23.03% and around 8 million farmers are expected to lose their incomes.

Salt-concentrated irrigation water has a detrimental effect on the soil fertility and the quality of the produced crops. Therefore, farmers tend to use artificial fertilizers to enhance crop quality. On the other hand, the excessive use of fertilizers affects crops and leads to accumulation of heavy metals, nitrate and phosphate, with the potential of bioaccumulation and bio magnification throughout the food chain and in human populations (Donia & Negm, 2018).

### *3.2.4 Sea Water Intrusion Exacerbation*

Constructing the GERD will not only cause the ground water depletion, but it will also cause an increase of the sea water stream into the coastal aquifers in the Northern Nile Delta area. As

a result, the vulnerability of the North Delta will be accentuated causing agricultural degradation, land subsidence, and other geotechnical problems. Areas around 2,677 and 4,675 km<sup>2</sup> will suffer from seawater intrusion after the depletion of groundwater, by 2 and 5 meters under sea level, respectively (Donia & Negm, 2018).

### *3.2.5 Environmental Decay*

The imbalance of the ecosystem is one of the adverse impacts of constructing the GERD. Environmental despoliation, water contamination, agricultural lands desertification and fish farms pollution are all some of the predicted consequences of the GERD.

On the other hand, climate change is a significant factor that will have uncertain effects on the Nile Basin. For instance, in case of dry weather and high temperatures due to global warming, the rates of evaporation will increase and will consequently reduce the water flow to the downstream countries. Contrastingly, in case of wet weather, the elevated condensation from evaporation will result in increase in the downfall causing abundance in the water flow from the highlands to the downstream, and the GERD will protect both Egypt and Sudan from any possible damage due to water flooding. However, the severity of the floods might change due to climate change (Donia & Negm, 2018).

In case of the GERD failure, all the water restored in the reservoir will flood into Sudan and Egypt, which means, the Aswan High Dam and other dams in Sudan will collapse causing major fatalities and damage in both countries (Donia & Negm, 2018).

### *3.2.6 Potential Dam Failure and Impacts on Sudan*

Sudan has long enjoyed a satisfactory share of Nile water, around 18.5 billion m<sup>3</sup> annual share according to the 1959 Nile water agreement between Egypt and Sudan. In 2010, Sudan froze its membership in the Nile Basin Initiative (NBI) due to disagreements with the upstream riparian countries over Nile River water management. In 2011, when Ethiopia announced the GERD construction, Sudan was witnessing a political turmoil in connection to South Sudan independence.

Sudan's initial response towards the GERD construction announcement was disapproving the project and Khartoum expressed its concerns over the safety of its own dams and the water flow coming from the Blue Nile. However, a year later in 2012, Sudan government was convinced by Sudanese water experts and some officials of the Ethiopian government that the GERD will benefit Sudan and therefore, Sudan joined the NBI again in November 2012 (International Crisis Group Report, 2019).



After completion, the GERD should regulate the water flow to Sudan and clear the sediments from its farmlands which opens the gate for agricultural development by harvesting and irrigating new agricultural lands. Sudan could potentially benefit from foreign investments from a number of countries. For instance, Saudi Arabia has a long history of investing in the Sudanese farmlands, and Port Sudan is regarded as one of its main food suppliers since it is only 400 km from Jeddah. On the other hand, UAE, Qatar and other Gulf countries have purchased thousands of acres of cultivable Sudanese lands to secure their long-term food security (International Crisis Group Report, 2019).

However, Sudan still needs to develop and improve its infrastructure in order to acquire the expected benefits of the GERD. The private business in Sudan is still poor, so the question is whether the foreign investors would be able to invest in the infrastructure as well or not. President Omar Al Bashir has long favoured securing the military sector more than the economic one which resulted in the economic inflation, in addition to fuelling the citizens rage (International Crisis Group Report, 2019).

Even though the GERD will offer a number of potential benefits to Sudan, such as maintaining the electricity supply and enjoying a steady Nile water flow throughout the year, in addition to managing the flood water that causes significant damage to Sudan and its people, the country is still concerned since the failure of the GERD would have a disastrous consequence on its capital Khartoum, and its main dams the Roseires, Merowe, and Sennar (Negm & Abdel-Fattah, 2019).

Dam failure is not a new phenomenon. It has continued to occur in spite of new construction methodologies. For instance, the collapse of the Malpasset Dam on the Reyran River in southern France in 1959 which killed more than 400 people and caused damage approximated to US \$68 million. In 1970, several dams collapsed as well, such as the flooding of Buffalo Creek Dam in West Virginia in 1972, the Teton Dam on the Teton River in Idaho, the United States which failed in 1976, the Laurel Run Dam and Sandy Run Dam which yielded in 1977 in Pennsylvania and the Lawn Lake Dam collapse in Colorado in 1982.

In 1998, Europe witnessed a catastrophic ecological disaster when the Aznalcóllar mine tailings dam near Seville, Spain failed causing around 5100 acres of land to be flooded with heavy metals and acidic water due to the high amount of arsenic, zinc, thallium and cadmium. Among other ecological consequences, the disaster resulted in more over than 30,000 kg of dead fish and the fading of the aquatic nature on the Guadiamar River (Negm & Abdel-Fattah, 2019). More recently, the critical failure of mine tailings dams in Brazil brought the 2019 disaster in Brumadinho, where 250 people were killed and 12 million cubic metres of tailings

polluted 300 km of rivers, and the 2015 Mariana disaster that killed 19 people and polluted 650 km of rivers reaching the Atlantic Ocean.

