



## Análisis del conflicto del agua: la disputa del río Nilo

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**Resumen:** La cuenca del río Nilo es la fuente de vida de Egipto, Etiopía, Sudán y los países río arriba, principalmente como agua para la agricultura y la energía hidroeléctrica. El recurso es el centro de un desarrollo muy disputado entre los países río abajo y río arriba. En los últimos años, debido en gran parte al cambio climático y al rápido crecimiento de la población, se ha producido un aumento en el nivel del conflicto relacionado con la escasez de agua y el subsecuente agravamiento de la inseguridad alimentaria. Además, las masas de agua transfronterizas tienen una gestión hídrica aún más compleja, convirtiéndose en uno de los principales temas geopolíticos de la actualidad. Este conflicto es el resultado de la ambición de los principales países ribereños, en particular Egipto, Sudán, Etiopía y otras naciones río arriba, por reclamar una mayor parte de los suministros de agua disponibles en la cuenca. Precisamente por eso, una teoría del juego cooperativo proporciona información valiosa sobre las disputas estratégicas en relación con los recursos hídricos. En este artículo, se evalúan las estrategias no cooperativas para determinar los posibles resultados de la disputa.

**Palabras clave:** hidropolítica, seguridad alimentaria, cambio climático, sequía, energía hidroeléctrica, cuencas fluviales transfronterizas, uso de aguas arriba, poder duro, poder blando, teoría del juego cooperativo, dilema del prisionero.

**Abstract:** The Nile River Basin is the source of life of Egypt, Ethiopia, Sudan, and Upstream countries, principally as water for agriculture and hydropower. The resource is the focus of much contested development between downstream and upstream countries. In recent years, largely due to climate change and rapid population growth, there has been an increasing level of conflict related to water scarcity and the consequent aggravation of food insecurity. Additionally, transboundary masses of water have an even more complex water management, becoming one of the main geopolitical issues of today. This conflict is the result of the ambition of the main riparian countries, notably Egypt, Sudan, Ethiopia and other upstream nations, to claim a greater share of the water supplies available in the watershed. That is precisely why a cooperative Game theory provides valuable insights into strategic disputes over water resources. In this paper, non-cooperative strategies are assessed to determine the possible outcomes of the dispute.

**Keywords:** Hydropolitics, Food security, Climate change, Drought, Hydropower, Transboundary River basins, Upstream water use, hard power, soft power, Cooperative Game Theory, Prisoner's dilemma.

## 1. Introduction

Water is an indispensable resource for the survival of any population and ecosystem. In recent years, largely due to climate change and rapid population growth, there has been an increasing level of conflict related to water scarcity and the consequent aggravation of food insecurity. Already in 2009 Ismail Serageldin (ex-vice-president of World Bank), stated that: “The wars of the twenty-first century will be about water, unless we change the way we manage water” (World Bank, 1995). Additionally, transboundary masses of water have an even more complex water management, becoming one of the main geopolitical issues of today.

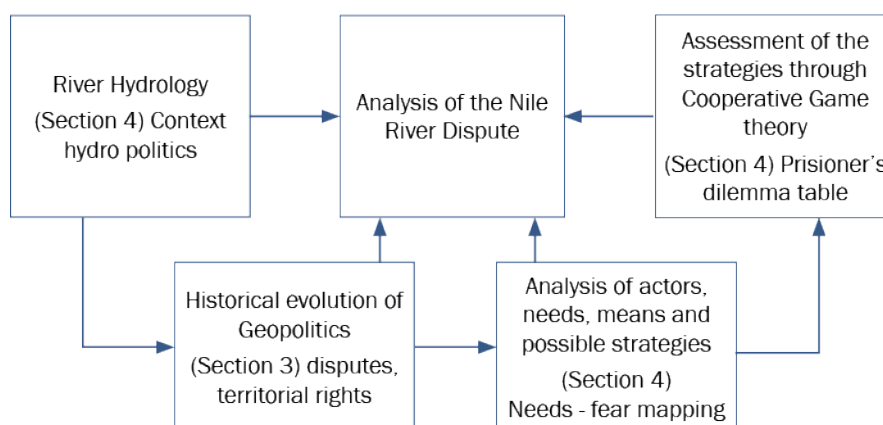
The aim of this paper is to analyse a case study of water conflict. The dispute on the Nile River presents a great opportunity to analyse the historical dynamics of water conflicts, and how these have evolved over time and how they have been affected by the emergence of new external factors as mentioned above.

The Nile River has been the source of life and conflict between riparian countries for centuries (Wiebe, 2001). The continuation of the conflict from colonial times to the present day is what has motivated my research question: Which are the main incompatibilities between the actors that prevent the conflict from being resolved and if it is to be resolved which possible strategies could the actors take?

To answer the question, this paper will conduct a combination of an historical dynamics analysis together with a rational choice analysis to provide a better comprehension of the strategic interactions of the actors involved, their interests, incompatibilities, and possible future scenarios. Through the cooperative game theory analysis, this paper aims to prove if the dispute can be solved, the most viable and rational strategy would be of cooperation.

Therefore, this paper adopts a state based, case-study design, with a qualitative analysis of the Nile Basin and the complex transboundary relations over shared waters. Information and data for this paper was collected through literature review, in conjunction with information gathered from relevant organizations and other sources.

This paper is mainly organized in 4 sections. First is presented a theoretical framework that describes the theories, concepts and tools used in this analysis. The second section focuses on a brief historical analysis of the Nile basin hydro-politics. The third section then applies a game theory approach through distinct tools and methods of conflict analysis. The paper concludes with an overall conclusion of the historical analysis in conjunction of the conflict analysis to answer the main research question.



**Figure 1**  
Outline of analysis  
own elaboration

## 2. Theoretical Framework

In this section, the main concepts, theories, and methods used in the subsequent analysis are presented. First, due to the common use of “conflict”, a specification of the concept is necessary. Subsequently, two forms of classification of power are defined that will be used in the analysis of strategies. The last two sections describe the conceptual background and the analytical tools used in the conflict analysis.

