

The Potential Water, Food, and Energy Security-Related Impacts of the Grand Ethiopian Renaissance Dam – Gerd (Amharic: ታላቁ የኢትዮጵያ ሕዳሴ ግድብ) on the Lower Stream Riparian States and Egypt’s Distinct Concern (Scepticism): A Systematic Review and Qualitative Synthesis

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Abstract: The Nile River is remained to be a critical resource and center of contradiction among the Nile basin states. Scholars argue that Egypt had an upper hand over the use of the Nile River. However, Egypt’s hegemony over the Nile has been significantly challenged since the initiation of the construction of the Grand Ethiopian Renaissance Dam (GERD) in 2011. This creates heavy tension, particularly between Ethiopia and Egypt in the last decade. Though the GERD has been filling the reservoir over the last two years and recently started to generate electric power, the potential negative impacts of the dam over the lower riparian countries remained unclear. This systematic review and meta-synthesis investigated the potential water, food, and energy security-related transboundary impacts of the GERD on the lower riparian states. Furthermore, the research work explored Egypt’s distinct concern over GERD.

The reduction in Nile water volume and velocity, the likelihood of water loss through evaporation, the impoverishment of agricultural lands, the depletion of water reserve, easing of hydroelectric power generation, and the ever-increasing threats in water security are reported to be some of the major water, food, and energy security-related transboundary impacts of the GERD on the lower stream riparian states. On the other hand, the fear of a potential reduction in water supply from the Nile and the consequent occurrence of drought during the dry seasons, and the unresolved tripartite disagreement on the operational detail of the mega-dam are identified to be the major concerns of Egypt over the GERD. Ethiopia has reportedly said the GERD has no significant harm on the lower riparian states. The country believes that the mega project is a way forward to facilitate economic development among the riparian states and mitigate the shortage of electric power in the region.

Keywords: reservoir, tension, downstream/upstream, filling, basin, riparian, transboundary, dam, adverse, impact, cooperation, negotiation

I. INTRODUCTION

Water is essential to sustain life in both the human and overall ecosystems. In almost every region of the world, accessing sufficient water supply is becoming more difficult following the increasing demands associated with industrialization, urbanization, and growing population. Moreover, water is very unevenly distributed both temporally and spatially. Thus, the distribution and consumption of limited water resources can cause various levels of conflict at the local, regional, and even international levels. History reveals and future may confirm that border crossing rivers have a strategic role in creating political tension and potential conflicts among riparian states (Nandalal, 2003). The current frustrating situation among the riparian states of the Nile River, particularly between Egypt and Ethiopia over the construction of the Grand Ethiopian Renaissance Dam (GERD), supports the above argument. This research project is initiated to identify the GERD's potential water, food, and energy security-related transboundary impacts on the lower stream riparian states and assess Egypt's distinct concern (scepticism) over the dam. Furthermore, the project anticipated providing supportive scientific evidence to the solicitous policymakers.

I. Statement of the research problem

Water is an ordinary fundamental asset for the survival of humankind. The practice of food production, horticulture, industrialization, and power generation cannot be imagined without water (Olumide Ogunnoiki & Salihu, 2020). History reveals the wide variety of interests among the Nile Basin states over-consuming the Nile waters. These distinct and sometimes antagonist states’ interests have been sources of contentions and conflicts. Countries like Egypt, Sudan, South Sudan, Uganda, and Ethiopia are reported to have exceptionally high stakes over the Nile River. Whereas,

riparian states such as Tanzania, Kenya, Burundi, and Rwanda are claimed to have moderate stakes over the river. Eritrea and the DRC are also among the Nile Basin states with seemingly low stakes over the Nile. On the other hand, the official launch of the construction of the GERD in 2011 is reportedly opening a new chapter of more intense political tension among the riparian states, particularly between Ethiopia and Egypt. Egypt has begun to insist on the shelving of the construction of the GERD as a condition sine qua non for potential negotiations by referring to her overwhelming reliance on the waters of the Nile (Abdelazim, Bekhit & Allam, 2020). Egypt further looked for provincial help for its inclinations and instrumentalist position by going on a discretionary hostile to subvert support for the construction of GERD. Furthermore, internationally leading Media such as Washington Post had reported the possibility of an attack on the GERD project by Egypt to safeguard her national interests in the areas of Nile River-related food and energy securities (Pemunta et al., 2021).

