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Crisis in the Eastern Nile Basin: an Examination of the Challenges to Egyptian Hydro-Political Hegemony and Potential Domestic Solutions

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CLAREMONT McKENNA COLLEGE

**CRISIS IN THE EASTERN NILE BASIN: AN EXAMINATION OF THE
CHALLENGES TO EGYPTIAN HYDRO-POLITICAL HEGEMOMY AND
POTENTIAL DOMESTIC SOLUTIONS**

SUBMITTED TO

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AND

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BY

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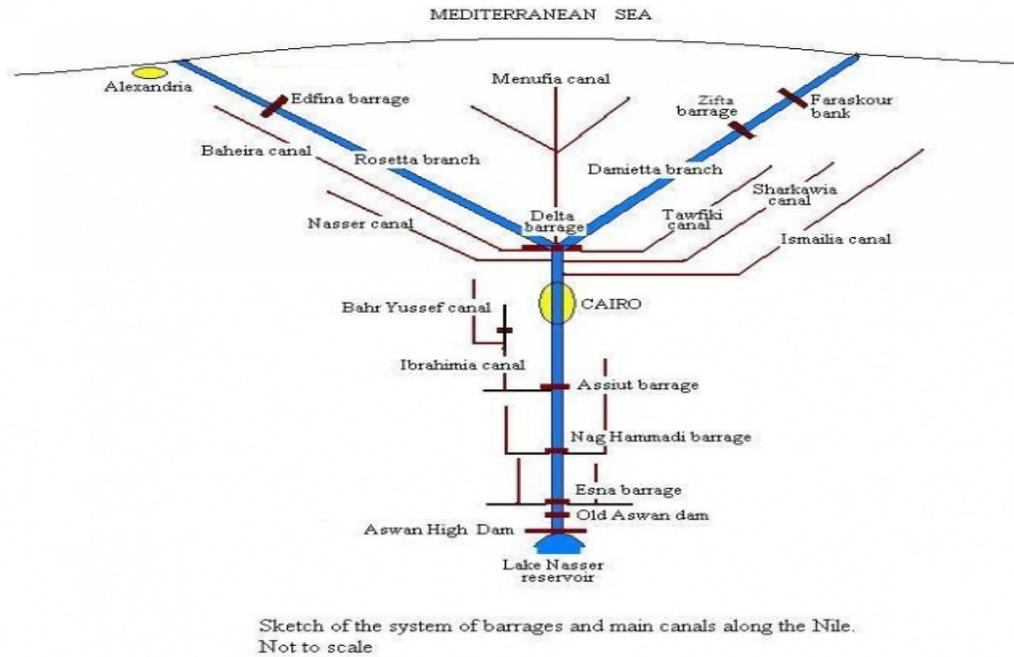
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Figure 1: The Nile Basin¹



Figure 2: The Nile Canal System²



¹ Stanton, John. "United States Moving into Africa's Nile River Basin: Securing Central and Eastern Africa via the Nile River." Weblog post. *Read My Mind*. N.p., 8 Oct. 2011. Web. 1 Dec. 2012.

<<http://arcticcompass.blogspot.com/2011/10/americas-conquest-of-africa-roles-of.html>>. html

² "Irrigation in Egypt." *Waterwiki*. N.p., n.d. Web. 1 Dec. 2012.

<<http://waterwiki.net/images/6/6f/NileCanals.JPG>>.

Abbreviations and Terms

AHD- Aswan High Dam

BCM – billion cubic meters

CONAGUA – Comision Nacional del Aqua (Mexico)

DRC – Democratic Republic of the Congo

EU – European Union

GRD – Grand Renaissance Dam

IAS - Irrigation Advisory Service (Egypt)

IIP – Irrigation Improvement Program

IMF- International Monetary Fund

MAWR -- Ministry of Agriculture and Water Resources (Mexico)

MPWWR – Ministry of Public Works and Water Resources (Egypt)

NBI – Nile Basin Initiative

USAID – United States Agency for International Development

USSR – The Union of Soviet Socialist Republics

WUAs – Water User Associations

I. Introduction

The Egyptian people have monopolized the water of the Nile River for more than 5000 years. Greek historian Herodotus famously referred to Egypt as the 'gift of the river' as its civilization grew and prospered on the Nile's fertile banks.³ Unchallenged access to the Nile allowed Egypt to emerge as the 'breadbasket of the Roman Empire' and has been a driving factor in its historic regional hegemony.⁴ In the late nineteenth century, Great Britain came to be the colonial power in the region, controlling both Egypt and its contiguous upstream neighbor, Sudan. The British sought to guarantee that these countries, particularly Egypt, had unchallenged access to the Nile's discharge to maintain their significant agricultural exports.⁵ This exclusivity was finally recorded in a 1929 agreement between the two countries that gave Egypt the right to utilize 48 billion cubic meters (bcm) and Sudan the right to 4 bcm of the assumed total flow of 52 bcm.⁶ More importantly, the entire flow of the Nile during the dry season was to be reserved for Egypt; it would also have veto power over any upstream development projects.

After the construction of the Aswan High Dam (AHD) during the Cold War, the amount of water that could be captured increased and a new, post-colonial agreement between Egypt and Sudan was signed in 1959. This allocated 55.5 bcm for Egypt and 15.5 bcm for Sudan, with an assumed 10 bcm lost to evaporation from Lake Nasser, the

³ Griffiths, J. Gwyn. "Hecataeus and Herodotus on "A Gift of the River"" *JSTOR*. N.p., June 1966. Web. 01 Dec. 2012. <<http://www.jstor.org/stable/543141>>.

⁴ Glain, Stephen. "Egyptian Peasants Make Themselves Heard." *The New York Times*. N.p., 28 June 2012. Web. 01 Dec. 2012. <<http://www.nytimes.com/2012/06/28/world/middleeast/egyptian-farmers-make-themselves-heard.html?pagewanted=all>>.

⁵ Waterbury, John. "Is the Status Quo in the Nile Basin Viable?" *Brown Journal of World Affairs* IV.1 (1997): 287-98. Print, 290.

⁶ *Ibid*, 290.

dam's reservoir.⁷ There were no other signatories to this 1959 agreement as most of the other riparian states were still under colonial rule. In effect, a prevailing status quo was established which disregarded the rights of upstream nations and people to develop their share of the Nile in a way that might harm Egypt's determined water allocation.

Until recently, the rights set forth by the 1959 agreement provided Egypt with a surplus of water to provide for its relatively small population and to irrigate its farms. The Egyptian economy and population became heavily dependent on the growth and export of agricultural products fed by the Nile's waters; the country currently utilizes between 80-85 percent of their allocation of the Nile's water for irrigation purposes. However, this surplus has gradually dwindled. Fifty years ago the country had 2,100 cubic meters of water per person, which was well over the 1000 cubic meter per person water 'poverty line' as outlined by the United Nations.⁸ Today, the average water allowance in Egypt is less than 800 cubic meters per person.⁹ This precipitous drop is largely due to the significant increase in Egypt's population from about 26 million in 1960 to over 83 million today with a projection of 114.8 million before it stabilizes in 2065.¹⁰ The historical access to excess water has led to an inefficient water irrigation system, a bloated and ineffective water bureaucracy, unwise strategic efforts to irrigate desert land, and other egregious and wasteful policies. It is widely recognized that Egypt is in the

⁷ Ibid.

⁸ Amin, Shahira. "Egypt's Farmers Desperate for Clean Water." *CNN*. Cable News Network, 10 Nov. 2010. Web. 01 Dec. 2012. <<http://www.cnn.com/2010/WORLD/africa/11/09/egypt.water.shortage/index.html>>.

⁹ El Dahan, Maha. "Egypt's Water Needs to Surpass Resources by 2017." *Reuters*. N.p., 18 July 2009. Web. 1 Dec. 2012. <<http://www.reuters.com/article/2009/07/18/idUSLI438735>>.

¹⁰ Swain, Ashok. "Mission Not Yet Accomplished: Managing Water Resources in the Nile River Basin." *Journal of International Affairs* 61.2 (2008): 201-14. *JSTOR*. Spring 2008. Web. 22 Sept. 2012.

midst of a water crisis. Riots and headlines about water shortages are rife in today's newspapers.

The sustainability of these internal inefficiencies and the ensuing wastage had not been threatened until recently; however, there are now mounting signs that the status quo has begun to unravel. Egypt faces dwindling regional power resulting from the fall of the Mubarak regime and increasing pressure from upstream riparian states, or the countries bordering the river, to develop an equitable water-sharing agreement. In 2010, six upstream nations signed the Entebbe Treaty, which asserted that they would no longer ask Egypt's permission to divert water for their own use. Not surprisingly, Egypt, Sudan and South Sudan, which gained independence in 2011, are not signatories. Ethiopia, which contributes significantly more water to the river's annual flow than any other country, has emerged as the most vocal proponent of capitalizing on its national right to use the Nile's waters. In April 2011, Ethiopia announced plans to construct the \$5 billion Grand Renaissance Dam (GRD), which will be the largest hydroelectric power generator in Africa and create one of Africa's largest reservoirs; it will also significantly reduce the flow of water reaching Egypt's borders.¹¹

Although Egypt is the riparian state most dependent on the waters of the Nile, Ethiopia is one of the poorest countries in the world. Egypt will not be able to stop the construction of the GRD using its typical methods of political and military coercion, and Ethiopia's population could greatly benefit from the export of hydroelectric power and the increased food security that would result from the irrigation of underutilized arable land. Ethiopia will pursue the construction of the Grand Renaissance Dam and Egypt

¹¹ "Grand Ethiopian Renaissance Dam." International Rivers, n.d. Web. 1 Dec. 2012. <<http://www.internationalrivers.org/campaigns/grand-ethiopian-renaissance-dam>>.

must take action to prepare for this certain reduction in its water supply. Egypt faces immense economic and political challenges to provide for its growing population in the face of decreasing food security, urban crowding and climate change. The current inefficient use of water is arguably the most crucial environmental and development problem in Egypt.¹²

This paper will discuss water rights diplomacy in the Nile Basin, the roots of the water crisis in Egypt and the capability of upstream riparian states, particularly Ethiopia, to utilize their share of the Nile. It will propose alternative solutions to remedy the conflicting claims to the Nile water without a regional devolution into war. Current water use trends in Egypt will be outlined including an analysis of supply and demand issues, distributional and institutional failures, and property rights problems that have led to an inefficient use of water. Other water use policies will be discussed including inefficiencies in the existing infrastructure, cropping patterns, evaporation, etc.