Consequently, in case of any unpredictable circumstances, the GERD might suffer a critical failure and the generation of the flood wave might cause disastrous fatalities in Sudan, particularly if there were not any prepared emergency plans for evacuation in advance.

The GERD dimensions are prodigious and the dam site is at high risk due to the instability of the soil upstream since it is located on one of the most earth-shaking places in the world. More than 15,000 strong earthquakes have been documented around the GERD site and over 16 earthquakes with 6.5 magnitude had a cataclysmic damage on Ethiopia in the 20<sup>th</sup> century. In addition to the destruction that might affect the five dams and the adjacent cities in the downstream countries. Out of the five dams, three dams belong to Sudan which are Roseires, Merowe, and Sennar, while the other two dams are inside Egypt; the Aswan High Dam and the Aswan Reservoir. Therefore, an analysis for the dam failure possibilities should be carried out and all the scenarios investigated in order to mitigate any damage that might happen, as well as to appease Egypt and Sudan's concerns (Negm & Abdel-Fattah, 2019).

A cooperation between Kyoto, Hokkaido, Mizuho universities with the United States Geological Survey (USGS) and the Foundation of the River Disaster Prevention Research Institute in Japan resulted in developing a software called the International River Interface Cooperative (IRIC) which will be used in the simulation of the dam failure and the expected consequences on the downstream countries (Negm & Abdel-Fattah, 2019).

### 3.3 International Reactions

After Ethiopia's sudden announcement of the GERD construction, Egypt considered it as a violation to the 1929 treaty and immediately requested Ethiopia to halt the construction until it provided a detailed study on the impacts of the dam on the downstream countries, whereas Sudan with a flexible position hoped for gaining benefits from the mega dam, yet it showed considerable concerns over the safety of its own dams and people.

Ethiopia, on the other hand, turned down Egypt's request and continued the construction of the GERD. In June 2011, the three countries started their tripartite negotiation to form a trilateral technical committee for negotiating the Nile water management and later in 2015, they recommended the "Declaration of Principles" to resolve the dam issue. The document stipulated that the three countries should cooperate according to mutual understanding and good intentions to manage the shared water and to take further steps in order

to hinder any fundamental harm (International Crisis Group Report, 2019). The three-country talks and meetings over managing and operating the GERD have been continued till present without any significant positive outcome.

The United States adopted a mediator role responding to the Egyptian president Sisi's request and President Trump intervened to host number of talks after inviting officials from the three countries. Ethiopia considers that the United States is taking the Egyptian and Sudanese side, and thus Prime Minister Abiy Ahmed skipped several rounds of the organized talks under the US mediation attempt (International Crisis Group Report, 2019).

Other countries have supported Ethiopia in constructing the GERD and they even contributed in funding it to reap its benefits in the near future. These include China, which funded more than 30% of the project (The Economist, 2011), Italy, the World Bank, the European Investment Bank and Israel which has great interest in Ethiopia. The mutual relation between Israel and Ethiopia has strengthened when Israel provided the technical and military assistance to Ethiopia in its war against Eritria in 1998-2000, in addition to its support after the Cold War (Abd al-Hay, 2020).

Along with providing Ethiopia with the necessary funding, Israel has its own construction and agriculture companies that are assisting the building of the GERD. Furthermore, after the tension mounted between Egypt and Ethiopia over the GERD, Israeli missile and radar companies developed a defence system for Ethiopia by installing a Spyder-MR anti-aircraft system around the GERD that can fire upon any warplane from a distance range from 5-50km (Abd al-Hay, 2020).

## 4. Methodology

In order to gain a deeper insight into the ongoing water conflict between the three riparian Nile Basin countries, this research has been conducted by applying the tools of conflict analysis. Following the definition of the US Institute for Peace, conflict analysis is “*a structured inquiry into the causes and potential direction of a conflict*” that “*seeks to identify opportunities for managing or resolving disputes without recourse to violent action*” (Levinger, 2013).

Conflict analysis can be used in examining different types of conflicts, the open conflict (conflict which is noticeable and entrenched), surface conflict (conflict which is prominent but depthless), and latent conflict (conflict that is subsurface but likely to arise) (Fisher et al., 2000). In addition, conflict analysis plays an important role in providing a thorough and comprehensive assessment for the conflict key issues and its update for policymakers, peace-

building organizations, as well as scholars. It is a crucial element in mitigating the negative consequences and improving the positive ones when working in conflict-prevalent areas (OECD, 2008).

Conflict analysis can be carried out for different purposes. It can be done as a preparation for cooperating with conflict parties or stakeholders and this requires an understanding of the diverse parties' perspectives, demands and the root of all the issues. The analysis can also be used as an intervention tool for a conflict resolution. In this case, it has to be parallelly performed with the conflict sensitive approach since it deals with sensitive matters, such as, power, interests, and possession. The sensitive approach allows the parties to understand their own conflicts while respecting other parties' feelings, issues and ownership. Transparency about the goal of the analysis process is an important factor of the sensitive approach. However, in some cases, it is essential to guarantee the safety of the communities during the analysis process. For example, asking compelling questions to people in public might expose them to danger or unsecure places, so in this case seeking transparency should be restricted by ensuring safety to the sensitive elements of the analysis process (Walovitch, 2015).

