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Cover Page Footnote

Farah Khayry, Undergraduate Student, Rhetoric and Composition Department, The American University in Cairo. The author wishes to thank her family and friends, who were a consistent and reliable support system throughout the research and writing of this paper.

The Grand Ethiopian Renaissance Dam and Egypt's Water Security

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Abstract:

The Nile River is the backbone of Egypt. Egypt's dry climate, lack of alternative water sources, and scarce rainfall and arable land have increased its reliance on the Nile River. In fact, the Nile River provides Egyptians with 97% of the available fresh water. Currently, Egypt is experiencing a rising water deficit due to wasteful water irrigation and consumption, global warming, and rapid population growth. The Egyptian population is increasing at an annual rate of two percent, creating a rising demand on the already dwindling Nile water supply. Another threat to the Egyptian Nile water supply is the Grand Ethiopian Renaissance Dam (GERD). The dam is a massive project that is intended to store water and generate electricity for Ethiopia. However, this dam endangers the water supply of downstream countries. As the most downstream country, Egypt is among the most affected by the impending threats of the dam, as the GERD can potentially curtail the Nile's water flow coming to Egypt by 25%. This percentage will not only jeopardize Egypt's water security, but also its agricultural industry: a major food and employment source as it fosters multiple subsidiary industries. Accordingly, the GERD poses as a direct threat to the wellbeing of Egyptian society. This paper will further analyze the impact of the GERD on the Egyptian water supply and the consequences of its impending decline, with emphasis on the effect of the increasing population, the agricultural industry, and the economy, as well as propose viable solutions.

Keywords: Egypt; Ethiopia; Nile River; Grand Ethiopian Renaissance Dam (GERD); Nile Basin Countries; Population Growth; Geopolitics; Social Stability; Government Policies; Political Relations; Water Scarcity; Agricultural industry; Employment rates; Water conservation; Climate Change.

Egypt is deemed one of the most populous countries in the world with one of the fastest growing populations. The population increase along with economic and political instability over the past decades have greatly strained the country's resources. The Nile river, moreover, is the beating heart of Egypt. The river provides fresh, consumable water, sustains irrigation and agriculture, and is vital for the operation of various subsidiary industries and employment opportunities, significantly contributing to the nation's Gross Domestic Product (GDP). As a result, when Ethiopia announced its construction of the mega dam- the Grand Ethiopian Renaissance Dam (GERD)- in 2011, the Egyptian government was heavily concerned due to the many risks the dam poses to the water supply of downstream countries like Egypt. This paper, consequently, will scrutinize the impact of the GERD on Egypt's water supply and how it will both exacerbate the current insufficiency of consumable water and escalate the threats posed by water scarcity, with emphasis on the dam's effect on the rising population, agriculture, and the economy, as well as pose viable solutions to this divisive issue.

The Nile River in Context

The Nile river is located in the heart of Africa, at the center of vast miles of desert land. The river provides the approximately 200 million inhabitants in its vicinity with

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consumable water, hydro-electricity, and fertile, arable land, fostering agriculture (Tutwiler 2019). Its setting in the midst of the desert with its dry climate and scarcity of arable land further accentuates its importance to the Nile Basin nations as it sustains life in the region. The Nile Basin region is comprised of the Democratic Republic of Congo, Eritrea, Kenya, Burundi, Ethiopia, Rwanda, South Sudan, Sudan, Uganda, Tanzania, and finally Egypt (Tutwiler 2019). The longest river in the world is divided into two tributaries, the White Nile and the Blue Nile, which later adjoin into one along the border of Sudan (Tutwiler 2019).

Upstream countries supply the Nile with the water that flows onward from Lake Victoria in East Africa into the White Nile and merges with the Blue Nile in Ethiopia (Schwartzstein et al. 2017). Along with its rich resources and heritage, the Nile river is a significant resource to all of the basin countries, especially now, as the Nile Basin countries are facing a substantial growth in population that is not reciprocated in resources (Tutwiler 2019). The same amount of natural resources no longer suffices the needs of the growing human and animal populations. Since 1959, in fact, the demand for water has increased by five times, and the animal population has increased by six times (Elnur 2019). Hence, countries along the river have been constructing dams, such as the Roseries Dam in Sudan and the Tekeze Dam in Ethiopia, to secure water sources for their populations and meet the mounting demand (Tutwiler 2019). Such dams can have different functions: storing water for downstream irrigation, generating hydropower to supply businesses and households, acting as reservoirs of consumable water, or serving as multifunctional dams that incorporate both purposes of irrigation and hydro-power production (Tutwiler 2019).