This paper will argue that the likelihood of a regional clash over water will be significantly reduced if Egypt reforms its water management and irrigation policies to yield greater water usage efficiencies and savings, thus avoiding a shortage when upstream development projects are implemented. The analysis of the Egyptian agriculture and irrigation sectors will conclude with a recommendation for a reform emphasizing the transfer of water management control to a more localized level. It will be essential to learn lessons from Mexico's implementation of the most successful irrigation reform in the world by delegating power to Water Users Associations (WUAs). These community-based groups create effective incentives, largely through the creation of an efficient

¹² Doss, Mervat, and Grant Milne. "Water As An Economic Good: An Approach to the Egyptian Economy." N.p., Mar. 2001. Web. 1 Dec. 2012. www.ictp.trieste.it/~eee/files/Doss.pdf, 2.

economic market for the resource, for local farmers to adopt water saving tactics. Similar to Egypt, the Mexican government agency in charge of water distribution and pricing was extremely centralized and exhibited rent-seeking behavior, thereby lacked the institutional capacity to implement water saving policies. This case will be examined and analyzed as an approach that could be utilized by the Egyptian government to implement policy that reflects the need for sustainable water use, efficiency and conservation. It appears that with successful reform, as illustrated by the Mexican case, water wastage will be decreased and the efficiency of the irrigation sector will be significantly increased from the current operating levels.

II. The Geography of the Nile Basin

The Nile is the world's longest river measuring 4,200 miles from its source in Tanzania to its mouth along Egypt's Mediterranean coast.¹³ The Nile flows from south to north and travels through the borders of Uganda, Ethiopia, Kenya, Tanzania, Democratic Republic of the Congo, (DRC), Rwanda, Eritrea, Burundi, South Sudan, Sudan and Egypt – the most downstream state. About 85 percent of the Nile's waters originate in Ethiopia's tributaries, the Blue Nile and the Atbara, whose discharge is only accessible to the downstream countries. The other 15 percent of the water comes from the White Nile which originates in Burundi. The Blue Nile meets the White Nile in Khartoum, Sudan; they converge with the Atbara shortly thereafter. But despite its significant contribution to the discharge of the River, Ethiopia's use of the river has been negligible due to Egyptian hegemony and internal strife. Ethiopia is the upstream country that could benefit most

¹³ Waterbury, "Is The Status Quo in the Nile Basin Viable?" 287

from increased access to these resources due to low levels of development, the underutilization of arable land and enormous hydroelectric potential. Egypt is the riparian state that is most dependent on the Nile as 97 percent of its water comes from the river; the other 3 percent comes from ground water, recycled water and rain water. Additionally, around 75 million of the Egypt's 80 million people live in the delta and river valley.¹⁴ The water dependence situation is similar in Sudan; however, Sudan's agriculture sector is less developed and therefore requires less water. This dependence is a stark contrast from some upstream countries, such as the DRC, for which the Nile is a minuscule part of their water resources. Most of the upstream countries lie in the 'Great Lakes Region' where the rainfall contributes substantially to water resources. The total population of the Nile Basin countries is 300 million of which 100 million live on less than \$1 day.¹⁵ With the exception of Egypt and Kenya, the other nine Nile Basin countries are classified as 'least-developed' by the United Nations.¹⁶ The size of the Basin population is expected to balloon in the coming decades; it is predicted that the populations of Ethiopia, Sudan and Egypt alone will reach 340 million by 2050.¹⁷

III. Egypt's Hegemony with Respect to Water Rights

For the past 5000 years, the Egyptians have been the regional hegemon and have enjoyed unchallenged access to the Nile. Though Egyptians have always utilized the Nile's fertile basin for agricultural purposes, the country's productivity, specifically in the

¹⁴ Pearce, Fred. "Does Egypt Own The Nile? A Battle Over Precious Water." *Yale Environment* 360. N.p., 19 July 2010. Web. 01 Dec. 2012.
<http://e360.yale.edu/feature/does_egypt_own_the_nile_a_battle_over_precious_water/2297/>.

¹⁵ Swain, "Mission Not Yet Accomplished," 202.

¹⁶ Ibid.

¹⁷ Ibid.

cotton industry, significantly increased under British colonial rule. This was due to their investment in water storage, including the first Aswan Dam, and transportation infrastructure to facilitate the export of agricultural products.¹⁸ During this period, the British also began to cultivate small industries in Sudan. In 1929, in order to solidify the water rights of these two countries, the British signed a water-sharing agreement between the two countries at a ratio of 12:1 favoring Egypt.¹⁹

In 1952, at the beginning of the Cold War, the Soviet Union financed Egypt's AHD, making it the first significant development project on the river and considerably increasing the amount of discharge captured. In response to this power play, Ethiopia's Emperor Hailie Selassie commissioned the U.S. Bureau of Reclamation to implement a survey on the irrigation and hydropower potential on its share of the Blue Nile before it reached Egypt's borders. The resulting report identified twenty areas with potential to produce hydro-electric power and five million acres of arable land whose utilization would require 6% of the Nile's water before it reached Egypt's borders.²⁰ As John Waterbury writes, "Egypt may have its Soviet-financed dam, but Ethiopia has Egypt's water."²¹ Despite the clear potential for its own development, the culmination of this analysis was the construction of a single dam in Ethiopia in 1972; further construction was halted due to internal strife.²²

In 1959, in order to solidify their respective historic rights to the water, a treaty entitled "Agreement for the Full Utilization of the Nile Waters" was signed between

¹⁸ Waterbury, "Is the Status Quo in the Nile Basin Viable?" 290.

¹⁹ Ibid.

²⁰ Ibid, 288.

²¹ Ibid.

²² Ibid.

Sudan and Egypt to divide this additional water. The AHD allowed for the complete exploitation of the Nile and increased the annual discharge by 32 bcm from the 1929 estimate. This increase was allocated at a 2:1 ratio between Egypt and Sudan.²³ Despite the fact that Ethiopia was no longer under Italian rule, it was not included in negotiations. The agreement vaguely addressed the potential threat of upstream riparians and indicated that Sudan and Egypt should jointly decide on a response to threatening development projects.²⁴ This new agreement defined water-sharing in absolute terms; John Waterbury writes, “it constructed a classic zero-sum situation; *ceteris paribus*, any gain in water to an upstream riparian must be a loss to Egypt and the Sudan.”²⁵ The control of the Nile by Egypt and Sudan is unique in comparison to other riparian arrangements as it gives complete control of the water to the downstream states; typically upstream countries control the resource and develop their portion of the river at the expense of downstream countries.²⁶

Until recently, Egypt did not face any direct threats to the rights set forth by the 1959 treaty. As Waterbury et al. point out, this arrangement was not contested by upstream riparians due to “Cold War rivalries, their own political instability combined with bouts of civil war, and their feeble economies did not allow... [them] to press any realistic claim to Nile Water arising in or traversing their territories.”²⁷ For example, in 1974, a coupe in Ethiopia brought to power Colonel Mengistu Meriam who allied with

²³ Ibid, 289.

²⁴ Waterbury, John, and Dale Whittington. "Playing Chicken on the Nile? The Implications of Microdam Development in the Ethiopian Highlands and Egypt's New Valley Project." *Middle Eastern Natural Environmental* 103 (n.d.): 150-66. Print, 151.

²⁵ Waterbury, "Is the Status Quo in the Nile Basin Viable?", 291.

²⁶ Rahaman, Muhammed. "Principles of International Water Law: Creating Effective Transboundary Water Resources Management." *International Journal of Sustainable Society* 1.3 (2009): 207-23. Print, 209

²⁷ Waterbury and Whittington, "Playing Chicken on the Nile?" 151.

the Soviets; at the same time, Egyptian leader Anwar Sadat began to ally with Western forces. Ethiopia lost the Western support and funding to develop their portion of the river based on the outcome of the U.S. Bureau of Reclamation survey.²⁸ Additionally, Ethiopia went to war with Somalia and internal civil war with Eritrean rebels; there was also severe economic crisis in Sudan. This gave Egypt unchallenged access to the Nile's water for the foreseeable future; as Waterbury point out, the only constraints were "those created by its own profligate use of water in its existing agriculture system."²⁹

Waterbury points to Egypt's vested interest in the destabilization of its upstream neighbors as exemplified by their support of the National Islamic Front in Sudan.³⁰ Waterbury points out that as long as they are in power, "the Sudan will be an 'outlaw' state, cut off from the international credits that would allow it to press ahead with its hydraulic plans."³¹ Additionally, Egypt has enjoyed significant influence in bi- and multi-lateral donor agencies.³² For example, Egypt was able to block funding for upstream development projects in the African Development Bank; additionally, the United States used its clout in the IMF and World Bank to deny funding to upstream development projects that would challenge Egypt's access to the Nile. This control prevented the economically weak and conflict-ridden upstream countries from undertaking projects without Egypt's specific consent or by clearly demonstrating that the project would cause Egypt no harm.³³

²⁸ Waterbury, "Is the Status Quo in the Nile Basin Viable?" 293.