For the purpose of this research, a number of conflict analysis instruments have been applied. These include the "conflict wheel", "INMEDIO's conflict perspective analysis (CPA)", and "Glasl's conflict escalation model". These tools allow for the understanding of all the conflict actors, dynamics, causation, structures and issues, focussing on certain aspects of the conflict and explaining how it emerged and how it escalated over time. The tools also lead to a future action plan that could resolve the dispute if all the countries' cooperation is guaranteed.

#### 4.1 The Conflict Wheel

The conflict wheel provides a thorough overview of the conflict before analysing each aspect and it aims at organizing the other conflict analysis tools. The wheel represents both the completeness and the movement since all the diverse aspects come together again after being analysed in order for the conflict wheel to keep rotating (Mason & Rychard, 2005).

The six dimensions of the conflict wheel are as follows:

##### 4.1.1 *The Conflict Actors/ Parties*

The parties of the conflict are being determined upon their level of intervention. Directly involved actors are called "conflict parties", while actors trying to mediate or convert the conflict path are called "third parties". Stakeholders are another significant actor who have interest in the conflict or its final outcome and they can vary from local people, organizations,

foreign countries, etc. stakeholders are usually not directly involved in the conflict (Mason & Rychard, 2005).

#### 4.1.2 The Conflict Issues

The conflict issues are the issues that have primarily caused the conflict and it could also be the consequences of some actions of one or more conflict parties.

#### 4.1.3 The Conflict Dynamics

The dynamics of the conflict have been explained in Galtung model of conflict analysis as the combination of the three elements (Attitude, Behaviour and Contradiction) and it can also represent the severity of the interaction that leads to the acceleration level of the conflict.



Fig. 3. Galtung's model of conflict analysis (Webel & Galtung, 2010)

#### 4.1.4 The Conflict Structures

The conflict contexts or structures refer to the structural violence that is being caused indirectly. The conflict issues affect one or more of the parties' economic and political state, resulting in poverty in these communities, which eventually leads to violence.

#### 4.1.5 Causation

Conflicts are usually multi-causal and a result of interaction between different factors. The causation part helps in differentiating between the diverse causes and the possible influence elements.

#### 4.1.6 Strategies/ Options

This point discusses all the feasible ways and tactics that could be used by the third parties to resolve the conflict or de-escalate it.

## 4.2 INMEDIO's Conflict Perspective Analysis (CPA)

The second method applied for analysing the conflict is the INMEDIO's conflict perspective analysis tool. The CPA tool explains the diverse attitudes and points of views of the actors, so that the common issues as well as the differences are clear. The CPA helps in preparing for the mediation between the conflicted parties by understanding each party's perspective and trying to reach to a mutual ground where compromises could be sought. It also helps in separating facts from assumptions and enables parties to stand in each other position to understand their fears and needs. This way each party's perspective would be broadened (Mason & Rychard, 2005).

The CPA can be presented by explaining:

- Conflict actors
- Facts
- Interests
- Motivations
- Available options (Mason & Rychard, 2005).

## 4.3 Glasl's Conflict Escalation Model

The third applied method of analysing the conflict is Glasl's conflict escalation model. It provides an analysis of the escalation stages of the conflict where the tension and intensity have been increased. Glasl's model explains the escalation in three levels through nine descending stages where the parties get drawn into the dynamics of the conflict.

The first level includes hardening, debates and actions not words. The second stage includes coalitions, loss of face, and strategies of threat. The third and final descending stage represents the real collapse in three stages, limited destruction, total annihilation, and together into the abyss.

Sometimes parties get stuck in one phase for a long time before falling abruptly into another stage. When the escalation level elevates, the mediating party needs to be more potent and forceful. In this case, the nature of intervention itself changes from conflict management that is based on mutual trust between the parties to a forceful one when the parties refuse to sit on the negotiation table and reject the intervention (Mason & Rychard, 2005).

## 5. Analysis of the GERD conflict

### 5.1 The Actors

The primary conflict actors are the government of Ethiopia and the downstream countries of Egypt and Sudan, while the stakeholders vary from national to international levels. On the national level comes the Ethiopian people who are going to benefit directly from the GERD construction through its power generation which will not only meet the people's electricity demands, but it will transform Ethiopia into the biggest African power hub in the region. In addition, it will enhance the economic development by increasing job opportunities. On the international level, the upper stream neighbouring Nile riparian countries such as, Brundi, Uganda, Kenya, Tanzania, South Sudan, Democratic Republic of Congo (DRC), and Eritrea, as well as the countries that contributed in financing the GERD, *e.g.*: China, Israel, Saudi Arabia, United Arab of Emirates and Turkey are supposed to reap their assistance and investments in the mega dam once it starts operating.

Third parties are different entities that have mediated upon the request of one or more of the conflict parties to bring both parties to the negotiation table. In this conflict, the United States has played the mediator role upon the request of the Egyptian president Abdel Fattah Elsisi to president Trump during the United Nations General Assembly in New York in September 2019 (Widakuswara, 2019).

On the other hand, Sudan has officially requested the mediation of the United Nations, the African Union and the European Union to help both Sudan and Egypt to reach legal and binding agreement with Ethiopia on filling and operating the massive dam (Mohiedeen, 2021).

Negotiations over the dam have started in 2011, approximately a decade now after Ethiopia's announcement of the dam construction with the facilitation of the World Bank and the U.S treasury department, however, the talks failed and reached a deadlock since the three countries did not manage to reach a mutual agreement.