Different countries in the Nile Basin Initiative, including Sudan, blamed Egypt for exacerbating the situation. On the other side, Cairo dispatched an assignment to Uganda to look for collaboration in restricting the development of the construction of the GERD. Though the Egyptian skepticism over the dam exceed its peak, Ethiopia remained adamant to admit the complaints of the potential adverse effects of the dam over the downstream water stream, rather the country tries to assert continuously the benefits of the GERD (Abdelhaleem & Helal, 2015). These national antagonist interests among the riparian states, particularly between Egypt and Ethiopia, have paused long-lasting political tension in the Nile region. Hence, this study was anticipated to identify the GERD's potential water, food, and energy security-related impacts on the lower stream riparian and assess Egypt's distinct skepticism over the dam (Barakat, 2020).

II. Objectives of the study

The prime aim of the study was to identify the potential water, food, and energy security-related impacts of the GERD on the lower stream riparian and assess Egypt's distinct concern (skepticism) over the dam. The specific objectives are listed below as follow:

- To identify the GERD's potential water, food, and energy security-related impacts on the lower stream riparian
- To assess Egypt's distinct concern (skepticism) over the dam
- To provide evidence-based data for concerned parties (policymakers and politicians)
- To provide baseline data for further research

III. Research questions

1. What are the GERD's potential water, food, and energy security-related impacts on the lower stream riparian states?

2. What are the main reasons for Egypt's distinct concern (skepticism)?

IV. The Significance of the study

The Nile basin features significant political tension over access to and rights over the Nile water resources among its eleven riparian countries. The Nile Basin Initiative (NBI), founded by 10 out of 11 riparian countries in 1999, has succeeded in its attempts to strengthen cooperation (Abdelhady, 2015). However, after Ethiopia initiated the construction of GERD in 2011, the collaboration began to weaken; instead, an intense tension has started to cultivate, the disagreement has brought negotiations to a standstill, especially between Ethiopia and Egypt (Helal, 2020). This research project aimed to identify the GERD's potential water, food, and energy security-related impacts on the lower stream riparian states and assess Egypt's distinct skepticism over the dam. The importance of the project is that it aids concerned policymakers and politicians in coming up with evidence-based round table negotiation and alleviating the overstretched tension among the riparian states, particularly between Ethiopia and Egypt. Furthermore, the study's findings could be used as baseline data for further in-depth studies.

II. LITERATURE REVIEW

I. The Nile River

One of the world's magnificent gifts of life is rivers. Rivers are the ground point of civilization that helped to enrich the insights of human beings. The river Nile is one of the greatest rivers that has triggered the imagination of politicians, adventurers, historians, poets, and explorers with the mystery of the source of its regular annual flood and volume. This phenomenon initiated the era of the discovery of the source of the Nile (Abdelhady et al., 2015). Regarding the Nile River, records were accurately kept since the year 660AD. In addition, during the 20th century, modern scientific studies were conducted to be able to regulate its unpredictable floods (Moghraby, 2018).

The womb of the Nile tombs in Ethiopia, a country located in the horn of Africa. Ethiopia is a land-locked country mostly containing high mountains and depressions with approximately 120 million people living in it (World Population Review, 2022). The country is wealthy in the source of water; 124.4 billion m³ river water, 70 billion m³ lake water, and 30 m³ groundwater resources. Unfortunately, these water resources are not well utilized. All in all, there are around 12 major river basins, 11 freshwater lakes, and 9 saline lakes in Ethiopia (Handiso, 2018).

The river Nile is one of the major rivers in Ethiopia and across the corresponding riparian states. The river is a home for a total of nearly half a billion dwellers habituated in the riparian states and whose livelihood is entirely attached to it. The Nile River travels across the political borders of several countries, which makes it one of the largest transboundary rivers in the world (Liersch & Hattermann, 2017). The Nile is shared by

eleven African countries namely; Tanzania, Uganda, Burundi, Egypt, Ethiopia, Eritrea, Sudan, South Sudan, Kenya, the Democratic Republic of the Congo, and Rwanda. The Nile River is also called to be “Abay”, an Amharic name, as the river finds its source in Lake Tana (Melat, 2020).

The major portion (86%) of the Nile River is made through the contribution of the Blue Nile, which originates from the Ethiopian highlands. The remaining 14% of the river is filled by the White Nile, which originates from Burundi and flows through the Equatorial Lakes (Victoria, Kyoga, and Mobutu) to the Sudd swamps of Sudan (Mohyeldeen, 2020). Similar to the Nile River, the Blue Nile passes through eleven (11) countries of Africa including Tanzania, Uganda, Burundi, Rwanda, the Democratic Republic of Congo (DRC), Ethiopia, Kenya, Eritrea, South Sudan, Sudan, and Egypt, before reaching the Mediterranean Sea. The Nile is a primary source of water for around 430million African accounting for one-tenth of the overall population in the continent (Pemunta et al., 2021).