### 2.1. Conflicts

The concept of conflict can be used in a similar way in different but related realities. In this paper, we use the definition of conflict given by Grasa (2020), in which conflict is understood as a dispute between parties who are believed to have incompatible objectives, but not necessarily violent and/or negative. This definition of conflict fits on NBD analysis, since is being used cooperative game theoretic approach, in which the incompatibilities of the conflict will necessarily not have negative consequences in the future. This paper also follows the criterion of conflicts set by Grasa (2020), in which the dispute is between 2 or more actors; one or more grounds for dispute; polarization, it is believed that it is impossible to meet the objectives; and can be on material incompatibilities (resource access etc.) or non-material (decision-making, recognition etc.). The paper identifies four main actors, and the grounds of the dispute further examined in section 3 and 4 are on water source allocation, recognition of their rights and Nile ownership. Therefore, NBD is defined as a conflict over material incompatibilities. Furthermore, it is important to mention that conflicts over water are nothing new to this century. As has been pointed out in other articles, concerns about conflicts over water as a disputed resource has been on the agenda for a long time, but it increased in geometric proportion as environmental issues gained importance on the international agenda since the 1970s Grasa (2020, p. 60).

## *2.2. Hard power & Soft power*

It is important to identify, define and classify the means that each actor must implement their strategies. The article uses concepts “hard power” and “soft power” developed by Nye (2003, 2009). According to Nye (2009), “Power is one’s ability to affect the behaviour of others to get what one wants. There are three basic ways to do this: coercion, payment, and attraction”. Therefore, Nye (2009, 160) distinguishes between hard power, and soft power. The former comprises use of coercion and payment and the latter, as the ability to obtain preferred outcomes through attraction, that mainly depends on credibility (Nye, 2003). Nye (2009, p. 160) emphasizes the “need for smart strategies that combine the tools of both hard and soft power” so they would face less resistance in its goals pursuit. This form of power can be seen in the establishment of certain norms, institutions that limit other actors’ activities.

## *2.3. Cooperative Game Theory (CGT)*

NBD presents a good case study to analyse water resource games through a cooperative game theory (CGT). CGT methods contribute to analyse the strategies that parties can use to share the incremental benefits of cooperation efficiently.

This paper uses cooperative game approach to explore different ways to form a rational coalition that can optimize the benefit of each actor. Following the model of Li & Shen (2012), in the cooperative game, each actor earns its maximum benefit only when the actors form a grand coalition, in which all of them are cooperative. Through the needs-fears mappings, this paper also analyses non-cooperative strategies that each actor has, to find how to maximize its benefit and find that the cooperation incentives provided by both reputation systems and water source allocations benefit. Furthermore, this paper also uses insights of cooperative game made by Colman (2003), in which we define the most influential solutions as core, described as the strategies that “satisfies individual, coalition, and collective rationality, inasmuch as it includes only divisions of the payoff such that the players receive at least as much as they could guarantee for themselves by acting independently, [...] so that nothing is wasted” (p. 144). In this paper, we analyse the possible strategies and how an inclusive cooperation (all NBC) strategy can be the most rational and viable option, that also might lessen the effect of what John Herz (1950) called the security dilemma, in which actors concerned about their own security, try to secure and acquire more power in order to evade the impact of other’s power.

## *2.4. Needs and Fears Mapping*

This paper uses Fears - Need mapping to analyse actors, strategies, means and possible outcomes. This is a conflict tool that Mason & Rychard (2022) describe as an actor-oriented classification tool, that is used in this paper to make an analysis through the comparison of various actors’ attributes and try to analyse

what would be the possible options to deal with the conflict and leave the deadlock position in which the conflict is (Mason & Rychard, 2022).

In the strategies analysis, a table showing the benefits and costs of pursuing each strategy will be used. On the final assessment of the strategies, that aims to answer if “it is to be resolved which possible strategies could the actors take?” The second option is named as BATNA. BATNA is a mean to ensure that the negotiation does not reach a detrimental point, so pursuing another strategy could lead to more benefits (Subramanian, 2022), and will allow us to analyse whether a cooperative solution to the incompatibilities is likely and rational.

Finally, Wu & Whittington (2006) categorization on different kinds of cooperation and alternatives will be used. The analysis distinguishes between full cooperation (all NBC), partial coalitions, and unilateral strategies. This classification aims to simplify the understanding of cooperative rationality.

### **3. Hydro politics on the Nile River Basin**

#### *3.1. Physical aspect of Nile River Basin*

According to the Nile River Basin atlas (2022), the NR is the longest river in the world at 6,695 km. Its flows from northward goes through the tropics and the highlands of eastern Africa and drains into the Mediterranean Sea. NR covers about 1/10 of the area of the continent, drains a total land area of 3 million km<sup>2</sup>. Furthermore, data from MS have shown that exist at least 14 storage dam's basin wide.

The NR system is formed mainly by two major tributaries, named the Blue Nile and the White Nile, both merging in Sudan forming the Main Nile. The Blue Nile flows from Lake Tana in Ethiopia that then joins the White Nile in the capital city of Sudan (Wheeler et al., 2016).

#### *3.2. Historical analysis of the conflict*

The historical analysis made in Tayia et al. (2021) identifies the origin of the contemporary dispute in the British colonization of Egypt (1882). The dispute is mainly divided into 2 historical periods. During the first period (1882-1929) under the influence of Great Britain, it was created as a regulatory framework for the distribution of Nile's water. The second period (1929–2010), was characterized by alternative attempts to establish legal and technical regulation of the Nile water to increase its efficiency.





**Figure 2**

Map of Eastern Nile region with reservoir locations

Wheeler et al. (2016).