Currently, Ethiopia is building the Grand Ethiopian Renaissance Dam (GERD), a new dam along the stream of the Blue Nile within its borders. The GERD's function is to generate hydroelectricity for Ethiopia, boosting the aggregate electricity output from 4000 megawatt (MW) to about 6450 MW (Leithead 2018). Ethiopia, moreover, plans to sell any excess electricity to neighboring countries, such as Sudan, increasing its yearly foreign exchange income by 1 billion dollars (Conniff 2017).

The GERD in Egyptian Context

The GERD poses as threat to downstream countries' Nile water supply (Leithead 2018). Ethiopia is an upstream country, supplying the Nile; consequently, such a project will greatly impact downstream, receiving countries. The furthest downstream country is Egypt; hence, it is one of the most affected nations by the GERD. The country currently encompasses over 100 million residents, who almost entirely depend on the Nile for arable land, consumable water, and irrigation (Leithead 2018). Exacerbating this reliance, dry climate and little rainfall characterize Egypt's geographical environment, leaving water for consumption and irrigation almost completely obtained from the Nile. In addition, the Egyptian population is growing at an excessively rapid rate; as a result, the country is facing a rising water scarcity as it cannot meet the surging demand for water (Samir 2018).

The GERD is expected to cause a severe decline in Egypt's water supply, aggravating the existing shortage (Conniff 2017). Along with consumption purposes, Egypt's population rely on the Nile for irrigation, arable land for cultivation, and the majority of employment opportunities. These elements are some of the primary building blocks of Egyptian society. Accordingly, the GERD jeopardizing these aspects is an explicit, destructive threat to Egypt and the welfare of its people. With Egypt's geographical location, fresh water sources are limited. In fact, Egypt is considered one of the poorest nations pertaining to the water share per capita: the country's consumption exceeds its resources as it largely depends on the transnational flow of the Nile water (Conniff 2017; "Security Implications" 2018).

Egypt's Water Deficit

The primary sources that supply Egypt with consumable water are the Nile river and underground water. Furthermore, Egypt receives only around 80 millimeters (mm) of rain annually (Dakkak 2018). Evidently, the Nile provides Egyptians with 97% of the available fresh water; it is essentially the only source of water for irrigation and consumption (“Security Implications” 2018). Egypt’s entrenched reliance on the Nile is heightened due to the existing dry climate and desert land with fertile soil mostly available along the river’s banks. Out of Egypt’s vast, desert land, only six percent is arable, located within the Nile Delta (Dakkak 2018). The Nile provides both the fertile soil and the water necessary for irrigation of agricultural fields.

Currently, Egypt has an annual water deficit of 13.5 billion cubic meters (m³) that is estimated to continuously increase to 26 billion m³ by 2025 (Omar 2016). The annual water share per capita is also at a deficiency, as it has declined to 700m³ in 2013 (“Security Implications” 2018). The United Nations has declared that this share is less than the required, standardized amount to sustain an individual’s need for water for consumption and irrigation (“Security Implications” 2018). The UN also stated that the share per capita is predicted to drop even further to 350m³ annually by the year 2050 (“Security Implications” 2018). In 2017, the amount of water allotted to each Egyptian resident was 660 m³, in contrast to 9,800 m³ for every United States resident (Conniff 2017).

Along with this existent water scarcity and rapid increase in population, the Grand Ethiopian Renaissance Dam (GERD) promises further constrictions on the Nile River flow. The enormous GERD is projected to store close to 74 billion m³ of water, over a negotiable period from 5 to 15 years, in which the Nile water supply coming to Egypt is predicted to decrease by a debilitating 25% (Conniff 2017). Threatening Egypt’s groundwater supply as well, the GERD has the potential to degrade the water quality and intensify the salinity of underground water reservoirs (Ibrahim 2017). In essence, the dam threatens Egypt’s water security.