²⁹ Ibid, 289.

³⁰ Ibid, 289.

³¹ Ibid, 294.

³² Ibid.

³³ Ibid.

Egypt has shown that the defense of the 1959 treaty is its principal objective. Waterbury writes that Egypt has “maintained great institutional continuity in its water sector [and],... has patiently cultivated the international arena and donor community for acquiescence to, if not support for, its priorities”³⁴ This is in clear contrast to upstream nations that, as Waterbury observes, “have not had consistent objectives, have constantly remade their institutions in an overall context of political turmoil and periodic purges, and they have little institutional or expert memory.”³⁵ Despite a rightful claim to a share of the Nile’s waters, upstream states have been unable to organize and collectively bargain for an new, more equitable arrangement. Furthermore, Egypt’s willingness to use their highly sophisticated and internationally financed military to respond to any upstream threat also deterred development projects. The government has been extremely blunt about its willingness to defend its water rights. Egyptian President, Anwar Sadat, famously declared that “the only matter that could take Egypt to war again is water.”³⁶ This combination of factors prevented upstream riparians from embarking on development projects that could harm Egypt’s share of the Nile for the majority of the 20th century.

IV. Regional Challenges to the Status Quo

This section will examine recent challenges to the status quo brought about by the increasing relative strength of upstream riparian nations and the simultaneous decrease in

³⁴ Waterbury, "Is the Status Quo in the Nile Basin Viable?" 294.

³⁵ Ibid.

³⁶ Halime, Farah. "Secret Document: Egypt Could Take Military Action over Nile." *Egypt Independent*. N.p., 12 Oct. 2012. Web. 01 Dec. 2012. <<http://www.egyptindependent.com/news/secret-document-egypt-could-take-military-action-over-nile>>.

the geo-political strength of Egypt. This will include a discussion of the recent attempts to come to an agreement over equitable water-sharing policy in light of the population growth, increasing food shortages in the region and international attempts to develop the region for food growth. Ethiopia's vulnerabilities and development potential will also be discussed. Finally, the regional power dynamic after the Arab Spring will be analyzed with specific attention paid to the implications of the Grand Renaissance Dam and potential Egyptian responses.

A. Nile Basin Initiative

The Nile Basin Initiative (NBI) was created in 1999, and marked the first time that all ten riparian states have come together to discuss the future of water-sharing on the Nile. The proclaimed mission of the NBI is to “achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources.”³⁷ The organization had hoped to achieve this goal through the negotiation of a new, comprehensive and inclusive water-sharing agreement.

For thirteen years, the countries of the NBI have been locked in a stalemate and have been unable to agree on a new arrangement. As the historic regional hegemon and nation that is most dependent on the Nile, Egypt has no intention of ceding additional water resources to upstream states. However, the other riparian states argue that the 1959 agreement is a ‘colonial relic’ and non-binding due to the fact that every other upstream state, with the exception of Ethiopia, was under colonial rule when the treaty was

³⁷ Mekonnen, Dereje. "The Nile Basin Cooperative Framework Agreement Negotiations and the Adoption of a 'Water Security' Paradigm: Flight into Obscurity or a Logical Cul-de-sac?" *European Journal of International Law*. N.p., 2010. Web. 01 Dec. 2012. <<http://ejil.oxfordjournals.org/content/21/2/421.full>>.

signed.³⁸ This belief led Ethiopia, Rwanda, Kenya, Uganda and Tanzania to sign a water-sharing treaty called the Entebbe Agreement without unanimous riparian support. This agreement aligns with other trans-boundary river treaties in that it prevents nations from using water in a way that would be harmful to downstream countries; conversely, however, these upstream nations pledged to disregard Egypt's veto-power over upstream development projects.³⁹ The Egyptian government reacted to this new treaty, as Pearce writes, "by going on a high-level diplomatic offensive with offers of aid, backed up by threats of legal action if its current water 'rights' are not upheld."⁴⁰ Interestingly, Burundi had initially refrained from signing the agreement at the urging of Mubarak, but reneged on its promise only weeks after the fall of his regime confident that there would be no retaliation from the fledgling transitional government. The Democratic Republic of the Congo has remained neutral and Eritrea only has observed status in the NBI due to its position in the river's watershed. Unsurprisingly, this treaty is opposed by Egypt, Sudan and South Sudan.

B. Growing Regional Demand

There are a number of modern issues that will further complicate the future of water sharing. Over the next 40 years, the population of the Nile Basin countries is

³⁸ Lupei, Jacob. "Jonglei Project in Southern Sudan: For Whose Benefit Is It?" *Sudan Tribune*. N.p., 26 May 2007. Web. 01 Dec. 2012. <<http://www.sudantribune.com/spip.php?article22060>>.

³⁹ Lamere, Carolyn. "Nile Basin at a Turning Point as Political Changes Roil Balance of Power and Competing Demands Proliferate." *New Security Beat*. N.p., 4 Sept. 2012. Web. 01 Dec. 2012. <<http://www.newsecuritybeat.org/2012/09/nile-basin-turning-point-egyptian-revolution-roils-balance-power-competing-demands-proliferate/>>.

⁴⁰ Pearce, "Does Egypt Own The Nile? A Battle Over Precious Water."

expected to increase from 429 million people in 2012 to 945 million people.⁴¹ According to experts at Egypt's Planning Institute, the country will need 50 percent more of the Nile's water by 2050 to provide for its growing population.⁴² Previously, the development potential of the upstream countries has been limited by insufficient energy and funds; some countries in the region are currently experiencing rapid economic growth which will allow them to independently pursue development projects which had not previously been plausible. For example, Ethiopia's economy is growing at 7.5 percent per year, Tanzania's growth is 6.4 percent and Rwanda's growth is 8.6 percent.⁴³ Lamere writes, "growing populations require more water, but so does growing affluence."⁴⁴ Egypt's regional economic dominance is still evident given its relative economic strength versus the other downstream countries. Egypt's GDP is \$231.9 billion while Ethiopia's GDP is \$31.2 billion, South Sudan's GDP is \$17.19 billion and Sudan's is \$62.9 billion.⁴⁵ However, based on current trends, this gap will significantly shrink in coming decades.

C. Ethiopian Vulnerabilities and Development Potential

Despite their willingness to challenge the status quo, Ethiopia is one of the least developed countries in the world. Ethiopia has a per capita GDP of \$1100 compared to

⁴¹ Lamere, "Nile Basin at a Turning Point as Political Changes Roil Balance of Power and Competing Demands Proliferate."

⁴² Ibrahim, Ekram. "Egypt's Poor Suffer Most from Ongoing Water Crisis." *Ahram Online*. N.p., 16 Aug. 2012. Web. 1 Dec. 2012. <<http://english.ahram.org.eg/NewsContent/1/0/50155/Egypt/0/Egypt-poor-suffer-most-from-ongoing-water-crisis.aspx>>.

⁴³ "Central Intelligence Agency: The World Factbook." *CIA: Country Profiles*. N.p., n.d. Web. 01 Dec. 2012. <<https://www.cia.gov/library/publications/the-world-factbook/docs/profileguide.html>>.

⁴⁴ Lamere, "Nile Basin at a Turning Point as Political Changes Roil Balance of Power and Competing Demands Proliferate."

⁴⁵ "Central Intelligence Agency: The World Factbook."

Egypt's \$6600.⁴⁶ Additionally, only 17 percent of the country's population has access to potable water; this percentage will only decrease as the population of the country is growing at the fifth fastest rate in the world.⁴⁷ The country is divided into highlands (above 1500 ft) and lowlands. The highlands are most suitable for rain-fed agriculture but are wracked by over population and highly degraded due to deforestation, overgrazing, soil erosion.⁴⁸ The lowlands are semi-arid and present significant potential for large-scale irrigation initiatives. Ethiopia has an estimated 2.3 million hectares of which less than 1 percent had been developed.⁴⁹ Despite this potential, Ethiopia only uses 1 percent of Nile Water and shortages of rainfall have caused widespread drought and famine.⁵⁰ Given its frequent and drastic shortfalls of food production, the country is serious about achieving self-sufficiency in food production 'at any cost.'⁵¹

Ethiopia has attempted to construct hundreds of small microdams, which are small-scale irrigation projects that can provide water for a few hundred hectares. While this infrastructure does not require international financing and is militarily invulnerable, these dams have numerous problems including the buildup of silt and the ensuing reduction in water storage capacity, and increased instances of malaria in local communities.⁵² Additionally, construction attempts have been halted or abandoned due to geological challenges resulting in high percentages of lost investment capital. These local

⁴⁶ Ibid.

⁴⁷ Abate, Zewdie. *Water Resources Development in Ethiopia: An Evaluation of Present Experience and Future Planning Concepts: A Management Method for Analysing a Key Resource in a Nation's Development*. Reading: Ithaca, 1994. Print, 45.

⁴⁸ Ibid, 26.

⁴⁹ Swain, "Mission Not Yet Accomplished," 206.

⁵⁰ Abate, "Water Resources Development in Ethiopia," 26.

⁵¹ Swain, "Mission Not Yet Accomplished," 206.