Talks' failure resulted from the obscurity of the Ethiopian side in reliving the downstream countries' concerns, in addition to Ethiopia's insistence on filling the dam's reservoir in less than three years which is against both Egypt and Sudan's request.

### 5.2 The Conflict Issues

The GERD is prone to a number of concerns that created the tension and conflict between Ethiopia and the downstream countries. The first issue is endangering the water security and the ecosystem of the downstream nations, specifically Egypt. The duration of filling the

reservoir determines the amount of water supply that will be cut from both Egypt and Sudan's share. As mentioned earlier, Egypt is expected to lose around 10-15 billion m<sup>3</sup> of its annual water share, consequently the agriculture sector will be hugely affected and the water levels in Aswan High Dam will be declined causing possible problems in producing the hydropower.

In case of drought seasons, water flow will automatically be reduced resulting in less water contribution to the downstream countries, which is another concern. Thus, managing the water during filling the reservoir and when the dam becomes operational is the main issue of conflict that has not been resolved despite the ongoing negotiations between the three countries since 2011.

As for Sudan, the biggest concern is the safety of their own dams located 15 km approximate to the GERD, in addition to the severe damage that might happen to the capital Khartoum and the Sudanese people in case of the GERD failure under any circumstances. The Sudanese people are the ones who would pay a heavy price in case of the dam failure.

### 5.3 The Conflict Dynamics

Negotiations between the three conflict parties started immediately right after Ethiopia's proclamation of building the GERD in 2011. The tripartite talks took place regularly without any noticeable agreement until the three countries signed the 'Declaration of Principles' on 23<sup>rd</sup> March 2015 in Khartoum, Sudan. The declaration of principles is not considered as a final agreement, yet it is a general framework which consists of 10 principles that need technical stipulation to put guidelines for cooperation when the dam starts operating (Eltaweel, 2020).

The outlined 10 principles are principles of cooperation; development, regional integration and sustainability; not causing considerable damage; fair and appropriate water use; managing water during the first reservoir filling and the dam operation; building mutual trust; exchanging information and circulating data; dam's safety; unity and sovereignty of the state; and the last principle is the peaceful resolution of the disputes between the three countries (Ahrmonline, 2015).

A series of fraught discussions have continued to take place even after signing the declaration of principles, however, the conflict escalated when Ethiopia unilaterally started the first filling of the reservoir in July 2020 with 4.9 billion m<sup>3</sup> during its heavy rainy season which starts in June and lasts till September. In the first filling the water reached the highest low point of the GERD wall and that allowed Ethiopia to test the dam turbines. On the other hand, during the dry seasons the retained water is expected to subside allowing the remainder part of the dam wall to be built up (BBC, 2020).



As part of the consequences of the first filling, Sudan recorded a critical drop in its water level coming from the Blue Nile when the Sudanese minister of Irrigation announced the water level reduction following the first filling in July 2020 (El Gundy, 2020). At the same time, Egypt criticized Ethiopia's unilateral decision of the filling without any prior agreement with the downstream countries. In addition to the water reduction resulted from the dam filling, Egypt is suffering from dry canals of irrigation due to climate change and lack of maintenance. According to the United Nations Food and Agriculture Organization, temperatures in most parts of Egypt are predicted to rise with an average from 1.8 to 3.6 degrees Celsius over the upcoming years, demanding extra amount of water to cultivate crops and to compensate the increased evaporation in both the Nile and its canals (Bearak & Raghavan, 2020).

Although the three countries have not yet reached to a binding agreement to secure their interests and water share, Ethiopia's minister of Water, Irrigation and Energy Seleshi Bekele announced on March 17<sup>th</sup>, 2021 that his country will carry out the second phase of impounding the reservoir with 13.5 billion m<sup>3</sup> this time since 79 percent of the GERD construction is complete (Kandil, 2021). As a result, Egypt sent a rejection letter to the United Nations stating that the negotiations held for 8 months under the supervision of the African Union proved its ineffectiveness and Ethiopia's insistence on the second filling would fuel the conflict and worsen the current situation by bringing more damage to the downstream countries (Egypt today, 2021).

The latest tripartite round of the negotiations in Kinshasa, Congo had also failed pushing the Egyptian president Adel Fatah El Sisi to repeat his threatening statements that all options are open to protect Egypt's water. The Egyptian political analyst in the Ahram Strategic Centre Hany Raslan pointed out that the military option is possible since the relationship between both Egypt and Sudan is witnessing an unprecedented rapprochement and the two countries performed joint air exercises including battle activities, along with commando batches (Salama, 2021).

In an attempt to mitigate the amounted tension and the international pressure, Ethiopia offered to exchange data about the GERD before the second phase of filling starts in July, however both Egypt and Sudan renounced the offer demanding signing a legally binding agreement before sharing the data. In addition, the Sudanese chief of negotiations, Mustafa Al Zubair, requested the African Union to change the mechanism of the negotiations and he restated Sudan's demand of forming a quartet committee of the African Union, the European Union, The United Nations and the United States to take an effective mediation role in the on-going conflict (Abdel Rahim & Abdel Moneim, 2021).