According to the historical analysis of Tayia et al. (2016), the treaties signed during the first period were aimed to secure the control of Nile flows. The most remarkably treaty was the 1902 Anglo-Egyptian Sudanese-Ethiopian treaty, in which Ethiopia committed to not develop any project on Nile River in exchange of the recognition of its sovereignty and borders with Sudan. During this period, 1929 agreement was signed between Egypt and Sudan that recognized the partial independence of Egypt and its right to maintain its flow of the White Nile water, to veto any upstream project (Tayia et al., 2016, p. 312). It also recognized Sudan as the second appropriator of the Nile water. British involvement during this period must be understood under economic interest. The British industry found that the Egyptian cotton is much cheaper than American cotton. Therefore, to increase productivity of the textile industry and, hence, profits, more water sources were needed (Sandstrom et al., 2016). Thereafter, the British government expanded its geopolitical interests to include Sudan under its sphere of influence. Sudan had potential for cotton cultivation to supply the British with a domestic textile industry (Waterbury, 2002). This was the start of British diplomatic efforts on setting up a more comprehensive formal institutional structure regulating the Nile (Tayia et al., 2016).

During the second period, it was clear for Egypt that not only it needed to maintain its natural share of the Nile, but also to find technical solutions to increase its water supply. Then **1949 treaty is negotiated** between the Egyptian government and Uganda<sup>1</sup>. This treaty allowed the construction and Egypt's financial assistance of Owen Falls dam in Uganda in return for raising the level of Lake Victoria to store the necessary water for Egypt during the dry season (Tayia et al., 2016). Concurrently, Egypt was trying to negotiate a similar treaty with Ethiopia, to build a dam on the mouth of Lake Tana, but the negotiations failed (Tayia et al., 2016). The two nations failed to reach a compromise solution that served their interests since both nations were claiming ownership rights to the Nile water. In 1956 Egypt became Independent and continued trying to safeguard its national interest in controlling and improving the water flows of the Nile River. Right after independence, the High Dam project was initiated. This dam project implied a Treaty with Sudan, to avoid any risk of sabotage, therefore, 1959 agreement was signed. Both countries will benefit from an increase in the available water (Abdalla, 1971). This treaty is the current water policy that regulates the distribution of water among NBC which attributes the largest share of the river's flow to Egypt, and the rest to Sudan, leaving other NBC watershed with undefined shares (El-Fadel, 2003). With the Aswan High Dam inaugurated in 1971 and having a storage capacity of two annual floods, water security was controlled within Egypt's borders. After 1959 agreement was signed in which both countries (Sudan and Ethiopia) led to the construction of the Aswan High Dam. It was inaugurated in 1971 and having a storage capacity of two annual floods, water security was controlled within Egypt's borders. Nonetheless,

Although the dam changed the Nile's behaviour in Egypt, it did not liberate the country and the political actors from the power of the structure of the water system itself. The dam made the Egyptians more dependent on the Nile than ever before. (Tvedt & Coopey, 2010, p. 16)

Egyptians cannot liberate themselves from this particular geo-political position caused by a geographical fact, its survival depends from the Nile's waters.

The agreements signed during this period were all exclusive, none of them included all NBC. That is why when the High dam project was announced and 1959 treaty was signed, Ethiopia reacted declaring that it would reserve its right to utilize the Nile waters originating in its territories. In late 90s, UC and Ethiopia attempted to repudiate these past claiming that were signed under colonial context. It was the beginning of unilateral initiatives. After denying these treaties Ethiopia built Finchaa, Tekeze, and Tana Beles dams. DC tolerated the construction of these dams since it did not represent a significant threat (Tayia et al., 2016).

Nile river is a transboundary water mass; therefore, it is not an internal issue, rather is an international and communitarian one. Presenting a double problem. UC cannot develop projects that diminishing the Nile discharge, since rises tensions with DC. However, it is also a problem for DC, due to its geopolitical position, they are totally dependent upon. Currently, the dispute over the Nile River faces additional external threats: Climate change and the growing rise of population. The effects of which imply changes in rain patterns, higher

evaporation rates among other consequences (Ghafar, 2018) that worsen the tension between NBC.

This historical analysis, has shown that the main incompatibility throughout time, has been the water allocation and ownership of Nile Basin. The main motive why the conflict persisted is because Egypt accounted for the means and legal basis to maintain this status quo (1902, 1929 and 1959 treaty). However, the conflict is dynamic, and the emergence of new external pressures, and the increasing influence of Ethiopia is changing the dynamics of conflicts. Thus, challenging this downstream hegemony that has prevented this conflict from being resolved and opening an opportunity to develop new strategies that slowly can drive to the resolution of the conflict.

### *3.3. Cooperative efforts*

The cooperative initiatives that are known about the modern Nile River dispute date back to 1998, when the riparian countries entered a dialogue, and a regional partnership was created. The main reason for its creation, was to facilitate the common pursuit of sustainable development and management of the Nile's waters. As seen in section 3.3, the historical past of water distribution has been turbulent and monopolized by a single state. Therefore, this initiative aims at adopting an inclusive transitional mechanism for cooperation until a permanent cooperative framework is established (El-Fadel, 2003). Finally, in May 1999 NBI was officially created.

In the Nile Basin Initiative (2022) atlas the NBI is defined as an inter-governmental partnership of 10 Nile Basin countries: Egypt, Ethiopia, Burundi, Rwanda, DR Congo, Kenya, Rwanda, South Sudan, The Sudan, Tanzania and Uganda. It is also mentioned that is the first all-inclusive basin-wide institution established, that aims to provide Basin States with a forum to discuss with trust and confidence the sustainable management and development of the shared Nile Basin water and related resources for win-win benefits (Nile Basin Initiative, 2022). Therefore, the main objective is to achieve an equitable use of water through a common structure that distributes the Nile water resources.

## **4. Conflict analysis**

In this section, the current conflict situation will be analysed. In the 3 sub-sections of this section, the actors, needs, means and strategies and the feasibility of the possible outcomes that can be developed are presented and analysed. The last sub-section of the section aims to answer the second part of the research question “if it is to be resolved which possible strategies could the actors take”, by analysing the costs and benefits of the main strategies presented in the previous section. This cost-benefit analysis is done through a cooperative game theory approach and is represented in a Prisoners Dilemma Table 1.