⁵² Waterbury and Whittington, "Playing Chicken on the Nile?," 154.

attempts to increase irrigation in the lowlands have failed in most places and further demonstrate the need for large-scale development.

A 1997 World Bank study reported that “the waters of the Nile probably constitute Ethiopia’s greatest natural asset for development... the development of the River Nile has the potential to contribute significantly to poverty reduction, meet domestic power and food demands, and become a cornerstone of a future Ethiopian export strategy.”⁵³ Despite widespread poverty, Ethiopia’s economy grew rapidly last year (2011); however, the Ethiopian economy is largely undiversified as 41 percent of their GDP comes from agriculture. Sustained economic growth will require expansion into other industries.⁵⁴ While Egypt has natural gas and Sudan has oil, upstream countries have fewer energy options.⁵⁵ Ethiopia’s installed capacity of hydropower dams is 3 percent of its potential and the economic rates of return on these projects are among the highest in the world.⁵⁶⁵⁷ According to Waterbury et al., “if Ethiopia continues to liberalize its economy and is politically stable, it may be anticipated that funds will be available from a variety of sources to finance... other larger water resources development projects in the Blue Nile watershed.”⁵⁸ Development projects on the Nile could give Ethiopia the option to export excess hydroelectric power to upstream countries due to its own low per capita energy consumption. This could substantially add to the country’s low GDP, diversify economic activity and provide cheap power to rural households. Nile development projects could also facilitate the irrigation of additional land, which could

⁵³ Erlikh, Hagai. *The Cross and the River: Ethiopia, Egypt, and the Nile*. Boulder, CO: L. Rienner, 2002. Print, 7.

⁵⁴ "Central Intelligence Agency: The World Factbook."

⁵⁵ Ibid.

⁵⁶ Abate, “Water Resources Development in Ethiopia,” 22.

⁵⁷ Waterbury and Whittington, “Playing Chicken on the Nile?,” 155.

⁵⁸ Ibid.

help the country increase its food security. As of now, rain-fed agriculture has been unable to meet the food requirements of the population.⁵⁹ The failure to utilize this resource in light of population projections, and economic and environmental degradation will only serve to plunge Ethiopia's population into greater poverty.

D. International Development Pressures and Agricultural Potential in East Africa

There will be further stress on water resources in the region as 16.9 million hectares in East Africa, principally Ethiopia and Uganda were sold or leased to foreign investors after the 2008 food crisis. Countries such as Saudi Arabia, India and the United Arab Emirates are countries that need to import food to meet the demands of their population due to insufficient agricultural conditions. Agribusiness companies in India plan to spend \$2.5 billion to buy or rent land in Ethiopia and Uganda. They are able to rent the land for around \$1.50/year per hectare for contracts up to 100 years making it some of the cheapest land in the world.⁶⁰ Much of this land will be used to grow palm oil, cereal and sugarcane – one of the most water intensive crops.⁶¹ The poor governments of these East African countries have welcomed companies heralding this foreign direct investment for its potential to create employment in the region. In reality, the government has been handing out subsidies and tax exemptions to these companies at the expense of local communities; thousands of local residents are facing eviction, pastoralist farmers are being excluded from land they have historically used for grazing and much of this land will be used to grow food for export further depriving rural areas that are already

⁵⁹ Abate, "Water Resources Development in Ethiopia," 131.

⁶⁰ Vidal, John. "Indian Agribusiness Sets Sights on Land in East Africa." *The Guardian*. N.p., 24 Aug. 2011. Web. 1 Dec. 2012. <<http://www.guardian.co.uk/global-development/2011/aug/24/indian-agribusiness-land-east-africa>>.

⁶¹ Ibid.

food insecure.⁶² The Nile Basin will face increased agricultural and irrigation pressure to grow this food with negligible development consequences for any countries involved.⁶³

E. The Arab Spring and the Grand Renaissance Dam

Despite Egypt's historical maintenance of the status quo, recent events have shaken the regional power dynamic. In 2011, Hosni Mubarak stepped down as the Egyptian leader after 30 years following protests. Additionally, the Ethiopian Prime Minister Meles Zenawi died in August 2012 after 17 years in office, and the newly independent South Sudan hopes to clarify and guarantee its rights pertaining to the 1959 Agreement. This series of events have raised questions about Egyptian President Mohamed Morsi's ability to maintain the country's hydro-political hegemony in the Nile Basin.

Evidence of Egypt's dwindling power in the region has been detected. Just weeks after Mubarak stepped down, the Ethiopians unveiled an aggressive development project known as the Grand Renaissance Dam (GRD). This is a part of a long-term national effort to spend close to \$12 billion by 2035 on development projects on Ethiopia's various rivers to generate an estimated 40,000 megawatts of power.⁶⁴ The GRD is projected to produce 5,250 megawatts of energy, can hold 65 bcm of water and will cost an estimated \$5 billion. Some economists predict that only 10 percent of the funding has

⁶² Ibid.

⁶³ Lamere, "Nile Basin at a Turning Point as Political Changes Roil Balance of Power and Competing Demands Proliferate."

⁶⁴ "Ethiopia on Track to Complete First Mega-dams by 2015." *EthioTribune*. N.p., 13 Nov. 2012. Web. 01 Dec. 2012. <<http://ethiotribune.net/tag/grand-ethiopian-renaissance-dam/>>.

been raised.⁶⁵ International investors include China and Djibouti, but many international investors are wary of supporting the project for fear it would spark further conflict in the region. The rest of the funding will be raised through the sale of government bonds and taxes raises. This price tag is equivalent to almost the entire budget of the country. This has prompted concerns by the IMF that the construction of the GRD will absorb all domestic financing.⁶⁶ However, as one Ethiopian remarked, “We’re going to do this with or without you. The Ethiopian government is issuing bonds and the population, all 85 million of us, are buying bonds in order to chip in to this huge Nile project.”⁶⁷ Ethiopian officials have announced that the dam is on track to be completed by 2015 and around 13 percent of total construction is completed.

The hydro-electric potential of this dam is enormous and Ethiopia will use the power to fuel its own growth and sells the surplus to upstream neighbors. One Ethiopian diplomat referred to the dam as “an ATM of hard currency for Ethiopia.”⁶⁸ Additionally, the Dam will create a reservoir almost twice as large as Ethiopia’s largest natural lake, Lake Tana, creating enormous irrigation potential.⁶⁹ The specifics of the dam’s potential are still unclear as there have been no published studies on its economic or environmental impact. The government has heralded the project for its ability to propel Ethiopia into the future and enable them to move beyond their current aid-based economy.⁷⁰

⁶⁵ Eastwood, Victoria, and Nima Elbagir. "Ethiopia Powers on with Controversial Dam Project." *CNN*. N.p., n.d. Web. <<http://edition.cnn.com/2012/05/31/business/ethiopia-grand-renaissance-dam/index.html>>.

⁶⁶ Davison, William. "IMF Urges Ethiopia to Slow Nile Dam Project to Protect Economy." *Bloomberg*. N.p., 12 Sept. 2012. Web. 1 Dec. 2012. <<http://www.bloomberg.com/news/2012-09-14/imf-urges-ethiopia-to-slow-nile-dam-project-to-protect-economy.html>>.

⁶⁷ Eastwood and Elbagir, “Ethiopia Powers on with Controversial Dam Project.”

⁶⁸ *Ibid.*

⁶⁹ *Ibid.*

⁷⁰ *Ibid.*

The GRD will cause a significant reduction of the flow of water to downstream countries during the period of time when the dam is being filled. It is predicted that it could take 2-3 years for this process to occur; estimates depend on annual rainfall.⁷¹ Egypt would experience around a 25 percent reduction in its water flows during this time and have no guarantee that they will be able to maintain their present share of water.⁷²

F. The Egyptian Response

Egyptian government officials are certain that the completion of the GRD project will have dire consequences for the country. Egypt views this project as a direct threat to its national security and has transferred responsibility for organizing a response to its Interior Ministry. When Ethiopia built a smaller, 580-megawatt hydroelectric dam in 2010, which had a fraction of the storage capabilities of the proposed GRD, Egypt ordered its military to “prepare for any eventuality.”⁷³

The Egyptian government could respond to this threat in a variety of ways.⁷⁴ First, it could put diplomatic pressure on the Ethiopian government, as any change to Egypt’s water flow is technically illegal under the 1959 agreement. The Egyptian government has funded a tripartite committee with scientists from Egypt, Sudan and Ethiopia to study the downstream effects of the dam. If it is proven that their supply will be threatened, diplomatic pressure may deter other international lenders from providing the remainder of the funding for the GRD for fear of souring relations with the Egyptians. Secondly, the

⁷¹ "Grand Ethiopian Renaissance Dam."

⁷² "Grand Ethiopian Renaissance Dam."

⁷³ "River Politics: Ethiopia’s Contested Dam Project on the Nile River." *Water Politics*. N.p., 11 Oct. 2012. Web. 1 Dec. 2012. <<http://www.waterpolitics.com/2012/10/11/river-politics-ethiopias-contested-dam-project-on-the-nile-river/>>.

⁷⁴ Ibid.