#### 5.4 The Conflict Structure

Besides the regional and international dynamics, internal conflict between the Ethiopian government and the autonomous ruling government in northern Ethiopia, Tigray People's Liberation Front (TPLF) has escalated since September 2020 to become a civil war resulting in thousands of deaths, massive destruction, 2 million people displaced, 60 thousand refugees fleeing into Sudan and around 80 percent of the region's six million inhabitants being cut out from the humanitarian assistance. The TPLF ruled Ethiopia from 1974 until 2018 when Prime Minister Abiy Ahmed got elected. TPLF has approximately 250 thousand fighters and they have participated in the war against Eritrea that ended in 2000 by signing a peace agreement between Ethiopia and Eritrea (Mikhail, 2020)

Apart from the Tigray crisis, another internal dispute is happening in Metekkel area of the state of Benishangul- Gumuz in western Ethiopia. One of the reasons of the attacks on Metekkel zone is the neighbouring Amhara state interest to occupy/ administer the region and to exploit the benefits of the cultivatable lands and ground minerals. In the meantime, Egypt and Sudan's interests are intersected in this conflict since the GERD is located in Guba, which is one of six districts of Metekkel. Guba is the nearest district to Sudan and since the downstream countries are deeply concerned with the GERD operation that might reduce their water share, Sudan started to claim their ownership of Guba district declaring that it was gifted from a former Sudanese leader Abdullahi in 1897 to the emperor of Ethiopia. Consequently, Ethiopia is accusing Sudan and its ally Egypt of financing the armed Gumuz militia to endanger the remainder construction of the GERD and filling its reservoir (The conversation, 2021).

Another direct structural violence to the GERD is expected to take place in Egypt when the GERD operates and Egypt water share sharply declines, the agriculture sector will drastically get affected leaving thousands of unemployed farmers and threatening the national food security. This will result into poverty that could potentially turn into violence.

#### 5.5 Causation

By building and operating the GERD, Ethiopia will have a full control of the Nile River water flow changing the geopolitics of the region and reducing the water levels flowing to the downstream countries Egypt and Sudan. This caused deep concerns and threatened the national security in the two countries particularly since the decade-long tripartite negotiations over a binding agreement that can secure each country's interests have failed and reached a deadlock.

Ethiopia's ignorance to Egypt and Sudan's demand of the slow filling of the dam's reservoir and the absence of transparency in sharing all the related data of the GERD's safety and the reservoir filling scenarios are main factors of fuelling the conflict and pushing the downstream countries to opt for military options in order to save their water share.

## 5.6 Strategies

Focusing on each country's national interests instead of cooperating to share the transboundary Nile River water has prevented the disputed countries from reaching a mutual agreement despite all the tactics that have been used by the third parties in an attempt to resolve the conflict.

The third parties have been adopting the preventive diplomacy in their intervention since the conflict was still nonviolent. They tend to call the conflict parties for series of negotiations to discuss the mutual interests, however, negotiations turned into bargain due to each country's dominance of its national interests.

The second used tactic was the mediation; mediation can help in changing the behaviour and approach of the conflict parties. The African Union and the United States along with the World Bank have played the mediator role and they tried to build a cooperation framework to alter the perceptions of the conflict parties from their focus on their interests to an African solidarity and cooperation.

Mediation requires the engagement of all parties and actors to reach a mutual solution and understanding, which was not achievable in most of the times.

The third feasible strategy is the inquiry and conciliation and both of them are based on fact-gathering and research. In the case of the GERD dispute, the difficulty lies in the lack of trust between the upper and downstream countries which prevented them from agreeing on the technical issues and the reports of the GERD operation impacts on both Egypt and Sudan. Therefore, the conciliation strategy can be applied in a later phase when all the parties start to acknowledge the importance of the mutual vision and solidarity (Faißt, 2019).

## 5.7 Perspectives

The CPA tool focuses on explaining each party's different perspective in a way that could facilitate the mediation process between them.

In the GERD case what entrenches the conflict is the insistence of each country on the righteousness of their perspectives. For instance, Ethiopia sees that constructing the dam and utilizing the Nile water to their benefits is one of their rights that they were not able to enjoy for a long time due to the British colonial water treaties. Ethiopia guarantees that it would not cause any harm to the downstream countries and the GERD is just for the country's development and energy production. However, the downstream countries (Sudan and Egypt) are fearful and concerned that their water share might reduce and that Ethiopia will control the water as long as the three countries are not compelled to a binding agreement on the dam filling and operation.

Table 1: *The three Conflict Parties' Different Perspectives and Interests through the CPA.*