II. Historical background

As history witnesses, Ethiopia and Egypt have had a strong cultural, religious and commercial bond merely for untraceable years. The intimate bond of the countries was gained through the Nile River. The Nile is the largest river in Africa and has played an enormous role in the geopolitics of North and East Africa (Obengo, 2016). Inopportunately, the politics of the Nile have been full of mistrust, anxiety, tension, and diplomatic confrontations between the upstream and downstream countries. The Nile hydro politics induced political confrontations among the riparian states has strung out the area to several proxy conflicts and major hostilities in the last decades (OlumideOgunnoiki & Salihu, 2020). Scholars argued that the fair utilization of the water from the Nile River has been shadowed and biased by colonial-era treaties. Furthermore, the century-old mistrust cynicality among Egypt, Sudan, and Ethiopia, who have fought over the Blue Nile basin, has played a major role in forming the deadlock situation over the Nile hydro-politics. The pioneer water politics expert Prof. Yacob Arsano has divided the historical agreements on the utilization of the Nile into three categories (Obengo, 2016).

1. Agreements between colonial powers: the Anglo–Italian protocol of 1891, the 1906 agreement, the 1925 Anglo–Italian agreement, and the 1934 agreement between Britain and Belgium.
2. Agreements between colonial powers and regional states: the 1902 Anglo–Ethiopian agreement, the 1929 agreement between Britain and Italy, and the 1952 agreement.
3. Agreements between independent states of the basin: the 1959 agreement signed by Egypt and Sudan, the 1993 Ethio–Egyptian agreement, and the Comprehensive Framework Agreement signed among the seven basin countries in 2010.

The first two bilateral agreements were initiated by the then colonial powers of the basin. Referring to the 1929 Nile waters agreement, 48 billion m³ was allocated to Cairo under the supervision of the British colonial (Mohyeldeen, 2020). In 1995 the Nile treaty was revised and made Egypt wealthy with the share of 55 billion m³, paving a convenient path for the construction of the Aswan dam. Inevitably, Aswan, which is the largest manmade water reservoir on the planet, erased the overdependence of Egypt on Nile flooding while infuriating upstream riparian countries, not least Ethiopia. Hence, the revised agreement of the Nile deranged the erratic relationship of the two countries and raises tension (Dahir, 2020).

On 22nd February 1999, an initiative called the Nile Basin Initiative (NBI) was formulated in an attempt of creating an all-inclusive utilization of the basin (Moghraby, 2018). The initiative was initiated to sustainably utilize and manage the basin development across the Nile basin countries. The NBI is one of the first inter-governmental initiatives which was a transitional institution until the Cooperative Framework Agreement negotiations were finalized and a permanent institution was created (Obengo, 2016).

III. Gerd

Ethiopia has decided to utilize its water resource for the generation of electric power. The country often claims that the project of generating electric power is not only dwelling on the nation-wide advantages but also considering the benefit of the region and the entire continent (Abdelhady et al., 2015). The aforementioned narration is referring to the impactful dam that is being built in Ethiopia, which is felt in the two downstream countries; the Sudan and Egypt. In the year 2011, the government of Ethiopia came up with an ambitious plan to build a dam over the river Blue Nile, the major tributary of the Nile, and began to build a massive hydroelectric dam. The project was initially named ‘Project X’ then called the ‘Millennium Dam’ and eventually obtained the name ‘Grand Ethiopian Renaissance Dam (GERD)’. The desire of constructing a dam on the Nile River is reported to trace back to the reign of Emperor Haile Selassie (Tesfa, 2013).

Unlike the 1990s and before, when Egyptian authorities successfully stopped Ethiopian attempts to build dams, a problem that has limited Cairo’s ability to prevent the GERD was the Arab spring. During this period, domestic issues disentangled Egypt from regional diplomacy and led to a discontinuation of its participation in the Nile Basin Initiative. In his short stint as president, Mohamed Morsi unsuccessfully struggled to assemble a coherent diplomatic effort to freeze the GERD. The military coup in 2013 led to the expulsion of Egypt from the African Union, further deteriorating Cairo’s position to confront the Ethiopian project. Therefore, the success of the GERD project can at least be partially attributed to the diplomatic disarray of Egypt following the Arab Spring events. On the other hand, Khartoum was caught off guard by the announcement of the GERD dam which it had opposed fearing its negative impact on downstream

countries. During this time, Sudan was grappling with domestic unrest and was preparing for the prospect of South Sudan's separation. However, in the following year, Khartoum shifted its position, accepting the Ethiopian dam for several reasons and re-joining the Nile Basin Initiative (Dahir, 2020).