The Nile River and Climate Change

Global warming and the rising sea levels also play a role in worsening the Nile water supply deficit (Conniff 2017). A study by the Geological Society of America (GSA) reported that the rising sea levels intensified by climate change gravely endanger the Nile Delta (Conniff 2017). The Nile Delta currently rests just about a meter above sea level, which means that if a mere half-meter rise in the sea level were to occur, it would shrink by 19%, according to a 2014 study by geologist Ahmed Sefelnasr at Assuit University (Conniff 2017). This contraction would impact the 63% of Egypt’s agricultural yield and 2.5% of Egypt’s six percent arable land that resides in the Nile Delta (“Security Implications” 2018).

Sefelnasr affirmed that the saltwater melding with the freshwater in the Delta, due to the rising sea levels, could endanger over a third of the region’s consumable water (Conniff 2017). Essentially, these rates convey a direct danger not only to Egypt’s primary freshwater source- the Nile- and food source- agriculture- but also to the livelihood of the 35 million Egyptians residing in the Nile Delta region (“Security Implications” 2018).

Egypt’s Surging Population

Another aspect that intensifies the implications of the GERD is that the population of Egypt is growing at an extreme rate. As the water share per capita shrinks, the population, in contrast, increases by an annual two percent (Wichelns 2001). Since the beginning of the 1990’s, the Egyptian population has increased by a staggering 41% (Dakkak 2018). Reports from recent years, suggest that every week, the population increases by approximately 4,700 births and by 2025, Egypt will host a population of 110 million (Dakkak 2018).

Egypt's rapid increase in population size will, naturally, result in an amplified demand for food, pressuring the already strained agricultural industry and Nile water supply to produce higher yields. In fact, irrigation, due to the rising demand for crops, comprises about 86% of all water withdrawals from the Nile ("Security Implications" 2018). The anticipated curtailment of the Nile water flow and the consequent decrease in the water share per capita as the GERD reaches completion demonstrate Egypt's palpable dependence on the Nile river and how the GERD's threats carry even more possible damage.

The Nile River and the Egyptian Economy

The Nile is the backbone of the Egyptian economy, nurturing copious businesses such as hotels and restaurants and industries like tourism and agriculture. The agricultural industry and its subsidiaries offer countless job opportunities for Egyptians, especially the youth, and therefore, contribute to the nation's GDP by a significant 14.5% ("Security Implications" 2018). In fact, Egypt's current Minister of Water Resources and Irrigation Mohamed Abdel Aty expressed his disdain at the risks presented by the GERD, stating that if the water flow coming via the Nile dwindled by a mere two percent, the country would lose around 200,000 acres of arable land that feed 200,000 families and employ around one million Egyptians (Leithead 2018). Abdel Aty labeled the GERD's endangerment of Egypt's primary water source as "an international security issue" (Leithead 2018).

Another effect of the GERD that will debilitate businesses and industries and thus the economy is that the dam has the potential to diminish the energy supply generated from the Aswan High Dam by a rate ranging from 20% to 40% (Ibrahim 2017). This accentuates Egypt's dependence on the Nile, as the slightest change to this water body due to the GERD is expected to cause visible, severe consequences to both agriculture and the amount of consumable water available in the country.

The GERD and Egypt's Sociopolitical Stability

Accordingly, political and social stability are also in jeopardy, as the January 2011 revolution objected to the high level of unemployment, at the time, that was accompanied by an inflation of food prices, which are likely to reoccur with the GERD's threats to agriculture, potentially indicating another uprising that could hinder Egypt's social and economic development and destabilize the country ("Security Implications" 2018). Moreover, the GERD leaves Egypt vulnerable to losing a substantial percentage of its annual revenue, mainly because the agriculture industry and its subsidiaries present the Egyptian youth with the majority of the available employment opportunities ("Security Implications" 2018).