#### *4.1. Needs – Fear mapping*

The historical analysis has shown how the conflict is mainly caused and evolved around the incompatibilities of the actors on the issue of the control of the Nile River and the distribution of the water resources within the Nile Basin countries. The centrality of actors and its incompatibilities in the evolution of the conflict, makes it more appropriate to address the conflict through “The Needs-Fears Mapping” tool, since it is an actor-oriented clarification tool. This model allows us to make an analysis through the comparison of various actors’ attributes and try to analyse what would be the possible options to deal with the conflict and leave the deadlock position in which the conflict is (Mason & Rychard, 2022). Additionally, the water resource game will be studied using cooperative game theory. The analysis of the incompatibilities and possible outcome will be used to find how cooperating parties shall fairly and efficiently share the incremental benefits of cooperation. In NB, it will be important to consider the economic benefits and water allocation.

## 4.2. Actors & Interest

**Table 1.**  
Needs - Fears Mapping on Nile River Dispute

Parties	Issues	Interest/Needs	Fears	Means	Options
Egypt	<ul style="list-style-type: none"> <li>Guarantee a beneficial water resource allocation</li> <li>Guarantee its influence in the region</li> </ul>	<ul style="list-style-type: none"> <li>Protect its historical 1 rights overcontrol of Nile River water</li> <li>Good image in international community</li> <li>Improve relations with basin countries</li> </ul>	<ul style="list-style-type: none"> <li>Alteration to the current water allocation regime → lose of control, water scarcity and food insecurity.</li> <li>Unilateral initiatives by upstream countries that affect the annual flow → food security, water scarcity</li> </ul>	<ul style="list-style-type: none"> <li>Superiority of economic and military means in the region → Retaliation</li> <li>Treaty of 1959</li> <li>Significant political influence in AU and other regional agencies (soft power)</li> <li>NBI cooperative framework</li> </ul>	<ol style="list-style-type: none"> <li>Follow 1959 status quo: Military retaliation</li> <li>Partial coalitions</li> <li>2.1. Egypt-Sudan</li> <li>2.2. Egypt - Ethiopia</li> <li>3. Full cooperation within the NBI</li> </ol>
Ethiopia	<ul style="list-style-type: none"> <li>Recognition and representation of interest and rights → leaving the 1959 treaty status quo</li> <li>Independent water development but maintain its security, thus preferring Egypt not to take retaliatory measures</li> <li>Reduce dependency (agricultural and water allocation)</li> </ul>	<ul style="list-style-type: none"> <li>Independent water development: resource security</li> <li>More financing</li> <li>Recognition of their rights and representation of their interest over allocation of water resources in the Nile → gain a portion of the vast amount of the water that originates in its territory</li> <li>Maintain its security, thus preferring Egypt not to take retaliatory measures against it, and second, to try to gain a portion of the vast amount of the water that originates in its territory</li> </ul>	<ul style="list-style-type: none"> <li>Being marginalized from matters dealing with the Nile's water resource allocation → water scarcity and food insecurity</li> <li>Not having enough financial resources to develop its projects</li> <li>Egypt's military or economic retaliation</li> </ul>	<ul style="list-style-type: none"> <li>GERD</li> <li>Upstream regional cooperation, excluding downstream countries</li> <li>NBI cooperative framework</li> <li>Joint water development projects with Sudan</li> </ul>	<ol style="list-style-type: none"> <li>Unilateral actions</li> <li>Partial coalitions</li> <li>2.1. Ethiopia - UC</li> <li>2.2. Ethiopia-Sudan</li> <li>3. Full Cooperation under NBI</li> </ol>
Sudan	<ul style="list-style-type: none"> <li>Balance its relationship with Egypt and good relations with Ethiopia and the remaining countries for both water quality and economic development purposes</li> </ul>	<ul style="list-style-type: none"> <li>To continue to receive an equity allocation of water</li> <li>Sustainable development</li> <li>Continue having the support of Egypt</li> <li>Good relations with its neighbors of the north</li> </ul>	<ul style="list-style-type: none"> <li>Ethiopian unilateral water development projects: threaten its own supply → water scarcity and food insecurity</li> <li>Egypt use of aggression against upstream countries</li> </ul>	<ul style="list-style-type: none"> <li>Treaty of 1959</li> <li>Joint water development projects with Ethiopia</li> <li>Support from a Chinese company</li> <li>NBI cooperative framework</li> </ul>	<ol style="list-style-type: none"> <li>Unilateralism</li> <li>Partial coalitions</li> <li>2.1. Sudan - Egypt</li> <li>2.2. Sudan - Ethiopia</li> <li>3. Full cooperation within NBI</li> </ol>
Upstream river countries	<ul style="list-style-type: none"> <li>Recognition and representation of interest and rights leaving the 1959 treaty status quo</li> </ul>	<ul style="list-style-type: none"> <li>Improve the water-based development circumstances of these countries</li> <li>Recognition of their rights and representation of their interest over allocation of water resources in the Nile</li> </ul>	<ul style="list-style-type: none"> <li>Being marginalized from matters dealing with the Nile's water resource allocation</li> <li>Water scarcity and food insecurity</li> <li>Egypt's military or economic retaliation</li> </ul>	<ul style="list-style-type: none"> <li>Upstream regional cooperation, excluding downstream countries</li> <li>NBI cooperative framework</li> </ul>	<ol style="list-style-type: none"> <li>Partial coalitions</li> <li>1. UC - Ethiopia: Upstream block</li> <li>2. Cooperation under NBI</li> </ol>

own elaboration.

based on the analysis of information gathered from El-Fadel et al. (2003), Madani et al. (2011), Oestigaard (2012) and Tayia et al. (2021).

**EGYPT** is one of the UC of the Nile Basin. Its topography is mostly characterized by desert, semi-arid and arid rangelands. Its climate condition does not contribute to diminish the problem since Egypt does not receive regular rainfall, what translates into a highly dependence on the Nile waters for the supply, being estimated that 95% of water resources come from the Nile (Ghafar, 2018). Therefore, Egypt has an interest in guaranteeing a beneficial water resource allocation. Egypt is the DC that has been the traditional controller and user of the Nile waters, exploiting its waters almost exclusively since colonial times (El-Fadel et al. 2003). This was possible due to its clear superiority on economic and military means. Nonetheless, the context of the 1959 treaty is no longer the same. UC have begun to consider controlling more of the Nile waters, to initiate economic development and sustain their growing populations. The Egyptian government has long identified any upstream development of the Nile's waters as a potential national security (El-Fadel et al. 2003) that threatens its historical rights under the legal basis of 1929 and 1959 treaties on the water allocation and ownership of the Nile. These basis clearly clashes with UC interests over water resource allocation, rights and ownership over the Nile.