The GERD has a length of 1,780m and is located in the Benishangul-Gumuz Region, which is 15km east of the Ethio - Sudanese border. The dam is being constructed to capacitate 63 billion cubic meters of water and generate 6450 megawatts (MW) of electricity making it the largest hydroelectric power plant in Africa. Furthermore, the GERD has reportedly ranked tenth in the world in terms of electric power generating capacity (Melat, 2020). Generally speaking, the dam is supposed to hold 74 x10⁹m³ of water and is estimated to produce 5570 MW per hour. It is estimated to take around 5 to 15 years to fill the dam with water. As the construction is progressing the Egyptians remain protesting while the Sudanese are indivision of opinions. However, the official stance of Sudan is believed to be in support of the construction of the dam (Pemunta et al., 2021).

On the other hand, the construction of the dam raised several concerns including lack of clarity on the efficiency of the dam, the negligence of conducting environmental and social impact assessment (ESIA), deficiency of reliable evidence regarding the impact of the dam on water, food, and energy security of the lower riparian states, and insufficient of data on the overall adverse effects of the dam on the ecosystem (Barakat, 2020).

To clear up these confusions and other controversies over the dam, the Ethiopian government was pressured to propose the formulation of a committee of experts consisting of 10 members recruited two from each country (Ethiopia, Sudan, and Egypt) and four from the international community (Helal, 2020). The committee met secretly. However, according to the leaked information, the committee was only focused on certain environmental, economic, and social-related agendas of the dam (Liersch & Hattermann, 2017).

On the other hand, the water misters of the three countries have reported to sat down for discussion eighteen times (up to May 2018) without reaching positive mutual agreements. In the meantime, the battle of words outburst between supporters and opposers of the dam. The supporters and opposers of the dam were predominately from Ethiopia and Egypt, respectively. Let alone the ordinary people, the battle submerged diplomats and academicians from both sides (Mohyeldeen, 2020). Recalling the original standpoint of Sudan, the president of the country imparted a huge amount of money, perhaps millions of dollars to support the construction of the dam. Albeit the GERD is a national pride and main agenda of Ethiopia, Egypt and Egyptians were in absolute opposition to the ongoing construction of the dam. On the 23rd of March, 2015th the presidents of the three countries signed a memorandum of understanding on the principles of the dam. Thus, they agreed on deploying an independent

company to study the Environmental and Social Impacts of the dam. Meanwhile, the construction progressed and the first filling should have commenced in August 2017; however, the conserving issues were not resolved and the impact assessments were not finalized (Moghraby, 2018).

IV. Geo-hydro politics and power dynamics over the GERD

The non-discriminatory utilization of the Nile Basin River (NBR) has been a central issue of misunderstanding among states residing over the NBR region for several centuries (Atwan, 2018). History has revealed that the riparian countries have been entangled in water, energy, and national security-related disagreements (Morsy et al., 2021). Factors ranging from historical disagreements over the Nile water utilization to Ethiopia's unilateral decision of constructing the GERD are reported to rifle the relationship between Egypt and Ethiopia. Factors such as climate change, desertification, population growth, and the involvement of other nations including China, the United States of America (USA), United Arab Emirates (UAE), and Qatar are reported to intensify the disagreement between the two countries. Egypt has been accusing the unilateral decision of Ethiopia to construct the GERD, which undermines her national water security interests over the Nile. On the contrary, Ethiopia has remained to decline Egypt's objection and other concerns related to GERD (Mohyeldeen, 2020).

Furthermore, Ethiopia has accused the US government, which has been the arbitrator between Ethiopia and Egypt over the GERD of being biased and siding with Egypt. This is in the wake of the US Secretary of State approving a plan to hold up an estimated USD 130 million of foreign assistance to Ethiopia as a means of pressuring her to the negotiating table (Pemunta et al., 2021).

Reports revealed that the various colonial treaties and water agreements, which reportedly favored Egypt, have given the country the exclusive right to control and utilize the Nile water for the last century. Scholars argue that Egypt's anger over Ethiopia's decision of constructing GERD should not be surprising (Wolf & Hamner, 2000). The decision to construct the GERD challenged Egypt's historical control over the Nile River, a major factor to create tension between the two sovereign states. On the other hand, factors such as climate change, whose implication is diminishing resources needed to satisfy the rapidly growing population amid scarce resources and the uncertainty over the potential drawbacks of the dam are reported to worsen Egypt's concern over the construction of the GERD (Kansara et al., 2021).