Actors	Ethiopia	Sudan	Egypt
Facts	<p>. Ethiopia has planned for the GERD construction since 1960, and it finally announced the establishment commencement in 2011</p> <p>. Taking unilateral decision in the first filling of the dam's reservoir in July 2020 without prior agreement nor notification to downstream countries</p> <p>. Negotiations have been going on since a decade without any significant progress towards the binding agreement.</p>	<p>. After the sudden announcement, Sudan favoured the decision realizing the mutual benefits that it could gain from the dam, however, after the overthrow of president Omar Al Bashir, Sudan aligned with Egypt in opposing Ethiopia and seeking a binding agreement on the dam's filling and operation.</p> <p>. Nile Water share and the amount of pure water reduced due to the sudden filling of the reservoir</p> <p>. Sudan demanded the mediation and intervention of the African Union and the European Union to supervise the tripartite talks</p>	<p>. Egypt received the announcement while witnessing a political turmoil after the 2011 revolution. Initially it opposed the dam idea completely, then it started to engage with Ethiopia and Sudan in the negotiation process.</p> <p>. Egypt did not get affected in its water share coming from the Blue Nile in the first filling of the reservoir</p> <p>. Egypt on the other hand, demanded the United States mediation and in September 2020, the United States stopped their financial aid to Ethiopia over the GERD conflict (BBC, 2020)</p>
Interests, Motivation	<p>. Ethiopia's motivation to build the GERD is generating electricity and exporting it to neighbouring countries to be the biggest African power hub.</p> <p>. In addition, the GERD is enhancing Prime Minister Abiy Ahmed's image as he is achieving political and economic development to Ethiopia (Salama, 2020)</p>	<p>. Even though Sudan is concerned with its water share and its own dams' safety, the GERD would benefit Sudan in ways such as, having access to stable water flow to irrigate their agricultural fields and to a cheaper electricity</p> <p>. Realizing the benefits from the GERD, Sudan is seeking negotiations with Ethiopia to ensure all conflict parties' rights without any possible harm</p>	<p>. Egypt considers the existential danger from the GERD filling and operation since Egypt is highly dependent on the Nile water and any shortage in its water share would have a serious impact on the agriculture sector as well as the economic one as mentioned earlier in the impacts section</p>
Options	<p>. Ethiopia offered in March 2021 to share the data regarding the second filling with the downstream countries, however both Sudan and Egypt rejected the offer since it is not within a binding agreement</p> <p>. Ethiopia's foreign minister declared in a statement on twitter that the second filling of the reservoir will be carried out as scheduled in July 2021 (Gebre &amp; Magdy, 2021)</p>	<p>. Both Sudan and Egypt submitted a proposal for resuming the negotiation and forming a quartet committee consists of the African Union chair, the Democratic Republic of Congo, the European Union, the United Nations and the United States, in order to facilitate the negotiations deadlock, however, Ethiopia rejected their proposal (Egypt today, 2021)</p> <p>. After several attempts to resume the negotiations peacefully, Egyptian president Abdel Fatah El Sisi declared that all options are open to protect Egypt's water and both countries carried out a joint military exercise on April 5<sup>th</sup> at Merowe military base in northern Sudan in a step seen to be a preparation for military intervention if needed (Sabry, 2021)</p>	

## 5.8 Conflict Stages

To understand how the dispute emerged and how it escalated, Glasl's model explains the conflict stages through three levels, each level includes three phases.

### 5.8.1 Level 1: Win-Win

Stage 1: Hardening: when each party's position solidifies, yet they still believe that the conflict can still be resolved through negotiations. In the case of the GERD conflict this stage can be explained after Egypt and Sudan announced their opposition to the GERD construction in 2011, nevertheless, they agreed to go for the tripartite talks to seek a solution for their dispute.

Stage 2: Debate, polemics: in this stage parties tend to mistrust each other and start to doubt the other party's sincerity in finding a mutual resolution. Arguments and debates tend to escalate into verbal confrontations and the frustration pushes both parties to prove that their position is the only right position. Parties start to lose hope that debates can lead them to any fruitful results. In the GERD case this state can be seen after several rounds of the tripartite negotiation which ended without any significant progress. Both the Egyptian and the Sudanese sides at that time started to attack Ethiopia verbally when the Egyptian minister of Water Resources and Irrigation Mohamed Abdel Ati accused Ethiopia with the negotiations' failure due to its inexorability and stubbornness. Ethiopia did not accept to guarantee the downstream countries that filling the reservoir will only depend on the rains. In addition, it does not accept signing a binding agreement about the mechanism and the operation of the GERD (ABU ZAID, 2021). All this contributed in the escalation of the situation to stage number three.

Stage 3: Actions not words: in this stage parties are convinced that talking is not helpful anymore, so one party or another starts to take a unilateral action without discussing it with the others. This is clearly seen when Ethiopia started the first filling of the reservoir in July 2020 despite all the disagreements from both Egypt and Sudan. As a response, the Egyptian ministry of Irrigation and Land Reclamation issued an objection statement pointing out that "*Such act reflects negative indicators showing that Ethiopia has no desire to achieve a fair agreement that aligns with the 2015 Declaration of Principles*" (Monzer, 2020). Additionally, Sudan was highly affected with the first filling when the Khartoum State Water Corporation announced that number of its Nile stations went out of order due to the rapid Nile water decline. Furthermore, the pure drinking water quantity has reduced as well (Mohyeldeen, 2020).

### 5.8.2 Level 2: Lose-Win

Stage 4: Images, Coalitions: the power imbalance becomes prevalent in this stage and there is only one winner, therefore the other parties start to seek support and make alliance with other entities. In the GERD case, Egypt and Sudan have been seeking the support of the United States, the European Union, and the African Union since the negotiations reached a deadlock.

Recently, Egyptian minister of Foreign Affairs Sameh Shoukry conducted a tour to some of the African countries; South Africa, Comoros, the Democratic Republic of Congo, Kenya, Senegal, and Tunisia to deliver letters from President Abdel Fattah El Sisi to the leaders of these countries explaining Egypt's and Sudan's position from the conflict and gaining these countries support and alliance against Ethiopia (ABU ZAID, 2021).

Stage 5: Loss of face: In this stage parties completely lose their trust to each other and they start the direct attack. This considers as a major step in the escalation level. It can be seen when Ethiopia accused Egypt and Sudan in instigating the ongoing internal violence and civil war in Ethiopia. On Dec. 29<sup>th</sup>, 2020, the spokesman of the Ethiopian ministry of affairs stated in a press conference, *"Egypt has turned Ethiopia into a 'danger zone' to escape its own internal problems, as there are tens of thousands of Islamists inside prisons in Egypt ... It is using such matters to avoid internal Egyptian issues and focus its attention on the GERD"* (Magdy, 2021).