**SUDAN** is the largest downstream country (Ahmed, 2016). In its lands is situated one main tributaries of the NR, the Atbara River, Khartoum (El-Fadel, 2003) and greatly benefit from the 1959 water policy. Additionally, Sudan accounts on further water resources such as surface, groundwater and rainfall<sup>2</sup>. Nonetheless, despite the beneficial good relations and bilateral agreements with Egypt, Sudan also shares common interests with Ethiopia, for both water quality and economic development purposes (Madani et al., 2011, p. 107).

Sudan, as many other NBC, is facing an increase in population that simultaneously implies a growing demand on usable water (Wiebe, 2001), added to a growing contamination and misuse of freshwater that together with inefficient irrigation, may result in droughts and floods (El-Fadel, 2003). Consequently, there is a growing need to achieve water quality and economic development purposes, implying Egypt cooperation, as its support is essential for the development of infrastructure and projects. However, Sudan needs to balance the relations the other NBCs, as much of the river's flow comes from UC such as Ethiopia. Jeopardizing their peaceful relations could imply a meaningful loss of water resources.

**ETHIOPIA** accounts with substantial natural resources and potential for agricultural production. From Ethiopian highlands emerge 2 of the main Nile River tributaries, the Blue Nile and the Atbara River, accounting more than 80 % of the Nile waters (Wiebe, 2001). Nonetheless, Ethiopia is one of the poorest countries in the world, in which food insecurity is a top priority. Ethiopian highlands, it has so far been able to develop only 0.04 and 2% of its irrigation and hydropower potential through its share of the Nile system (El-Fadel et al., 2003). This precarious situation is because Egypt consumes nearly 60% of the Blue Nile water (Al-Anani, 2020). This disproportionate resource allocation is at the core of the Egyptian–Ethiopian conflict. Ethiopia claims its natural rights to exploit its waters (El-Fadel et al. 2003) that clashes with the 1959 water policy basis. Ethiopia together with UC have tried to invalidate it or renegotiate

new agreements that also take their rights and needs into account. The past events of Ethiopia<sup>3</sup> weakened the economic and military means, defaulting its capacity secure the flow of its own water. So far, Ethiopia has overseen a major development to produce electricity to prevent many electricity shortages, this is the GERD, a project that not only will enhance its economy and improve its people's lives but offers the possibility of selling electricity to other African countries. GERD could transform Ethiopia into Africa's largest power exporter (Al-Anani, 2020), being a source of soft power, since it will bring Ethiopia with more power and influence in the regions. Being the reason why DC perceives it as an existential threat that concerns national security of both countries (Saied, 2021).

Finally, UC<sup>4</sup> faces food insecurity and water scarcity, that is why an improvement in water-based development is needed. Furthermore, their rights over NB water flows are ignored in the current water policy<sup>5</sup>. Therefore, UC have been discrediting the agreement and asking for renegotiation of its contents to take their own interests into account. UC want their determination to be completely recognized as legitimate performing actors for reasonable understandings over the allocation, utilize, and management of the Nile waters (Hussein & Grandi, 2017).

#### *4.3. strategies & Outcomes*

After having analysed the actors involved in the conflict, in this section we analyse their strategies and possible outcomes.

**EGYPT.** According to their interest in making sure they continue to receive river flow, due to their dependence on water, 3 possible strategies have been identified, accordant to its means.

##### *Strategy 1. Maintaining 1959 status quo: Military retaliation*

If Egypt wants to maintain its full % of the river flow, trying to maintain the 1959 status quo is certainly an option. Despite having the disadvantaged downstream position, it has traditionally been seen as the potential hegemon in the basin due to its clear military and economic superiority (Sandstrom et al. 2016) its means of Egypt, since they are coercive, can be identified as hard power. Egypt already used economic and military power to threaten and block some initiatives that previously threatened the 1959 status quo. In the early 1990s, Egypt used his hard power combined with its international political influence (soft power) to successfully block the African Development Bank from assisting Ethiopia financially with its proposed water development projects. Nonetheless, the global landscape has changed. Ethiopia has gained more economical and political influence (soft power), a clear demonstration is the unilateral initiative of the construction of GERD. Therefore, military threat could imply not only huge economic, military costs, but also international image damage. It could even threaten its own water supply since Ethiopia now has the power to constrain the UC's interest. Furthermore, climate change and the alarming population growth are serious threats to water resource development and allocation.

The pressure of external forces poses serious obstacles on Egypt's preference to maintain the status quo. Pursuing this strategy could undermine its own food security, worsen water scarcity. The future consequences of external forces are uncertain, but their presence cannot be ignored. Attempting to solve the issue in isolation will only lead to more costs and difficulties in reversing the catastrophic effects of these existential threats. Therefore, due to the magnitude and global impact of these imminent threats will ideally require cooperative action.

If Egypt prefers to cooperate, 2 main cooperation strategies have been identified.

### *Strategy 2. Partial coalitions*

In partial coalitions, not all NBC are included. Consequently, Egypt has to be aware that the previous exclusion of Ethiopia from the crucial water agreements of 1959 has created a hostile environment for successive negotiations between the two countries (Rahman 2011 in Hussein & Grandi, 2017), culminating in unilateral development projects by Ethiopia. As mentioned, post-civil war Ethiopia is experiencing rapid economic growth, and with it increased leverage. A strategy of cooperation would be beneficial to both. Egypt has another negotiating framework to maintain an equitable share of the water source allocation without the use of coercive means that could harm international image. Both Egypt and Ethiopia are the most consequential countries, therefore their cooperation and amity are essential for the region's stability and peace (Al-Anani, 2020). Both parties have to be aware that satisfying each country's maximalist position is nearly impossible if we consider the regions' circumstances and instability to sustain a prolonged and unneeded conflict (Al-Anani, 2020). It is true, however, that a cooperation agreement would imply DC contribution in the costs of new projects made under coalitions basis. Notwithstanding, given the historical past of rights denial and exclusion, a framework of bilateral cooperation, may lead to increased tensions with the other UC and further unilateral initiatives by non-included parties.