The national interests of China, which claims to finance to the GERD, the interest of Egypt favored Western donors such as the USA, the power competition of the two superpowers (China and the USA) and the GERD as the new battlefield, the involvement of UAE, and the preceding volatile nature of the region have been reported to play a determinantal role in shaping the geo-hydro politics and power dynamics concerning the construction of the GERD (Bernauer, 2015).

Scholars foresee two potential scenarios about the geo-hydro politics and power dynamics in the region. The first one is that the geo-hydro politics and power dynamics could herald a new era in water cooperation in the basin. Accordingly, the fair utilization of the Nile water could be regarded as a guarantor of economic prosperity for both households, communities, and large-scale industries in the region. Therefore, the Nile basin's water regime would remain a significant component of the strategic and security policy of states of the region (Wolf et al., 2005). On the contrary, any approach other than strengthening cooperation could provoke political, economic, and military retaliation from countries of the region, which would be catastrophic (Pemunta et al., 2021). The latest news vis-à-vis the water diplomacy is under the auspices of the African Union (AU) and negotiations on the Grand Ethiopian Renaissance Dam (GERD) remains stalled (Ministry of Foreign Affairs, 2021).

III. METHODOLOGY

Generally speaking, the methodology of this research project consisted of topics such as research design, procedures of data collection, and extraction of data.

I. Research design

The researcher conducted a systematic review- qualitative synthesis (meta-synthesis) to condense the results of primary research and provide reliable answers to the research questions (Thomas & Harden, 2008).

II. Procedures of data collection

The data collection procedure adhered to the following strict predesigned approaches to come up with pertinent information for data analysis (synthesis) (Yin, 2018). This section included the searching strategy, sampling technique, inclusion criteria, and quality assessment measures employed during data collection.

A. Searching

An electronic search on Political science and International Affairs database Library, OAC Library, the CSI Library, and MIT Library was conducted. The search strategy used terms such as GERD, GERD's transboundary impact, and GERD's Lower Stream Riparian States. The work was cohered to the Qualitative Research Quality Checklist (QRQC) guideline.

B. Sampling techniques

Like meta-analysis, meta-ethnography (synthesis) utilizes multiple empirical studies, but, unlike meta-analysis, the sample is purposive rather than exhaustive because the purpose is an interpretive explanation and not prediction (Polit & Beck, 2012). Therefore, the purposive sampling technique is used to select.

C. Inclusion criteria and quality assessment

Peer-reviewed articles, which discuss the potential water, food, and energy security-related impacts of the GERD on the

lower stream riparian countries and Egypt's distinct concern over the dam, were considered for data analysis.

Assessing the quality of qualitative research is essential in meta/thematic synthesis. Hence, QRQC guideline was used to assess the quality of selected articles in this study.

D. Extraction of data

The 'key concepts' from 'conclusion' and 'results' or 'findings' were emphasized as a source of pertinent information and extracted for data analysis (Thomas & Harden, 2008).

IV. THEMATIC SYNTHESIS- DATA ANALYSIS

The data analysis had three stages: the coding of the findings of primary studies 'line-by-line'; the organization of these 'free codes' into related areas to construct 'descriptive themes'; and the generation of 'analytical themes' (Thomas & Harden, 2008). In addition, the researcher used Max Qualitative Data Analysis (MAXQDA) qualitative and mixed methods data analysis software to facilitate data storage and organization. In the end, the data extracted from the electronically searched articles were compiled and analyzed. In general, the overall process of the thematic synthesis- data analysis went through the following key steps.

I. Thorough reading

The entire content of each article included for data analysis was rigorously read. Pertinent information has been highlighted and marked.

II. Developing a category scheme

Data organization was the second step in the data analysis process of this study. The data were indexed and classified into manageable units (depending on concept similarity) to be able to easily retrieve and review. The category scheme focused on ascertaining the core objectives of the study (Polit & Beck, 2012).

III. Coding the qualitative data

The data obtained in the data collection process was classified based on the similarity in information and assigned codes by the researcher to differentiate later one from the other in organizing and analyzing the data (Polit & Beck, 2012). After coding text category scheme was formed.

IV. Generating analytical themes and thematic synthesis

The data obtained from reviewing the articles were rewritten in word format. The formatted data was organized and stored into the MAXQDA software to preserve it in a retrievable form. Later, the well-managed data helped to make the data analysis straightforward. The data obtained from the review was eventually converged to come up with the research findings, which are discussed in the upcoming chapter of this research work (Polit & Beck, 2012; Yin, 2018).

V. FINDINGS OF THE STUDY

The results of the systematic review and meta-synthesis have

been organized around the main aim and objectives of the study.