In response to Ethiopia, Egypt summoned the Ethiopian envoy to Egypt to clarify Mufti statement and in the meantime the spokesman of the Egyptian ministry of Foreign Affairs Ahmed Hafez strongly denounced the Mufti statement as *"a blatant transgression and outright unacceptable, in addition to a flagrant infringement of the commitments enshrined in the Constitutive Act of the African Union"* (Magdy, 2021).

Stage 6: Strategies of threats: In this stage the conflict parties start to threaten the other party showing them that they have the power to prove these threats. After the failure of the last round of the negotiations in April 2021 that took place in Kinshasa, Congo, the Egyptian president Abdel Fatah El Sisi declared in a press conference, *"I am telling our brothers in Ethiopia, let's not reach the point where you touch a drop of Egypt's water, because all options are open"*. He continued, *"We have witnessed the cost of any confrontation"* (Alhadi, 2021). In addition, the Sudanese Irrigation minister Yasser Abbas also warned Ethiopia saying, *"Sudan stands ready to harden its stance in the dispute and lobby afresh at the highest international levels. For Sudan, all options are possible, including going to the UN Security Council and hardening policy if Ethiopia began the second filling of the reservoir without*

*agreement*” (Alhadi, 2021). Furthermore, Egypt and Sudan have carried out joint military exercises later in March in a step that is seen as a preparation for a possible war against Ethiopia (Kalabalik, 2021).

Threats are not only limited to the governmental level, Egyptians are contributing on social media platforms with the hashtag “#Nile4All” and posts like “I am proudly ready to volunteer to join the Egyptian army to destroy Ethiopia and its dam” (Mersel, 2020).

### *5.8.3 Level 3: Lose-Lose*

Till now the conflict over the GERD has not entered level three of lose-lose situation, however, the escalating trend could potentially lead to resort to armed violence driving the conflict into a lose-lose situation. Potential targets could include an initial disabling air-strike against the dam infrastructure, impeding power production or the filling up of the dam.

Stage 7: Limited destruction: in this stage parties are less secured due to the threats in the previous stage and they think that the other party will carry out their threats. A slight possibility for another round of negotiations cannot be expected. The ultimatum option is still open as a last resort. A limited disabling air-strike against the GERD dam would be a likely option.

Stage 8: Total annihilation: the main purpose of this stage is destructing the other party completely by targeting the key powerful people and decision makers like leaders and political representatives. This way they would demolish their legitimacy and the system would fall apart. To achieve this, Egypt and Sudan could also fuel internal conflicts within Ethiopia by arming certain groups or supporting nonviolent uprisings against the government.

Stage 9: Together into the abyss is the last stage of conflict escalation. The desire to annihilate the counterpart is extremely strong to the extent that self-defence or the survival instinct is ignored as long as the other party will get destroyed.



## 6. Results

Following findings can be pointed out after the previous analysis of the conflict:

- Although the main actors of the conflict are the three countries, Ethiopia, Sudan and Egypt, many stakeholders' countries are getting benefits from the GERD project, such as China, Israel, Gulf countries including Saudi Arabia, United Arab Emirates, and Qatar. In addition to Turkey. Such countries have close ties particularly with Ethiopia since they are investing millions of dollars in the GERD and they should take a positive role in mediating between the conflict parties instead of waiting to reap the benefit of their investments (International Crisis Group Report, 2019).
- Lack of transparency and trust between the conflict parties turned the negotiations which started in 2011 from win-win situation and a real possibility for cooperation into a lose-win situation, as it is shown in the Glasl's model of escalation. In the lose-win situation Ethiopia continues to act unilaterally without consideration of Sudan and Egypt's demands and concerns.
- If the situation remains the same without any progress in the negotiation, the conflict has the potential to descend to level three which is a lose-lose situation where military options could be considered from the downstream countries against Ethiopia and in this case the three countries would fail in real abyss and would pay a steep humanitarian and ecological price.
- The failure of the tripartite negotiations is not considered as a failure for Ethiopia, since the country is determined to resume the second filling of the reservoir scheduled in July 2021. Ethiopia has been postponing signing any binding agreements with the downstream countries and this was one of the main reasons that ignited the conflict.
- Considering the stakeholders of the GERD project and the countries which contributed in funding the dam, it is possible to think that the GERD is not merely for Ethiopia's economic development. The large dam is going to change the geopolitics of the Middle East and North Africa since Egypt has been a regional power in the region. Till now, the Nile River flow to Sudan and Egypt has not been controlled by any of the riparian countries, however, by building the GERD, Ethiopia would be able to control the flow of the Nile in which Egypt mainly depends on its water for all aspects of life.
- The downstream countries are dealing with the GERD as a fact now. Their attitude turned from opposing the idea and trying to politically sabotage the dam to seeking ways of compromising and agreeing to a cooperative strategy for managing the Nile

water. Therefore, with a responsible attitude from Ethiopia in clearly explaining to what extent the filling of the dam would impact the downstream countries, the three countries could avoid potential escalated armed conflict in the region.