### *Strategy 3. Join NBI: Full cooperation*

In present times, joint management of infrastructure across international boundaries of NBC is non-existent (Wheeler et al. 2016). Management of an equitable water resource allocation in this international basin has been complexed to achieve since it implies a limitation in the sovereignty of all implied countries over the common good of more equitable and efficient water resource management, being one of the main obstacles that has hindered the development of this partnership. As mentioned in Strategy 2, the context and threats have changed and it requires a new way of acting; unilateralism is unfeasible and ineffective. Bilateral treaties lead to increased tensions and mistrust between parties that do not participate in possible agreements. Therefore, if Egypt wants to achieve more equitable and effective agreements, maintain a good image in the international community as well as improve the relations with the other NBC, cooperation under the NBI seems the most effective and suitable option



(Madani et al., 2011). Under this legal and normative framework, Egypt can find new forms of power, or what has been defined as soft power (Nye, 1990) since economic superiority, and influence in the international scenario, can be used as soft power and tool to project its interests in the projects and agreements within the NBI framework. Therefore, soft power could be translated into an advantageous bargaining position within the framework, to get more benefits. One case where Egypt could use its soft power is in the agricultural exports. Up until now, Ethiopia has relied mainly on imported food from Egypt, what creates a certain dependence on Egypt. The construction of GERD implies that Egypt will lose profits. In this case, Egypt can use its influence within the NBI to negotiate compensation, which can be either economic or a greater distribution of water resources. Furthermore, the external pressures being a common problem, with worse effects in Egypt, due to its topography. Hence, a full cooperative strategy would lessen the costs of facing these common threats. Infrastructure and larger projects cost will be covered cooperatively. In fact, during the Nairobi meeting in July 2011, Hisham Kandil, stated that:

Egyptians would 'look for ways and means to move forward because we have no other means but to cooperate and work together. We share the Nile, we share the water, we share the destiny [...] The past is based on a zero-sum game. That is gone'

Furthermore, Essam Sharaf describes the GERD as a 'source of benefit (...) and something useful' (Oestigaard, 2012:42). The present context, in conjunction with external pressures, makes NBI full cooperation the more feasible, rational, and stable strategy for Egypt since it can safeguard its influence in the region by adapting to the new scheme, and facilitates large-scale solutions to a problem that affects Egyptians most severely.

**ETHIOPIA** since the mid-1990s, however, the situation has changed. Ethiopia has emerged from a long period of civil war and famine into a phase of accelerated growth and economic development (Swain, 2002). This economic and political development can lead to mainly 3 different strategies.

### *Strategy 1. Unilateralism*

Ethiopia has encountered numerous obstacles in developing its own projects. Nonetheless, an increase in financial assistance from individual western countries (Swain, 2002) allowed Ethiopia to be more confident and to successfully counter Egyptian and Sudanese objections to its WDP at the diplomatic level. Until now, Ethiopia has been able to construct and plan many small dams to improve the country's irrigation and hydropower capacity (Swain, 2002), becoming an increasingly important actor in Nile basin hydropolitics. However, even though unilateral projects such as GERD will boost Ethiopia's agricultural yields and reduce food insecurity, it is in Ethiopia's interest to do these projects in a cooperative manner, which will help the other NBCs to access energy cheaply. In this way, Ethiopia would not only benefit from the benefits of its own project (both energy and economic), but also project its influence in the region (Soft power) and counterbalance the quasi-hegemonic Egyptian status quo. GERD could be used as a compliance-producing strategy in order to achieve predominance in the dimension of bargaining power (Hussein & Grandi, 2017,

p. 805). Not to mention that unilateral initiatives always led to a rise of tensions in the countries negatively affected. Therefore, it is better to have the counterparts as part of the project so they cannot present major obstacles.

### *Strategy 2. Partial coalitions*

Ethiopia – Sudan. It is widely known that Sudan and Ethiopia have historically maintained peaceful relations despite the long-standing border dispute over the agricultural area known as al-Fashaqa (Tessema, 2021). Relatively recent events have evidenced a change in the pattern of alliances. Sudan that historically has been aligned with Egypt seems to be gradually shifting its perspective in favour of Ethiopia's claims, due to the mutual opportunity of favourable energy deals (Hussein & Grandi, 2017). Further materialized by the several joint draft projects aimed on more efficient water resource distribution and for further energetic benefits (Wiebe, 2001). Ethiopia – UC. Ethiopia and UC could enhance an "upstream block" that would definitely challenge downstream hydro hegemony and use it to erode Egypt's bargaining power. This partial coalition will increase the ability of voicing their own interests at expenses of DC interest. (Hussein & Grandi, 2017). Therefore, it will raise tensions with DC. Furthermore, given Egypt's superiority of means able to block projects, it would not be rational to exclude them from the negotiations since its economic and political superiority makes it a tough adversary, but a powerful ally, so a better alternative is a full cooperation (see below) since it would imply greater economic capacity and political opportunities, both regionally and internationally.

### *Strategy 3. Full cooperation within NBI*

Ethiopia is known as both, founder and participant of the NBI. Therefore, work in a full cooperative strategy under the same legal and juridical framework guarantees all interests represented in a transparent manner (Madani et al., 2011). GERD could be added into this cooperative framework the GERD and could be used as a tool to exert influence on the riparian countries (political alignment) and gain more bargaining power (Hussein & Grandi, 2017). Furthermore, NBI would introduce a new normative framework to renegotiate the conditions and distribution of water in a more equitable and efficient manner than the 1959 water policy. Additionally, as mentioned in Egypt's Strategy 3, due to the immediate consequences of external pressures in the region, full cooperation is the most viable and efficient strategy to implement.