I. Databases Search Result

The initial search from all the databases yielded a total of 56 studies. Out of the total, 25 were considered potentially relevant based on title and/or abstract review. Accordingly, the full text of all these articles considered to be potentially relevant was accessed through searching the OUC library and using google search. After an in-depth review of the retrieved full texts, 13 studies fulfilling the inclusion criteria were finally selected for data extraction and analysis.

Finally, all the 13 articles selected for data extraction and analysis underwent through QRQC critical appraisal checklist, which consists of a series of questions to assess the internal validity and external validity of each study identified. After data analysis, the overall findings of the study are presented in two major themes. The first theme presents the overall impacts of the GERD on the Nile basin states. This theme is further refined into two subdivisions. The first subsection presents the negative aspects of the GERD on the lower stream riparian states, that is, water, food, and security-related unwanted impacts of the GERD. Whereas, the second subsection reveals the positive impacts of GERD as works of literature report. The second major theme hosts Egypt's distinct concern (skepticism) over the GERD.

II. The overall impacts of the GERD on the Nile basin states

The construction of the GERD was launched in 2011 by Ethiopia. The GERD is reported to be one of the biggest projects in the country. The GERD is considered as a mega asset and the source of National pride in Ethiopia. Ethiopia believes that the mega project is a way forward to facilitate economic development and mitigate the shortage of electric power in the country. Furthermore, Ethiopia has been repeatedly mentioning the multidimensional advantages of the GERD for the region and lower riparian states (Handiso, 2018). However, the lower riparian states, particularly Egypt and Sudan have been forwarding their doubt and concern over the ongoing construction of the dam. Egypt and Sudan have expressed their concern about the project's impact on the efficiency of High Aswan Dam and Roseries Dam, respectively. The issue of water security seems their leading concern (Aziz et al., 2019). Amid the complex decade-long diplomatic dispute embroiling these three countries, Ethiopia is currently (February 20, 2022) gearing up to begin testing hydropower generation at GERD (Sudan Tribune, 2022). Yet, the GERD is remained to be the subject of controversies after the UNSC has sought to alleviate tensions and the African Union (AU) continues to broker negotiations to invigorate talks among the three Nile basin states and maintain peace in the volatile dispute (OlumideOgunnoiki & Salihu, 2020). The following subsections present the negative and positive impacts of GERD as reported in the reviewed literature.

A. Water, food, and security-related negative impacts of the GERD on the lower stream riparian states

Article 5 of the 1997 UN convention discussed the equitable and reasonable utilization Principles regarding border crossing rivers. The article states that "The Watercourse States shall in their respective territories utilize an international watercourse equitably and reasonably. In particular, an international watercourse shall be used and developed by watercourse States to attain optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of the watercourse States concerned, consistent with adequate protection of the watercourse. Watercourse States shall participate in the use, development, and protection of an international watercourse equitably and reasonably. Such participation includes both the right to utilize the watercourse and the duty to cooperate in the protection and development thereof, as provided in the present Convention" (Tanzi, 1992).

In contrary to this international law, Egypt and Sudan have been pleading with their colonial use rights, which is considered to be antithetical to the principle of equity, reasonable utilization, and participation. Referring to these international principles, Ethiopia has been remained adamant on its decision of constructing the GERD, amid diplomatic turmoil over the last decade (Tadese, 2020). Ethiopia has initiated an independent committee to investigate the potential transboundary impact of the GERD on the lower riparian nations based on the principle of co-operation "The Watercourse States shall cooperate based on sovereign equality, territorial integrity, mutual benefit and good faith to attain optimal utilization and adequate protection of an international watercourse. In determining the manner of such cooperation, watercourse States may consider the establishment of joint mechanisms or commissions, as deemed necessary by them, to facilitate cooperation on relevant measures and procedures in the light of experience gained through cooperation in existing joint mechanisms and commissions in various regions" described under the Article 8 of the New York UN convention (Tanzi, 1992). Furthermore, the country claims herself to adhere to the no-harm rule of "Watercourse States shall, in utilizing an international watercourse in their territories, take all appropriate measures to prevent the causing of significant harm to other watercourse States" stated under Article 7 of the 1997 UN Convention (Tanzi, 1992). Accordingly, Ethiopia has reportedly said the GERD has no significant harm on the lower riparian states (Ministry of Foreign Affairs, 2021).

On the contrary, Egypt has been accusing Ethiopia of her ignorant to call the Nile basin countries (key stakeholders) to discuss the mega hydroelectric project (GERD) before launching its construction officially in 2011 based on Article 5 of the 1997 UN convention (Tanzi, 1992).