The dam threatens Egypt's agricultural food supply and crop yield, potentially triggering a ripple effect on other subsidiary industries such as textile and cotton. With this in mind, it is evident that the GERD holds a damaging aftermath to practically every function of the Egyptian society, economy, and development, accentuating the significance of the Nile to the country as well as the severity of the aftermath of a potential water decline due to this Ethiopian dam.

Proposed Solutions

Furthermore, Ethiopia has been to a large extent has been reluctant to engage in diplomacy. It has pursued the construction of the dam, while evading the Nile Basin countries' concerns and objections since it financed the five billion dollar project independently (Tutwiler 2019). Despite these obstacles and threats posed by the Grand Ethiopian Renaissance Dam (GERD), there are numerous solutions that Egypt can implement to conserve the present water supply and minimize the impact of the GERD on the country

and its development. The proposed solutions incorporate both policy changes and practical, behavioral changes of both businesses and individuals.

Firstly, stricter rules need to be applied to ensure that neither factories nor households discard their toxic waste into the Nile. The Egyptian government, moreover, should monitor the effective execution of national policies that mirror the worsening water scarcity, in a sense that raises awareness and establishes firm regulations regarding water allocation, irrigation, and drainage (Wichelns 2001). These policies should aim to conserve and efficiently distribute water for businesses, households, and individuals.

Adopting a new irrigation system, such as the drip or sprinkler irrigation systems, and replacing Egypt's wasteful and obsolete "flooding" system can possibly conserve up to 60% of the water expended and even enable the country to cultivate twice as much land (Elnur 2019; Omar 2016). There are several systems, pertaining to irrigation and agriculture, that can save water and amplify production. Currently, Egypt's plan for efficient water usage is compromised by pollution of the available water bodies, incompetent water delivery infrastructure, and wasteful irrigation systems throughout the majority of Egyptian fields ("Security Implications" 2018). Evidently, from all of the fields irrigated on Egyptian land, only six percent operate with improved irrigation methods ("Security Implications" 2018). As a result, Egypt ranks among the bottom 10% of the countries in the Middle East and North Africa (MENA) for irrigation efficiency ("Security Implications" 2018).

Timing land irrigation and automatically measuring leaks in distribution pipes and drains in new agricultural fields to avoid added water waste are samples of viable alternatives to Egypt's current inefficient operational methods (Omar 2016). Similar to Saudi Arabia, Egypt can desalinate water from the Mediterranean and Red seas, in addition to underground water, to procure consumable, fresh water (Conniff 2017).

Extracting deep groundwater, for instance, from the Nubian aquifer with a desalination resource, is an alternative approach by which the country can obtain more water, abating some of the GERD's aftermath (Omar 2016). Moreover, it is imperative that Egypt monitors the sediment buildup in the Aswan High Dam due to the GERD, as it could inhibit water from reaching other parts of the country beyond the dam and impede silt- a natural fertilizer- from reaching the Nile Delta and surrounding fields. This is especially important to prevent farmers from resorting to chemical fertilizers, which are harmful for humans, animals, and the environment (Tutwiler 2019).

Firm policies are also essential to prohibit the disposal of agricultural waste, such as industrial emissions, pesticides, and untreated sewage, into the Nile River as they are gradually contaminating the water into becoming unsuitable for human consumption ("Security Implications" 2018). Lastly, collective cooperation between the Nile Basin nations to mediate any ongoing or future Nile-based projects and ensure equitable division of the Nile water is vital (Tutwiler 2019). This can be exemplified through the Nile Basin Initiative (NBI). The NBI is a program established in 1999 that serves as a means "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from the common Nile Basin water resources" (Tutwiler 2019).