Egyptian government could support proxy military groups to create political instability in the Ethiopia. This would likely involve engaging Eritrean rebels who have historically become involved in intensifying ethnic grievances within Ethiopia; this would serve to unsettle the ethnically divided government.⁷⁵ Lastly, if the issue becomes ‘securitized,’ the government could utilize military force to halt the construction of the dam. This would depend on the characteristics of Morsi’s new government, but any large-scale reduction would likely be intolerable.⁷⁶ The likelihood of this response is demonstrated by a leaked WikiLeaks document that claims Sudanese President Omar al-Bashir agreed to host an Egyptian airbase with the explicit purpose of developing the capability to launch a military attack on the dam.⁷⁷

No matter Egypt’s response, the construction of the GRD will have profound regional implications and directly threaten Egypt’s 5000-year control of the Nile. The Arab Spring has created immense monetary volatility and political turmoil in Egypt. The Egyptian economy has stalled, the new government has offended former allies and protests continue to plague the country. This environment has diminished the government’s traditional ability to stonewall financing and diplomatic support for the upstream development projects.⁷⁸ Since the revolution, many decisions have been made to upset control and patronage within organizations that have traditionally helped Egypt

⁷⁵ Ibid.

⁷⁶ Ibid.

⁷⁷ El Gizouli, Magdi. "The Arab Spring: Turabi Rehabilitated." *Sudan Tribune*. N.p., 17 Sept. 2012. Web. 01 Dec. 2012. <<http://www.sudantribune.com/spip.php?article43919>>.

⁷⁸ Cunningham, Erin. "Egypt Is Losing Its Grip on the Nile." *GlobalPost*. N.p., 9 Apr. 2012. Web. 02 Dec. 2012. <<http://www.globalpost.com/dispatch/news/regions/middle-east/egypt/120406/egypt-losing-its-grip-the-nile>>.

maintain control.⁷⁹ Specifically, the military government has upset its long-standing relationship with the United States. For example, the government put American democracy activists and their Egyptian colleagues on trial for attempting to undermine the state.⁸⁰ The revolutionaries ridiculed at the \$3.2 billion aid package from the IMF and then backtracked and asked for additional funding.⁸¹ Because the United States is the biggest stakeholder in both the IMF and the World Bank, this will undoubtedly reduce US willingness to block needed development projects for upstream countries to maintain Egypt's status quo with respect to the Nile's waters.

V. Literature Review

In order to understand the regional conflict over the Nile, it is essential to consider water-sharing norms, and investigate the international law and theory that dictate riparian behavior. *Muhammad Rahaman* discusses various theories of sovereignty, their relevance to international law and ability to manage cross-boundary resource sharing. The theory of absolute territorial sovereignty says that nations can utilize waters flowing through their territory to their full advantage and have no duty to consult with other riparian states. This effectively means that upstream states could utilize all resources without regard to downstream need.⁸² This theory is generally rejected and is not invoked in the creation of international water sharing law. The alternative theory of absolute territorial integrity states that downstream nations have the right to “the continued and uninterrupted flow of

⁷⁹ Lamere, “Nile Basin at a Turning Point as Political Changes Roil Balance of Power and Competing Demands Proliferate.”

⁸⁰ Ibid.

⁸¹ Ibid.

⁸² Rahaman, “Principles of International Water Law: Creating Effective Transboundary Water Resources Management,” 209.

water from the territory of the upper riparian... ‘no matter what the priority.’”⁸³ Interference to this flow by upstream actors requires the consent of downstream countries. For obvious reasons, this theory is often supported by downstream countries; however, it also has limited support within the international legal community because it places downstream interests ahead of an equitable agreement in the best interest of all riparians.

Finally, the theory of limited territorial sovereignty states that every nation can utilize waters flowing through their territory as long as “utilization does not prejudice the rights and interests of co-riparians.”⁸⁴ This theory is most often used to draft international law as it recognizes the equal rights of both upstream and downstream riparians, and includes a ‘obligation not to cause significant harm.’⁸⁵ This theory was invoked in the drafting of the Entebbe Treaty signed by upstream riparians as they hoped to develop a water-sharing agreement that would equally benefit all involved parties; this would replace the existing treaty that allows Egypt to ‘cause significant harm’ to other riparian states.

Jorg Barandat and *Aytul Kaplan* argue that access to fresh water is a foremost national security issue and that international water law is an inadequate instrument to influence the behavior of riparian states because it lacks effective enforcement mechanisms to ensure the equitable use of this shared resource.⁸⁶ The most notable international water-sharing standards are outlined in the Helsinki Rules and drafted by the

⁸³ Ibid, 210.

⁸⁴ Ibid.

⁸⁵ Ibid, 211.

⁸⁶ Scheumann, Waltina, and Manuel Schiffler. *Water in the Middle East: Potential for Conflicts and Prospects for Cooperation*. Berlin: Springer, 1998. Print, 12,24.

International Law Association in 1966. This framework advocates trans-boundary cooperation and equitable sharing to promote social equality, economic growth and environmental and ecological protection.⁸⁷ Specifically, these rules require one riparian to inform all other riparian nations of any pending development projects that may harm their interests.⁸⁸ Additionally, the Helsinki Rules advocates the collection and sharing of data among all riparians so they may fully understand the externalities of development projects; it also calls for reasonable compensation if the interests of the state are violated.⁸⁹ The authors point out that this treaty fails “to sufficiently define the utilization or consumption of water, establish binding criteria for equitable utilization, and clearly fix priorities with respect different kinds of utilization.”⁹⁰ While the Helsinki Rules lay out an important framework for multilateral negotiations, it requires states to give up their absolute territorial sovereignty over a shared water resource which is often outside of their national interest.

Rainer Durth discusses the conditions under which cooperative solutions between riparian countries emerge. He writes, “cooperation will only come about if the riparian states are prepared to submit themselves to credible sanctions in the event of infringements of treaty obligations.”⁹¹ This statement further exploits the inadequacies of the Helsinki Rules as states have no incentive to submit ‘to credible sanctions.’ He argues that this type of self-regulation will only emerge if there is a mutual dependency between states. He points to integrated regions such as the European Union (EU) as an example of

⁸⁷ Ibid, 16.

⁸⁸ Ibid, 12

⁸⁹ Ibid, 16.

⁹⁰ Ibid.

⁹¹ Ibid, 58.

a successful mutual dependence. The EU countries have a duty and interest in cooperating on issues, such as pollution, that effect their entire region.⁹² Conversely, this cooperation will not emerge if upstream and downstream states have “radically different ideas about the fair usage or division of international resources.”⁹³ Without agreed upon enforcement mechanisms and self-imposed sanctions, an international legal framework based on mutual cooperation will be largely ineffective.

John Waterbury further elaborates on the determinants of collective action between riparian states. Waterbury acknowledges that collective action theory is better at explaining noncooperation; however he claims that while it is undoubtedly difficult to initiate and sustain, collective action is not rare.⁹⁴ He argues that most international treaties are not demanding, compliance is difficult to monitor and there are no credible repercussions for defection.⁹⁵ Therefore, adherence to established treaties “buys observer status at a minimum, and access to the data and reporting of other members...[and confers] some legitimacy in the eyes of the international community.”⁹⁶ However, when “bottom-line national interests are at stake,” regimes may “throw international legitimacy to the winds.”⁹⁷ He argues that this is the case in the Nile Basin as the “quasi-regime,” consisting of Egypt, Sudan and South Sudan, consider the maintenance of the status quo to be a matter of national security. Waterbury predicts that any collective agreement will be “open to periodic renegotiation and adjustment as the cost-benefit analysis of each of

⁹² Ibid, 60

⁹³ Ibid.

⁹⁴ Waterbury, John. *The Nile Basin: National Determinants of Collective Action*. New Haven: Yale UP, 2002. Print, 17.

⁹⁵ Ibid, 22.

⁹⁶ Ibid.

⁹⁷ Ibid.

the parties to the regime changes.”⁹⁸ This inability to create a cooperative water-sharing agreement is a direct result of the fact that no mutual dependence can be created; there is no community of Nile riparians.⁹⁹ The Nile states have and will act as unitary actors, and there is weak domestic support for the creation of a functional regime encompassing all riparian nations. He argues that only rational, interest-based solutions can be applied in this scenario and would inevitably require Egypt to harm its long-term interests in the name of collective cooperation.¹⁰⁰

Stefan Deconinck points out that in the absence of a proactive approach by Egypt to adopt new policies and address inefficient water usage, this issue may become ‘securitized;’ this means Egypt will feel compelled to use its military resources to protect its control of the Nile. He attempts to dissect the rationale behind countries who “wield an official discourse of water scarcity and emergency, while wasting precious amounts of water through poor water management.”¹⁰¹ This includes an analysis of the conditions under which resource scarcity becomes a security threat for one country while remaining a policy issue for another. He argues that this shift occurs when an actor “refers to an issue as an existential threat, and tries to convince an audience that extraordinary measures must be taken to contain the problem.”¹⁰² Without basin-wide cooperation or effective preparation for the time when the supply of water is insufficient to meet the demand, the Egyptian government could invoke this tactic to protect their historic rights and attack Ethiopia’s dam.

⁹⁸ Ibid, 34.

⁹⁹ Ibid, 33.

¹⁰⁰ Ibid,34

¹⁰¹ Deconinck, Stephan. "Security as a Threat to Development: The Geopolitics of Water Scarcity in the Nile River Basin." *Royal High Institute for Defence* (2009): 1-14. Print, 6.

¹⁰² Ibid, 7.