In addition to the legal concern, Egypt and sometimes Sudan have been expressing their concern on the potential adverse effects of the GERD on the lower riparian states. Consequently, the findings of this review support the various

concern of the lower riparian countries including Egypt and Sudan. Accordingly, some of the articles included in this study have reported mild to severe water, food, and security-related effects of the GERD on downstream countries, particularly of Egypt. These effects include changes in surface water level, groundwater levels in shallow and deep aquifers, saltwater intrusion, evaporation loss, and increases in soil salinity, which could affect crop yields (Aziz et al., 2019). On the other hand, Hammond (2013) argued that GERD would have a significant water shortage effect on Egypt and Sudan, underlying the outweigh effect of the dam on Egypt compared to Sudan.

A mathematical model developed in 2013 to predict the potential consequence of the construction of GERD on Egypt's water resources security reported a 5.9% reduction in water volume after evaporation loss. The model also predicted a significant reduction in storage of Lake Nasser within a few years (Ramadan et al., 2013).

In general, decrease in Nile water level, increase in evaporation losses, reduction in Nile water velocity, impoverishment of agricultural lands, and associated water source scarcity, deteriorations of food production, hydropower losses, and security concern was mentioned as potential transborder impacts of the GERD on the riparian states, particularly on Egypt (El-Nashar & Elyamany, 2018). Increased likelihood of a flood in Sudan and potential drought in the downstream countries including Egypt during the upcoming dry spells were also reported in the reviewed literature (Kansara et al., 2021). In the short term, the construction of the GERD is also reported to influence the volume of the irrigation water obtained from the High Aswan Dam (HAD) for agricultural practice in Egypt. The annual energy output from HAD during the filling and after the filling stage of GERD is estimated to reduce by 7% to 12% (Mulat & Moges, 2014). Furthermore, Abdelhaleem and Helal (2015), indicated that Egypt may suffer from a 5 - 15% reduction in water share following the construction of the GERD. The possibility of GERD-induced severe environmental, economic, and social problems on people residing in the lower riparian states have been also reported (Ramadan et al., 2013). Other GERD-induced environmental impacts such as the blockage of migration routes of fish, alteration of the overall ecosystem, and revamping of the terrestrial life around the reservoir were reported in the reviewed literature (Morsy et al., 2021).

B. Positive impacts of the GERD on Ethiopia and the lower riparian states

Contemporary literature does not only discuss the ill-consequences of the GERD on the lower riparian states. The advantages of GERD were also explained in different research works (Tesfa, 2013). This systematic review and meta-synthesis have identified and included some pertinent research papers that have highlighted the potential advantages of GERD.

Reports revealed that the mega GERD project is expected to generate 6000 MW of hydropower energy with an annual energy production of 15130GWH, which is anticipated to cover the power supply-demand in the country as well as in the East Africa region (Mulat & Moges, 2014; Tesfa, 2013). Moreover, Tesfa (2013) argued that GERD has a beneficial effect on Egypt and Sudan in terms of removing silt and sedimentation by 86% and regulating steady water flow, which is essential to avoid unexpected flooding to downstream countries, through conserving water in Ethiopian highlands. Generally speaking, the capability of the project to be a power hub for east and north Africa, the vitality of the GERD in regulating steady water flow and potential flood in Sudan and Egypt, the GERD role of water conservation for Sudan and Egypt in Ethiopia highlands, and the GERD enormous impact in managing sedimentation are reported to be the major advantages of the GERD project (Tesfa, 2013). For instance, Sudan is endowed with an abundance of fertile land suitable for commercial agriculture. However, a major problem that faces the sector is the annual Nile floods that force Sudanese authorities to spend millions of dollars on managing sediments. Sudan believes the GERD will regulate the flood, thus benefitting Sudanese farmers and increasing harvests annually with greater crop yields (Maroudis, 2019). Another point on Sudanese backing of the Ethiopian project relates to the prospects of the dam's cheap electricity, which Sudan plans to draw on rather than producing it domestically. Furthermore, a well-regulated yearly water flow will enable Khartoum to efficiently expand its power production in its main dams (i.e., Roseires, Sennar, and Merowe). For all these factors, Sudan has supported the GERD in the course of the tripartite negotiations and disputed the Egyptian argument that the GERD would significantly reduce the water flow downstream. Though the country's position over the construction of the GERD is reportedly eventually shifted (Dahir, 2020). The GERD can also foster cooperation, mitigate climate change uncertainties, and catalyze greater market integration and trade (OlumideOgunnoiki & Salihu, 2020). Indeed, the GERD is reported to enhance the water security of Ethiopia and the region following the dam's ability to increase the annual storage capacity by 74 BCM. This water security increment can be used to supply various sectors for multipurpose (Handiso, 2018).