## 7. Conclusion and Recommendations

Water scarcity and the exacerbating climate change, along with the unhindered construction of dams on the transboundary rivers are main factors of the water disputes all over the world. Some disputes have been managed through cooperative strategies, and others reached a deadlock where the possibility of armed conflicts is possible such as the Grand Ethiopian Renaissance Dam case.

The gap between Ethiopia's persistence in rejecting the downstream countries' demands and the dire request of Egypt and Sudan for a binding agreement to ensure the absence of significant harm to their water share and dams' safety is still wide (International Crisis Group Report, 2019). If Ethiopia continues to reject the downstream proposals for detailed studies of the GERD impacts and ways to compromise the reservoir filling period in order to mitigate the dangers, downstream countries could resort to the armed conflict option which would cause severe damage to the three countries.

The GERD could be a great opportunity for cooperation between the eleven riparian countries, not just the three conflicted parties if the Nile Basin Initiative (NBI) that has been formed in 1999 created a framework for equitable water share to benefit from the Blue Nile and the Nile River water. Egypt withdrew from the NBI after the tension started with Ethiopia over its announcement of the GERD construction in 2011. The reason for Egypt's withdrawal was Ethiopia's mobilization of the upstream countries to have a new cooperation framework without the consensus of both Sudan and Egypt. When the downstream countries disagreed to the new suggested framework and demanded a veto right for any possible projects on the Nile River, the upstream countries led by Ethiopia rejected the demand and Egypt suspended its participation. Therefore, for the NBI to start working again in favour of all the riparian countries, Egypt has to compromise and to join the initiative again in order to reach a mutual agreement (International Crisis Group Report, 2019).

The following recommendations could be taken into consideration for a possible resolution to the current conflict.

External parties such as the World Bank could play a more effective role in resolving the GERD conflict by applying the Cooperation in International Waters in Africa (CIWA) program. The program has been implemented for 10 years and it proved its effectiveness in navigating disputes over transboundary rivers specifically in Africa and helping the involved countries' governments to share an equitable water rights through a collaborative environment (AR2020 - CIWA program, 2021).

A successful applicable example of the cooperative management of the transboundary rivers is the Senegal River. The Senegal River is the third longest river in Africa with 1800 kilometres running across Mali, Guinea, Senegal, and Mauritania. Water access in this region is crucial since the region is afflicted by drought, dense population and poverty and the dependency on the river water is critical.

The Senegal River Basin Development Authority put into effect a framework to adjust the fair sharing of the ownership of the infrastructure among the riparian countries (Kenny, 2021). The Senegal River Basin Development Authority was formed in 1972 after several years of tough drought and managed to implement a framework that allows all the River Basin countries to have a shared ownership of the infrastructure including dams that are built on the Senegal River.

The World Bank later in 1980 assisted the Senegal River Basin Development Authority by integrating the CIWA program in order to help the authority in implementing a sustainable management for the water reducing the poverty in the region (KOMARA, 2014). However, in order for such an example to be applied to the GERD conflict, both parties (Ethiopia and the downstream countries) have to make compromises.

For Ethiopia it has to agree on slowing down the filling process of the reservoir and submitting a transparent data of the impacts and safety levels of the dam. On the other hand, Sudan and Egypt have to realize that if a new cooperative framework is to be carried out, it would be completely different than the colonial era treaty which allowed Egypt and Sudan to freely enjoy the Nile water share.

Another recommendation could be using solar and wind power in the dry seasons which generate great concerns to the downstream countries. The GERD's reservoir is designed to be filled during the rainy seasons and it would be empty in the dry seasons, releasing the accumulated water in a stable flow through the year and thus generating power all over the year. This mechanism would greatly affect the natural flow of the river water since Ethiopia will be controlling the flow. Consequently, averting the natural flow of the river, not only

would affect the ecological system, but also will have large impact on the water amount reserved in the Egyptian Aswan High Dam (AHD) and its power generation. Amid Ethiopia's refusal to ensure the mitigations of filling the reservoir, both Sudan and Egypt's concerns increase. However, an applicable solution in this case is utilising solar and wind power as alternative sources.

During the dry seasons, both the sun and the wind are strong in Ethiopia, Sudan and other riparian countries. Thus, it could be possible to generate solar and wind electricity during the dry seasons when producing hydropower from the GERD is less than its expected average in the rainy seasons. In this case, the solar and wind power could be implemented on a common region between Ethiopia and Sudan. It could also be supervised by the Eastern African Power Pool which established in 2005 to develop the clean energy systems in the East Africa region.

Furthermore, an electricity-based agreement between the three conflicted countries could be reached and it could achieve a win-win situation for all the parties. The idea of generating solar and wind power would compensate generating power from the GERD in the dry seasons, which would allow both Sudan and Egypt to receive more or normal water flow during these dry seasons. This way, Ethiopia would produce energy the whole year and would achieve its dream of being the largest African power hub. On the other hand, Sudan and Egypt's concerns about water flow reduction in case of drought would be relived. In addition, Egypt would not need to adjust the Aswan High Dam operation (Sterl, 2021).

## 7.1 Limitations of the Study

Due to the COVID-19 pandemic, the conflict analysis was limited to applying the conflict analysis tools. However, a direct data collection approach such as interviewing stakeholders and governmental officials in the upstream country Ethiopia, along with farmers and officials from the ministry of Irrigation in both Sudan and Egypt would have made the analysis more fruitful and thorough. The interviews would have reflected the real concerns of the people in the affected downstream countries.

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