Current Solutions and Plans

Egypt's Minister of Irrigation and Water Resources Mohamed Abdel-Aty explained that Egypt has implemented several policies and preventive measures to protect Egypt and its water rights (Egypt Independent 2021). He explained that the country has established a strong infrastructure system surrounding the Aswan High Dam to protect Egypt by absorbing large amounts of water before reaching Lake Nasser, "in the event that the... GERD collapses" (Egypt Independent 2021). Abdel-Aty underscored that the ministry is "ready for all options" (Egypt Independent 2021). The country formed an international committee that spanned from

2011 to 2013, which concluded that the GERD suffers “major technical problems... [that] could lead to instability” (Egypt Independent 2021). Minister Abdel-Aty commented that the country is concerned and is seeking to be prepared on various fronts to stay ahead of any consequences of the GERD’s “‘suspicious’ construction” (Egypt Independent 2021). During the long negotiations between Ethiopia and the basin countries over the GERD, Egypt and Sudan have been seeking “legally binding agreement on operating the dam,” to protect the nations’ water rights (Egypt Independent 2021).

As a part of its four-pillar approach to alleviate water scarcity, Egypt launched the National Water Resources Plan (NWRP 2017-2037), a “EGP 900 billion, 20-year initiative involving nine ministries and various international partners” (Egypt’s Strategy 2018, 2). The plan’s budget involved EGP 240 billion allocated by the Ministry of Water Resources and Irrigation and EGP 70 billion allocated by the Egyptian government “towards solving Egypt’s water shortage crisis” (Egypt’s Strategy 2018, 2).

The first pillar of the NWRP was concentrated on enhancing water quality by controlling pollution, managing solid waste, and treating groundwater and sewage water (Egypt’s Strategy 2018, 2). The second pillar focused on water conservation through various methods, including but not limited to increasing irrigation efficiency, investing in farming technology, improving water management, and optimizing the Egyptian population’s water consumption (Egypt’s Strategy 2018, 2).

The third pillar was centered on water resources’ development including desalination plants and harvesting and storing fresh water (Egypt’s Strategy 2018, 2). In fact, Egypt just inaugurated ‘the Bahr El-Baqar’ wastewater treatment plant in September 2021 (Wagner 2021). This mega wastewater treatment plant is located in Port Said governorate, costing over EGP 20 billion, comprising over 1,250,000 cubic meters, and holding three Guinness World Records as “it is the largest structure of its kind as well as the world’s biggest solar-powered sludge drying system” (Wagner 2021). Finally, the fourth pillar’s core is raising awareness among the Egyptian population through different approaches to capacity building and awareness media campaigns (Egypt’s Strategy 2018, 2).

Conclusion

With the preexisting water shortage and dry climate, the scarcity of alternative freshwater sources, and rapid surge in population, Egypt is likely to experience an intensified decline in the Nile river water supply due to the GERD. A decline that could deeply impact the nation’s population, economy, development, and overall societal stability. Furthermore, Ethiopia’s construction of the GERD will aggravate the existing water supply deficit. During its filling period, the dam has the ability to curtail the Nile water flow by about 25%, which could greatly imperil the economic and social wellbeing of Egypt (Conniff 2017).

The GERD’s ability to decrease the Egyptian Nile water share has a myriad of effects, entrenched within nearly every field and function within the nation. In fact, not only would the population experience a decline in the water share per capita, but also the agricultural industry, which feeds millions of families and employs around one million Egyptians, would suffer from the water shortage (Leithead 2018).

While the population surges at an annual rate of two percent and the resources, such as water and agricultural yield, remain static or are even reduced as aforementioned, the GERD’s threats will have a progressively dire impact (Wichelns 2001). Finally, the social and political stability of Egypt are also at risk due to the possibility of an uprising as the country would face yet another period of high unemployment and inflation in food prices due to the GERD’s effect on the river and shrinking resources- a situation similar to that which instigated the January 2011 revolution (“Security Implications” 2018). However, there are various feasible amendments pertinent to the water and irrigation policies and operations that

can be implemented to preserve and conserve the Nile water and ensure the equitable division of the Nile water among the Basin countries, such as implementing strict rules against water pollution, adopting new irrigation systems, and searching for alternative freshwater sources or desalination processes (Wichelns 2001; Elnur 2019; Omar 2016).

The most pivotal solution is for the Nile Basin countries to cooperate on the planning of transboundary, Nile-based projects to guarantee minimal water waste and an equitable division of water and shared resources. The Nile is a remarkable asset for all the Basin countries that they can employ for their collective welfare and prosperity, through developing innovative and resourceful strategies by which they can actualize the River's full and rich potential.

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