SUDAN. Sudan's main interest is to balance the good relations with Egypt, together with Ethiopian and other upstream countries relations. This balance will allow Sudan to further gain water quality and economic development (Madani et al., 2011).

### *Strategy 1. Unilateralism*

The Sennar and Rossaries dams built on the Blue Nile together with the Ghirba dam on Atbara are independent projects that Sudan has unilaterally

been able to afford. It is known that Sudan accounts with the support from Chinese companies to build additional projects, independently or with Ethiopia (IWP&DC, 2007 in Madani et al., 2011). Therefore, Sudan has the sources to act independently from Egypt. However, this strategy directly interferes with the needs and interests of Egypt, known for historically pursuing a strategy of threats and obstruction whenever its needs are at risk. Additionally, as mentioned, any independent action entails more costs than benefits as it not only increases tensions but also makes it difficult to elaborate efficient strategies that can combat the external pressure's effects.

### *Strategy 2. Partial coalitions*

Sudan – Egypt. One of Sudan's options is to support Egypt in maintaining the 1959 status quo. With this option, Sudan is guaranteed to continue to receive the one-third of water flows established in the 1959 agreements. However, pursuing this strategy would mean denying the rights and interests of the UC, which are the major contributors of Nile water. Thus, augmenting the probabilities of UC unilateral strategies. Sudan prefers that neither Ethiopia nor UC act independently since it could threaten its own supply (Madani et al., 2011). Therefore, to find the balance is not only important to maintain a stable and peaceful situation between the NBC but is also necessary to ensure further economic development and improvement to electricity access. To this strategy, as to all others, must be added the impact of external pressures on water scarcity and food insecurity. Therefore, pursuing this strategy will hinder its own security. Sudan – Ethiopia. See strategy Ethiopia – Sudan.

### *Strategy 3. Full cooperation under NBI*

Full cooperation within NBI is a viable option since Sudan's main interest is to balance good relations with Egypt, together with Ethiopian and UC that will further improve economic development and sustainable and efficient water source allocation. This framework enables Sudan to represent its interest and needs in a less constrained way than in 1959 agreements. It further allows Sudan to participate and benefit from the cooperative projects and infrastructures destined to distribute water resources efficiently and equitably. Hence, this strategy will also imply some costs in the short term as the shared costs for the shared infrastructures. Positively, this strategy will enable a communicative framework that will also serve to face jointly the existing and future threats.

UC. This set of actors has mainly been identified as being interested in changing the 1959 status quo that does not recognise their rights over the distribution of water from the Nile River. Therefore, two main strategies have been identified:

### *Strategy 1. Partial coalition*

See strategy Ethiopia – Sudan

### *Strategy 2. Cooperation within NBI framework*

This cooperation strategy would be ideal, since, as mentioned before, not taking into account the interests of DC would hinder any project to be carried out. Furthermore, external threats require a large-scale strategy to mitigate the negative effects of climate change.

#### *4.4. Cooperative game theory analysis of the strategies*

In the following paragraphs, the 2 main strategies identified for each actor, and an analysis of the costs and benefits of each are shown<sup>6</sup>.

#### *Strategy 1. Unilateral strategies*

Egypt, Sudan and Ethiopia, have the option of taking unilateral strategies. For Egypt, this would consist of military retaliation. Sudan, developing unilateral projects with financial support of Chinese companies. Similarly, Ethiopia with GERD. The previous analysis has shown that the benefit of unilateral projects is less than the cost of dealing with the impediments posed by the other actors involved. In other words, Unilateral actions in water resource management will set these countries on a collision course (Wu & Whittington, 2006) that will not resolve the main incompatibilities nor finish the dispute. Unresolved water disputes, in conjunction with external pressures severely hampers the economic development in the basin (Wu & Whittington, 2006).

#### *Strategy 2. Partial coalitions*

Egypt – Sudan. With this option, both Egypt and Sudan are guaranteed to continue to receive the water flows established in the 1959 agreements. However, pursuing this strategy would mean denying the rights and interests of the upstream countries, which are the major contributors of Nile water. Thus, Sudan would see his interests of maintaining good relations with both Egypt and the neighboring UC threatened, since it is practically impossible to maintain. It is known that neither Sudan nor Egypt's wants Ethiopia to independently carry out water development projects, since it could threaten its own supply. Similarly, they would not want the upstream nations to develop their own projects (Madani et al., 2011).

Egypt – Ethiopia // Sudan – Ethiopia // Ethiopia – UC. As previously being analysed, framework of bilateral cooperation, or exclusive agreements, may lead to increased tensions with the other NBC. Given the historical past in which their rights have been excluded and a current reaction to claim their rights, continuing with this pattern of bilateral treaties may lead to increased tensions and unilateral initiatives by the other UC.

Overall, unilateral strategies do not represent the BATNA of any of the actors, as it has been described the cost of unilateral actions might exceed the benefits that could bring. Therefore, in case of a failure of joint inclusive negotiations under NBI framework, the BATNA of all actors are partial coalitions. In the

case of UC and Ethiopia, a partial up-regional cooperation, will imply having their interest, rights and needs represented and the capability of further and joint projects that will improve the water allocations between them, and a stronger strength on facing external pressures such as climate change. For DC, the possible BATNA, will be to cooperate bilaterally with UC, to ensure that they receive efficient water allocations to survive the droughts. A downstream cooperation, that is the strategy that Sudan and Egypt has been pursuing since colonial times, is no longer feasible, since UC have developed enough consciousness and resources to be able to contest them and even block their traditional water allocation source.

This can be understood by the prisoner's dilemma (see table 1): if none of the actors cooperate, the cost in the short and long term will be higher, unilateral projects take much longer and one actor bears the full cost of the process. Added to this is the external pressures. None of the actors would be able to carry out their projects unilaterally, as the others would put numerous obstacles in the way.