VI. Hypothetical Cooperative Solutions

Though highly unlikely, it is interesting to consider a couple of potential regional projects that would create a win-win outcome for all actors. First, the region should consider the inadequacies of the Aswan High Dam. Lake Nasser is an ‘amazingly inefficient bank’ where between 10 and 16 bcm evaporate from its surface; this is more than a quarter of the river’s flow in some years.¹⁰³ British engineers opposed the creation of a giant dam at this site for precisely this reason; instead they wanted to build a series of dams upstream in the ravines of Ethiopia where the temperature would be cooler and the surface area smaller.¹⁰⁴ Pearce writes that “it would be expensive, and a major concession for Egypt to allow the main faucet on the river to move to another country—particularly its regional rival, Ethiopia... [but] it would massively add to the amount of water flowing down the Nile.”¹⁰⁵ Pearce argues that a single, regulating dam in the most hydro -logically efficient location would be a solution to this regional dispute and would leave enough water ‘for nature, as well as for the people of the Nile.’¹⁰⁶

Additionally, the region could consider reviving the Jonglei Canal project. In 1978, The Egyptian and Sudanese governments resurrected an older British project to dig the Jonglei Canal through the Sudd swamps in Southern Sudan.¹⁰⁷ They dug 260 km of the planned 360 km of the canal, but were forced to stop due to intensifying civil war in Sudan. The Sudd is a wetland in the middle of the desert that is created by spillage from the Nile’s second tributary, the White Nile. This swamp stretches for more than 40,000

¹⁰³ Pearce, "Does Egypt Own The Nile? A Battle Over Precious Water."

¹⁰⁴ Ibid.

¹⁰⁵ Ibid.

¹⁰⁶ Ibid.

¹⁰⁷ Waterbury, "Is the Status Quo in the Nile Basin Viable?," 292.

km and causes the evaporation of almost half of the White Nile's discharge in the process.¹⁰⁸ If this project was completed and the water was diverted through the canal instead of evaporating in the swamps, an additional 5 bcm will be available to the downstream countries. While this solution would allow more water to be taken from the Nile by upstream countries without harming Egypt's allocation, it would have detrimental effects on the Sudd's ecosystem, which supports an enormous and diverse wildlife.

Despite these regional solutions that could be collectively undertaken, this literature review puts the Nile Basin conflict into a theoretical framework which suggests that the international water law and norms have historically been ineffective at solving conflicts that involve such diverse actors, priorities and goals. These authors present a highly pessimistic outlook for collective cooperation by the riparian states; therefore, in the interest of regional stability and the avoidance of war, it is necessary to consider a policy proposals that will modify current water usage in Egypt and solutions that directly relate to a more sustainable utilization of this resource.

VII. Egypt's Water Policies and Agricultural Inefficiencies

It is essential to consider the deteriorating domestic water situation in Egypt, which has emerged as a direct result of the government's unrealistic and inefficient policies. In addition to the increasing regional demand for a more equitable water-sharing solution, Egypt itself is facing high population growth, rising food prices and dwindling agricultural productivity. Though Egypt uses the large majority of the Nile's waters, it per capita water allotment has been falling and is now 800 cubic meters per person which

¹⁰⁸ Pearce, "Does Egypt Own The Nile? A Battle Over Precious Water."

places the population in the category of ‘water scare’ as defined by the United Nations.¹⁰⁹ This is largely due to the fact that only 15-20 per cent of Egypt’s water allotment goes towards household consumption. The remaining water is used to irrigate land to grow food for the country’s growing population. It is essential to consider both the macro-level policy decisions that the Egyptian government is making to deal with this population pressure and the related food needs, and the micro-level inefficiencies of the agricultural sector including those of the government water bureaucracy.

a. Macro-Level Policy Challenges

Despite the increasing controversy over the Nile and the imminent needs of its population, the Egyptians are undertaking several development projects that require a significant amount of water. Egypt is considering several reclamation schemes, such as the New Valley Project, that would redirect a significant portion of its water endowment to the Western Desert. The New Valley Project is part of the government’s plan to deal with population growth in Egypt. Around 95 percent of Egypt’s population lives in the Nile Delta and the river valley.¹¹⁰ Egypt plans to divert between 5 and 10 bcm from the AHD to the Western Desert to irrigate this land to move people to areas with low-population density and grow additional food. When the project is finished, between 300,000 and 500,000 additional hectares will be irrigated.¹¹¹

¹⁰⁹ Amin, "Egypt's Farmers Desperate for Clean Water."

¹¹⁰ Cunningham, Erin. "Could Egypt Run out of Water by 2025?" *GlobalPost*. N.p., 9 Apr. 2012. Web. 01 Dec. 2012. <<http://www.globalpost.com/dispatch/news/regions/middle-east/egypt/120406/could-egypt-run-out-water-2025>>.

¹¹¹ Waterbury and Whittington, "Playing Chicken on the Nile?," 157.

The question is, given the fact that only 0.5 bcm of the Nile's water reaches the Mediterranean and the rest is used within Egyptian borders, where will the additional water for the New Valley Project come from? The government claims that they will not overdraw from its Nile allotment but instead will find the water by "use existing water supplies more efficiently, fostering water conservation efforts, abstracting ground water, using reclaimed wastewater and shifting out of the sugar cane and rice to less water-intensive crops."¹¹² Yohannes points out that "the diversion of 5.5 bcm of Nile water to the western desert casts a shadow on the elites' commitment to efficiency."¹¹³ While these conservation efforts need to be considered in the grand scheme of things, these water-savings will be needed to make up for shortages when Ethiopia completes construction of the GRD and cannot be used to irrigate hyper-arid desert land. Egypt's allotment of water as outlined by the 1959 Agreement is contingent upon minimal water use by upstream countries. It would be very difficult, if not impossible, to irrigate this additional land and provide for its growing population even with savings from improved efficiency. This New Valley project, and the use of valuable water to grow food in an area that is hyper-arid, is not an economically rational decision for Egypt.

The New Valley Project is only one of the development factors stressing Egypt's water resources. Suburban development in and around Cairo is also utilizing enormous amounts of water to accommodate the lifestyles of the city's elite at the expense of the poor. In 2004, despite the government's inability to create an effective pricing system to control the agricultural and irrigation sectors, it sought to experiment with a water-pricing

¹¹² Ibid.

¹¹³ Yohannes, Ozbazghi. *Water Resources and Inter-Riparian Relations in the Nile Basin: A Search for an Integrative Discourse*. New York: State University of New York, 2008. Print, 44.

scheme in Cairo. It began to privatize its urban water facilities in order to increase efficiency; this reform forced water utility companies to operate at a profit, which resulted in the water price doubling in some areas of the city. The majority of this water has been diverted from small fishing and farming villages that cannot afford to pay the city's high prices. This has forced many residents of Cairo, where around 40 percent live on less than \$2 a day, to get water from the dirty Nile canals.¹¹⁴ An analysis of the city's water supply by a local NGO found that 75 percent of the samples distributed in the low income area of Manshiyat Naser, or Garbage City, did not meet the minimum standards for drinking water as outlined by the city.¹¹⁵ Tens of thousands of Egyptians protested water shortages this summer (2012) and claim that they are suffering from environmental bias; this is shown "towards cities over villages, coastal areas over southern ones, and rich ones over the poor."¹¹⁶

b. Characteristics of Egypt's Agricultural and Irrigation Sectors

Egypt's agriculture and irrigation sectors are currently wracked with inefficiencies and are entirely unequipped to handle a future reduction in water. Already, both Egypt's ground water and surface water resources are fully exploited.¹¹⁷ Egypt's agriculture sector utilizes 80-85 percent of the water from the AHD; however, the industry only accounts for 20 percent of the country's GDP and 30 percent of the

¹¹⁴ Ibrahim, "Egypt's Poor Suffer Most from Ongoing Water Crisis."

¹¹⁵ Piper, Karen. "Revolution of the Thirsty." *The Design Observer Group*. N.p., 7 Dec. 2012. Web. 01 Dec. 2012. <<http://places.designobserver.com/feature/egypt-revolution-of-the-thirsty/34318/>>.

¹¹⁶ Amin, "Egypt's Farmers Desperate for Clean Water."

¹¹⁷ Yohannes, "Water Resources and Inter-Riparian Relations in the Nile Basin: A Search for an Integrative Discourse," 41.

workforce.¹¹⁸ The efficiency of water use within the agriculture sector is measured at between 60 and 70 percent.¹¹⁹ This percentage drops significantly if only irrigation methods are analyzed. By some estimates, only 2 percent of Egypt's 3.2 million hectares used for agriculture are irrigated by efficient methods.¹²⁰ As Okbazghi Yohannes explains, "if efforts to improve demand side management, conservation, and the efficient use of water are not supported, the consequences could be dire."¹²¹

The majority of Egypt's agricultural sector has high crop yield per unit of land and high cropping intensity in comparison to country averages; this is due to its favorable climate for many species including tomatoes, potatoes, grapes and strawberries.¹²² Merrey points out that, "maintaining the high cropping intensity and increasing the value of agricultural output will be impossible if water supplies are stretched too thinly, and become unreliable."¹²³ Currently, only 3.5 percent of Egypt's land mass, mainly in the Nile's Delta, is being utilized as agricultural land.¹²⁴ The government has invested heavily in expanding the amount of irrigated land since the completion of the AHD to reduce population density in the Basin and grow additional food. This is exemplified by the New Valley project and other land reclamation projects. The current rate of

¹¹⁸ "The Agriculture Industry in Egypt: Abstract" *GlobalTrade.net*. International Trade Resources, 13 Mar. 2011. Web. 01 Dec. 2012. <<http://www.globaltrade.net/f/business/text/Egypt/Agriculture-Animal-Husbandry-Hunting-Fishing-The-Agriculture-Industry-in-Egypt.html>>.

¹¹⁹ Yohannes, "Water Resources and Inter-Riparian Relations in the Nile Basin: A Search for an Integrative Discourse". 43

¹²⁰ Ibid, 44.