III. Egypt's distinct concern (skepticism) over the GERD

Egypt is the most and the third most populous country in the Arab world and Africa, respectively. Egypt constitutes a growing population of 105 million (World Population Review, 2022). It has been reported that the country has seen the GERD as an existential threat (OlumideOgunnoiki & Salihu, 2020). According to works of literature reviewed in this systematic review and meta-synthesis, Egypt's distinct concern (skepticism) over the GERD is primarily originated from the fear of a potential reduction in water supply from the Nile and the occurrence of drought that follows the shortage of water during the dry season. Furthermore, Egypt is concerned about no tripartite agreement has been reached yet

among Ethiopia, Sudan, and herself on the GERD reservoir's filling schedule (Abdelazim et al., 2020).

The Nile River is reported to be the source of more than 90% of Egypt's freshwater. Egypt has proposed to Ethiopia to fill the mammoth dam's reservoir, which is reported to be bigger than the size of Greater London, over 15 years. However, Ethiopia has declined Egypt's proposal and planning to fill the reservoir within 3-7 years. In addition, Egypt is skeptical about the amount of water Ethiopia can potentially release at the time of multi-year droughts. Accordingly, the above-mentioned concerns and the country's overwhelming reliance on the Nile waters have forced Egypt to request for the immediate shelving of the GERD construction as a condition sine qua non for negotiations. However, Ethiopia remained adamant about Egypt's concerns and running the construction of the gigantic dam on the continent (Olumide Ogunnoiki & Salihu, 2020).

In general, Egypt's skepticism in part arises from the scholar's argument that the GERD has a clear negative impact on downstream countries, especially at the end of the irrigation network in the Egyptian Delta (Abdelhaleem & Helal, 2015). Furthermore, reports revealed that GERD can negatively affect the volume of surface water, the quantity of groundwater, and the soil quality, which later on result in salt accumulation. Scholars argue that this effect may cause the deterioration of agricultural production and associated economic crisis in Egypt (Heggy et al., 2021). In other words, a shortage of surface and groundwater, a decrease in soil quality, and the reduction of favorable agricultural fields that can be cultivated by economic crops-such as rice and maize-could affect the Egyptian economy (Aziz, 2019).

VI. CONCLUSION AND RECOMMENDATION

The GERD is anticipated to increase the availability of electric power by 200% in Ethiopia. Hence, the accomplishment of the GERD project is assumed to be a milestone for economic developments in the country (Dahir, 2020; Embassy of Ethiopia in Brussels, 2018). The GERD is also considered as a source of national pride in Ethiopia. Furthermore, scholars argued that the hydroelectric power generated by the GERD could be a source of energy in the East Africa region (Melat, 2020). Apart from, the GERD is not limited to improving electric power supply in the region, the project can also benefit the downstream countries including Sudan and Egypt by removing up to 86% of silt and sedimentation. In addition, the mammoth dam is reported to reduce the risk of displeasing water evaporation and unanticipated flooding to the lower riparian states (Tesfa, 2013).

On the contrary, Egypt considers GERD as an existential threat. The Nile River is the lifeline of the largely arid country (Aaron et al. 2005). Egypt asserts that the GERD could have severe implications on her source of waters from the Nile River, which is reported to supply 90% of Egypt's freshwater demand (Block, 2015). Reports revealed that the GERD could

have several transboundary negative impacts on the lower riparian states including Egypt (El-Nashar & Elyamany, 2018). Reducing surface, ground, and deep aquifers water levels and saltwater intrusion are some of the transboundary risk factors associated with the GERD project (Abdelazim et al., 2020). These risk factors are reported to be major predictors of increased soil salinity, which could potentially affect crop yields in the downstream countries (Aziz et al., 2019). In general, the findings of this systematic review and meta-synthesis identified both the transboundary advantages and disadvantages of the GERD project on the riparian states located along with the Nile River.

However, more robust and detailed scientific investigations need to be carried out by independent research teams to rule out the potential pro and cons of GERD, envisaging the likelihood of researcher bias, Egypt's scholars seem to exaggerate the danger of GERD, whereas, Ethiopian scholars look championing the construction of the GERD. In addition, the GERD's aptitude to foster cooperation, mitigate climate change uncertainties, and catalyze greater market integration and trade should be regarded as an asset among the riparian states. Accordingly, the undesired transboundary adverse effects of the GERD project need to be identified and addressed profoundly in a cooperative manner (Handiso, 2018).

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