If partial cooperation takes place, there are two possible beneficiaries and two possible losers. Firstly, the case of upstream cooperation, together with Ethiopia, would benefit from having their interests and needs represented under a joint legal framework, reducing the costs of large projects (such as future dams) that ensure an efficient water allocation. DC, however, would lose the water allocation they had maintained under the 1959 status quo. Secondly, cooperation between DC could give them short-term leeway to continue to benefit from water allocation, which implies the denial of rights and the lack of representation of the needs and interests of UC.

Finally, the fourth option is for all actors to cooperate. In this option, the benefits are more long-term, since there is first the negotiation phase that implies having to give up certain freedoms or positions. However, in the long term, it is the solution that gives the most benefits to all. Cooperation under the same legal framework guarantees the representation of the interests, needs, rights and obligations of each state. It reduces the costs of possible future projects. And it enables the possibility of jointly addressing external threats.

Therefore, in terms of cost-benefit, stability and efficiency, the best and most rational strategy to follow, and therefore possible outcome, is the cooperation of all NBCs under the NBI framework. In the case of full cooperation, the abundant surplus of hydropower that will generate UC could be used to provide the energy needed for DC to expand and improve its agricultural production. Therefore, this increase in electricity flows will turn in a major agricultural output for DC to UC, therefore, reducing UCs' water requirements for domestic consumption (Wu & Whittington, 2006). Nonetheless, this economic benefit has to be seen under full cooperation, after an agreement on equitable and efficient water source allocation is being reached.



**Table 2.**  
Prisoner Dilemma applied to NBC strategies<sup>7</sup>

Egypt and sudan (Party A)			
Ethiopia &upstreani countries (party b)	Cooperation		Defect
	Cooperation	<ul style="list-style-type: none"> <li>• short term cost (-1)</li> <li>• all interest, rights and obligations represented (+2)</li> <li>• long term projection of bigger future projects (+2)</li> <li>• efficient and equitable water source allocations and management (+2)</li> </ul>	<ul style="list-style-type: none"> <li>• all PARTY B interred, need rights and obligations represented. Share cost of projects (+2)</li> <li>• PARTY A risk of losing enough water source allocation to survive drought periods (-2).</li> </ul>
		BOTH PARTIES: benefits 5	PARTY A (-2, +2) PARTY B
	Defect	<ul style="list-style-type: none"> <li>• PARTY A, benefits from short term maintenance of 1959 water source allocation (1)</li> <li>• PARTY B, lacks recognition of its right, needs and obligations. facing legal obstacles to pursue their projects to ensure their survival (-1)</li> </ul>	<ul style="list-style-type: none"> <li>• Both parties enjoy from short term benefits (+ 1)</li> <li>• Long-term escalating the conflict and tensions (-2).</li> <li>• Continuous obstacles between them (-1)</li> </ul>
		PARTY A (+1, -1) PARTY B	BOTH PARTIES, loss (-2)

own elaboration.

## 5. Conclusion

In conclusion, our research has “Which are the main incompatibilities between the actors that prevent the conflict from being resolved and if it is to be resolved which possible strategies could the actors take?” has been answered through the historical and conflict analysis. The historical analysis has allowed us to identify the main incompatibilities in the dispute. Since colonial times, the issues at stake have been the water source allocation and the capability to develop and/or veto projects in Nile Basin. During the colonial era, Egypt had the military, economic and political means to exert its will in the distribution and control of projects in the Nile Basin. While Sudan, Ethiopia and UC were at a disadvantage in terms of means. Sudan had the political advantage of having GB on its side, so it could receive 1/3 of Nile water flows, but could not decide or act independently (as 1959 treaty establishes). Ethiopia and the UC did not have the economic, military or political means to counterbalance, which is why the conflict has lasted so long. At

the end of the historical analysis, together with the subsequent conflict analysis, it has been described how the emergence of external threats (climate change and population growth) have been important factors in changing the conflict dynamics, opening up a very real opportunity to see an end to the dispute. This is important for the second part of the research question, “if it is to be resolved which possible strategies could the actors take?”. The conflict analysis in section 4 elaborates a series of strategies that each actor can pursue according to their needs and means. Subsequently, the probability and rationality of each strategy and its possible future outcome have been analysed. This section analysed the strategies that could lead to a possible solution to the dispute. As seen in the previous final assessment through a cooperative game theory, strategies 2 and 3, which correspond respectively to partial coalitions and full cooperation under NBI framework, could be considered as the possible strategies to solve the conflict. However, partial coalitions do not ensure an end to the dispute, but rather a temporary stability, since the interests of all the actors involved in the conflict are not represented in these agreements. For this reason, under a cooperative game theory analysis, strategy 3 “full cooperation within NBI”, is the most efficient and rational (as seen in Prisoner’s dilemma table their costs and benefits). Strategy 3 involves collaborations of all actors involved in the dispute; therefore, all their interests and needs are represented under the same institutional framework, and therefore stability would be more in the long term.

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## Notes

- \* This article is product of the final degree thesis.
- 1 Uganda at that time was under the British administration.
- 2 According to Ahmed (2016), rainfall constitutes one of the main sources of water originating in Sudan.
- 3 30 years of civil war and the armed conflict with Eritrea.
- 4 Considering the upstream countries (Uganda, Kenya, Tanzania, Burundi, Rwanda, and Democratic Republic of Congo) as a single entity that acts as a stable, single decision-making coalitions, is nonrealistic. Therefore, this paper represents a first preliminary analysis for understanding multilateral negotiations in the Nile Basin. More in-depth analysis of the likely behaviour of the upstream countries is surely needed.
- 5 1959 Treaty
- 6 This analysis is based on the previous results on section 4.3. Strategies & Outcomes.
- 7 In the table Ethiopia and UC are represented under the same Party (B) in the same way as Egypt and Sudan are represented under the same part (A) this is due to the complicity of strategies and interests analyzed in the previous sections in which consequent costs and benefits of each were similar. This assessment is non-realistic. Therefore, this table represents a first preliminary analysis for understanding the general cost and benefits of each strategy. Further detailed analysis is needed. The distribution of points goes on 1 point is added or subtracted when the benefits or costs are considered short-term. 2 points are added or subtracted when the benefits or costs are considered to be long-term. At the end of the table is the tally of benefits and/or costs for each actor.

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