¹²¹ Ibid, 43.

¹²² Merrey, Douglas. "Governances and Institutional Arrangements for Managing Water Resources in Egypt." *Liquid Gold* 3 (1998): 1-21. Print, 2.

¹²³ Ibid, 2.

¹²⁴ "The Agriculture Industry in Egypt: Abstract."

reclamation is around 37,000 hectares a year and requires a substantial amount of Egypt's current water allotment.¹²⁵

The irrigation system is a complex system of channels that lead from the AHD to the most rural villages. (Figure 2)¹²⁶ Water is released from the AHD into a single irrigation tunnel that features seven barrages, or large gates, that control water flow into the canal branches; this water flow is continuous. The most significant barrage is directly after Cairo and release water into to the Rosetta and Damietta branches which carry water to various areas of the Delta. From these branches, water is siphoned into distributaries, or *mesquas*, according to a rotation schedule -- not a continuous flow. The water from the *mesquas* is manually pumped from the canals to irrigate nearby fields.¹²⁷

c. The MPWWR and its Excessive Bureaucracy

In order to maintain the productivity of the sector given the substantial competition for the Nile's resources, there must be efforts to increase efficiency and maintain productivity. The current government agency that manages Egypt's water resources, the Ministry of Public Works and Water Resource (MPWWR), treats Egypt's water as if it is unlimited. Its current policies are only contributing to water scarcity and there is a need for institutional reform.¹²⁸ Merrey refers to greater efficiency within the organization prior to the construction of the AHD as the organization had to manage both

¹²⁵ Ibid.

¹²⁶ "AQUASTAT: Egypt." *Food and Agriculture Organization of the United Nations*. N.p., 2009. Web. 01 Dec. 2012. <http://www.fao.org/nr/water/aquastat/countries_regions/egypt/index.stm>.

¹²⁷ Ibid.

¹²⁸ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 2.

flood and drought crises.¹²⁹ After the completion of the dam, the MPWWR had a water surplus in most years which deteriorated its incentive to maintain an efficient irrigation system. Its efficiency dropped further in the late-1980s when the government shifted from a policy of controlling crop patterns to a policy that allows the ‘market’ to drive demand for certain crops – without charging for water.¹³⁰ Due to these loose regulations, many Egyptian farmers’ now grow cash crops such as sugarcane and rice whose growth is highly water-intensive. The MPWWR has failed to adapt its policies to reflect the country’s growing population, soaring food prices and the fact that its share of the Nile is under threat. The Ministry needs to alter its institutional objectives and governing policies to reflect the fact that the country is now moving towards a period of water scarcity. Primarily, this will involve reforms to improve cost recovery, accountability, water quality and distribution, etc. in order to create an institution capable of dealing with the impending crisis.

The MPWWR has a full-time staff of more than 88,000 employees, with the Irrigation Department being the largest; its responsibilities are diverse and extensive. The Ministry is in charge of policy-making, construction and design for civil works projects, maintenance and operation of water distribution and drainage from the AHD, coastal protection, etc.¹³¹ The MPWWR is highly centralized. Merrey points out that “authority is held mostly at higher levels and there is little participation of lower-levels in decision-making; and there is little accountability of higher to lower levels, or the organization to

¹²⁹ Ibid, 18

¹³⁰ Ibid, 4

¹³¹ Ibid.

its customers.”¹³² There is a general reluctance to delegate authority from the top-tier of the organization due to engrained systems of patronage and a lack of operational protocol.¹³³

This top-down system has resulted in private interests, specifically those of large landowners, being represented and prioritized within the organization.¹³⁴ It has been reported that under the Mubarak regime, small-scale farmers were forcibly evicted from their land so that political elites could settle and develop there.¹³⁵ Those that are wealthy and have political connections had few complaints about dependability in the system. This is reflected by the results of survey in which small-scale farmers in middle Egypt and the Delta ranked ‘absolute water shortage’ as their most pressing problem while larger farmers had few complaints about consistency in their water supply.¹³⁶ Local farmers, as Radwan argues, “have been divested of any meaningful control over the patterns of [water] supply with the result that cooperation...has been replaced by a large degree of individualism, as farmers limit their attention to their own specific needs in a local context.”¹³⁷ There is high variability in the water supply to the small-scale, fragmented farms in Egypt’s rural areas which have caused prevalent reports of over-pumping and the premature depletion of the canals when there is water. This inequality in distribution has forced rural farmers to account for future shortages thereby taking more than their share of the resource and harming their downstream neighbors; there have also

¹³² Ibid, 12.

¹³³ Ibid.

¹³⁴ Ibid, 13.

¹³⁵ Glain, "Egyptian Peasants Make Themselves Heard."

¹³⁶ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 13.

¹³⁷ Radwan, Lufti S. "Farmer's Responses to Inefficiencies in the Supply and Distribution of Irrigation Water Requirements in Delta Egypt." *Liquid Gold* 3 (1998): 41-60. Print, 42.

been reports of farmers using untreated sewage to rescue their crops which poses enormous health risks to the community and livestock.¹³⁸

d. Failure of Informational Linkages

As Merrey points out, “there is no information on how much water is delivered to specific areas and no capacity to measure and allocate specified amount of water. There is no clear sense of water rights... no basis for establishing and enforcing such rights, and no clear priorities for water use.”¹³⁹ The MPWWR accepts that there is a high margin of error in their calculation of national water requirements and in the past, it has embraced a policy that releases water in the canals in far excess of their estimates.¹⁴⁰ However, as illustrated, this surplus discharge from the AHD still creates shortages in certain areas. The water released from the AHD into the canal system is largely unregulated and the government has no knowledge of how this water is distributed into the lower-level or distributaries canals. Additionally, surplus water flowing into sparsely populated canal routes flows into escape structures and enters the drainage system.¹⁴¹ The waste from the canals is supposed to be regulated by MPWWR water guards, or *bahhar*, who are required to visit all sections of the canals on a daily basis. In reality, the guards rarely visit the canal ends and fail to consistently measure water levels.¹⁴² Due to this ineffective management, much water remains unused and some valuable water is siphoned into the Mediterranean. The *bahhar* is supposed to act as the liaison between

¹³⁸ Amin, "Egypt's Farmers Desperate for Clean Water."

¹³⁹ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 3.

¹⁴⁰ Radwan, "Farmer's Responses to Inefficiencies in the Supply and Distribution of Irrigation Water Requirements in Delta Egypt," 46.

¹⁴¹ Ibid.

¹⁴² Ibid.

the farmers and the MPWWR; however, the delegation of power to the local level has failed due to weak linkages between the various levels of the organization. This systemic breakdown has created informational shortages, which has resulted in significant water waste.

e. Supply and Demand Allocation Inefficiencies

The inequality and unreliability in the irrigation system is exacerbated by the inefficient mechanisms for determining water demand; the calculated need has become increasingly unrealistic as the government relies on the likely cropping pattern at the beginning of each season, previous growth volume and other outdated data.¹⁴³ Attempts to average a nationwide community ‘quota’ without specific information has been extremely inaccurate due to varying conditions across rural areas such as the quality of the irrigation infrastructure, crop type, climate, etc. For example, in the village of Yaquat, the cropping patterns submitted to the government did not accurately reflect the true needs of the community. The land area was overestimated by 5 percent due to a failure to update land records either due to negligence or corruption.¹⁴⁴ Once these inaccuracies are calculated at the national level, there is an enormous amount of inefficiency and waste in the water allocation system which leads to an abundance of water in some areas and deficiencies in other areas.

There have been diverse community-based responses to deal with the variability in supply. The situation varies across the country depending on whether the community is

¹⁴³ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 2.

¹⁴⁴ Radwan, "Farmer's Responses to Inefficiencies in the Supply and Distribution of Irrigation Water Requirements in Delta Egypt," 48.

receiving a surplus of water or facing shortages. Those facing shortages can appeal to the *bahhar* to request additional water; however, in many cases these requests are refused based on the assumption that they are unjustified.¹⁴⁵ In reality, these local agents of the MPWWR have little authority to increase discharge and do not want to become involved in a direct confrontation with their superiors.¹⁴⁶ In the rare case that these demands reach higher levels of the organization, usually due to the influence of a bribe, any resulting increase is usually short-term.¹⁴⁷ The failure of the government to solve these problem forces individuals to utilize informal methods to ensure their water supply; these techniques often have harmful effects of their neighbors and community at large. In rural areas, water is released on a rotational schedule meaning that it comes once every 10-15 days if it arrives on schedule.¹⁴⁸ One resident of rural Abu Sir explains, “each small canal has to pass through a series of villages, and because of the water scare, everyone is taking more. So, by the time it gets to the end of the canal, it’s drained.”¹⁴⁹ Therefore, farmers will often water ahead of requirements when there is a surplus of water in their canal. Additionally, some water users take precautionary measures and engage in the practice of ‘damming,’ meaning that upstream farmers block-off the *mesqua* immediately before the inlet to their fields to get a buildup of water. Damming blocks access to the canals for

¹⁴⁵ Ibid, 53.

¹⁴⁶ Ibid.

¹⁴⁷ Ibid.

¹⁴⁸ Amin, "Egypt's Farmers Desperate for Clean Water."

¹⁴⁹ Viney, Steven. "Rural Irrigation Canals Are Afflicted by Water Shortages and Contaminated Water."

Egypt Independent. N.p., 13 Aug. 2012. Web. 01 Dec. 2012.

<<http://www.egyptindependent.com/news/rural-irrigation-canals-are-afflicted-water-shortages-and-contaminated-water>>.

users father downstream and often creates community-wide conflict regarding fair allocation of their limited resources.¹⁵⁰

f. Water as a Public Good

The federal government provides water without any charge to local farmers. In most rural areas, irrigation water is free but farmers have to pay monthly fees for the maintenance and running of the pumps that bring water out of the *mesquas*.¹⁵¹ The only limiting incentive on the amount of usable water is the effort of pumping water from the canal to the fields and, of course, the availability of the water. Given these factors and the political unpopularity for a water-pricing system in Egypt, the current cost recovery system is extremely ineffective. Additionally, there is high concern regarding water quality in the country. While there are laws that govern pollution levels, the enforcement of these standards have been sub-par. Dumping garbage in the irrigation canals has become common in rural areas due to a lack of waste management facilities; when water flow is low, the garbage accumulates and poses significant health risks to the crops and the community.¹⁵²

g. Implications

This lack of accountability to the public, inefficiency and excessive bureaucracy is characteristic of many of the Egypt's governing organizations. Merrey predicts that changing "old, large organizations, with their long traditions, large numbers, and political

¹⁵⁰ Radwan, "Farmer's Responses to Inefficiencies in the Supply and Distribution of Irrigation Water Requirements in Delta Egypt," 55.

¹⁵¹ Amin, "Egypt's Farmers Desperate for Clean Water."

¹⁵² Viney, "Rural Irrigation Canals Are Afflicted by Water Shortages and Contaminated Water."

power of their vested interests, and their critical... [importance] to the economy will not be an easy job and will not be accomplished in a short period.”¹⁵³ Efficiency can only be achieved if there is accurate, community specific data regarding seasonal cropping patterns in each area, delivery efficiency, water quality, etc. This information can only be collected with the cooperation of the local farmers who feel that they will gain, not lose precious water, by complying.¹⁵⁴ This lack of regulation, community-specific knowledge, and the inefficient management of the lower canal system has resulted in excessive water allocated to certain areas of the country while others are extremely water deprived. If management at the national level cannot be reformed, there must be a re-delegation of power, likely to a community-based water distribution system

VIII. Mexican Irrigation Reform

Given the systemic inefficiencies in the Egyptian institution that govern the nation’s scarce water resources and the concern over the likelihood of improvement, it is necessary to look at the strategies undertaken by the Mexican government to delegate power away from the federal level and reforms its water resource allocation system. This endeavor by Mexico began in the mid-eighties and was driven more by budgetary pressures exacerbated by economic crisis within the country than a shortage of water or food supplies. Mexico implemented successful irrigation reform based on the use of Water User Associations (WUAs). While the driving factor behind irrigation reform differs between Egypt and Mexico, many of the characteristics of the Mexican water

¹⁵³ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 20.

¹⁵⁴ Radwan, "Farmer's Responses to Inefficiencies in the Supply and Distribution of Irrigation Water Requirements in Delta Egypt," 49.

sector prior to reform align with the current situation in Egypt. Primarily, the Mexican institution governing the water sector, The Mexican Ministry of Agriculture and Water Resources (MAWR), was awash with bureaucratic excess, similar to the Egyptian MPWWR. As part of the reform effort, the government reduced the amount of government officials in the sector 40,000 to 4,000.¹⁵⁵ Additionally, the Mexican water sector was characterized by an excessive amount of government subsidies in order to meet demand without effectively charging farmers for water use. Mexico's water operation and management costs were extremely high, and its cost recovery system was negligible leading to an immense financial burden on the government. This burden is similarly felt by the Egyptian government due to their policy of 'meeting' water demand without charging users. One Mexican government official remarked "at the beginning [the MAWR] thought the machines the most important, the office, the infrastructure, the canals and the dams, but now they think water is the most valuable resource they control"¹⁵⁶ Additionally, the Mexican government faced immense degradation in its canal infrastructure and drainage systems which is also prevalent in much of Egyptian rural areas.

While there are marked difference between the two countries and their respective crises, aspects of the Mexican strategy can be utilized in Egypt to begin to address this 'creeping crisis.'¹⁵⁷ Historically, the Mexican irrigation system was characterized by high levels of government subsidies for all farmers belonging to cooperatives in irrigation

¹⁵⁵ Rap, Edwin. "The Success of a Policy Model: Irrigation Management Transfer in Mexico." *The Journal of Development Studies* 42.8 (2007): 1301-324. 24 Jan. 2007. Web. 1 Dec. 2012. www.tandfonline.com/loi/fjds20, 1318.

¹⁵⁶ Ibid.

¹⁵⁷ Merrey, "Governances and Institutional Arrangements for Managing Water Resources in Egypt," 3.

districts. Cummings and Nercissiantz point out that this meant “with few exceptions... farmers have never been required to repay capital costs association with water... moreover, for long periods of time, [operation and management] costs were heavily subsidized by the government.”¹⁵⁸ These inefficiencies created immense budgetary pressure on the MAWR. Rap explains that “public management of irrigation districts led to poor irrigation performance and decreasing levels of productivity, because the government bureaucracy lacked the incentives and responsiveness to optimize management performance.”¹⁵⁹ The administration sought to transfer management to the local level. The government wanted users to participate in this restructuring so that effective incentives would exist to improve efficiency and lower costs.¹⁶⁰

Beginning in 1989, the country embraced a series of neoliberal policies to radically reform its water management system by transferring control of their irrigation sector to WUAs. The Mexican government created the *Comision Nacional del Agua* (CONAGUA), an organization whose sole purpose was to oversee the transfer of water authority from the MAWR to WUAs. Under the reform, MAWR was merged with CONAGUA; at the highest level, CONAGUA would be responsible for “establishing policies, norms, [and] standards, approving and supervising plans and annual budgets... [and] supervision, monitoring and evaluation of all activities at the national and basin levels.”¹⁶¹ CONAGUA divided the country’s agricultural lands into modules that had

¹⁵⁸ Cummings, Ronald, and Vahram Nercissiantz. "The Use of Water Pricing as a Means for Enhancing Water Use Efficiency in Irrigation: Case Studies in Mexico and the United States." *Natural Resources Journal* 32 (1992): 731-55. *HeinOnline*. Web. 1 Dec. 2012. <http://heinonline.org>, 740.

¹⁵⁹ Rap, "The Success of a Policy Model: Irrigation Management Transfer in Mexico," 1304.

¹⁶⁰ *Ibid*, 1304.

¹⁶¹ "Creating the Foundations for Equitable Growth: Mexico 2006-2012." *The World Bank*. N.p., 2007. Web. 1 Dec. 2012. <http://www->

clearly defined boundaries and could operate as autonomous organizations.¹⁶² Each module was to become financially independent and develop a staff not administratively reliant on CONAGUA's jurisdiction. The leadership of the WUAs would be chosen directly by the users and the WUA as an organization would be financially dependent on the users. This created an incentive structure to reduce the costs of water management from both the user and administrative perspectives. The users would choose administrators that could most effectively reduce costs.¹⁶³ This system significantly strengthened property rights to water and provided users with clear roles and responsibilities. The WUAs now operate the majority of Mexico's canals and CONAGUA maintains only the head structures of the system including dams and multiuse canals.¹⁶⁴ The WUAs have improved operation and maintenance costs, and achieved financial autonomy and administrative self-sufficiency.¹⁶⁵ Today, 452 WUAs comprising of 506,000 water users manage total land of 3.3 million hectares.¹⁶⁶ Interestingly, both the population of Mexico and agricultural land under development at the time of reform are not dissimilar from those of Egypt.

The rapid implementation of these reforms by the Mexican government and the ensuing success of its policies have been heralded by the international community as an example for other countries to emulate to cut costs and improve the performance of their irrigation sector.¹⁶⁷ Rap points out that the replication of this type of model requires

wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/09/24/000020439_20070924120807/Rendered/PDF/P0948670English0Public.pdf, 294.

¹⁶² Ibid, 1305.

¹⁶³ Ibid.

¹⁶⁴ "Creating the Foundations for Equitable Growth: Mexico 2006-2012," 305.

¹⁶⁵ Rap, "The Success of a Policy Model: Irrigation Management Transfer in Mexico," 1305.

¹⁶⁶ "Creating the Foundations for Equitable Growth: Mexico 2006-2012," 305.

¹⁶⁷ Rap, "The Success of a Policy Model: Irrigation Management Transfer in Mexico," 1302.

strong government commitment at the highest level supplemented by ‘champions’ of reform who can mobilize support within the legislative bodies.¹⁶⁸ Additionally, the effectiveness of WUAs is grounded in an effective legal framework with defined ownership of water resources and strong property rights protection.¹⁶⁹ The cornerstone of success is the financial self-sufficiency of the WUAs; in Mexico, the water users pay a fee to the WUA prior to receiving the water to ensure the longevity of the organization.¹⁷⁰ This has resulted in more than 90 percent of users paying their assessed charges.¹⁷¹

IX. Egypt’s Irrigation Improvement Program

In 1996, the Egyptian government experimented with the implementation of WUAs through a series of pilot programs in select rural areas to test the feasibility of a shift towards community management of water resources. This project was called the Irrigation Improvement Program (IIP) and was a joint venture between USAID and MPWWR. It is essential to compare this program to the strategies undertaken by the Mexican government. While the IIP programs were only implemented in a few villages, the outcome of these policies highlight essential areas that need to be modified before a nationwide shift to WUA control can be successful.

A primary goal of the IIP effort was to “increase MPWWR knowledge and capabilities to analyze and formulate strategies, policies and plans related to integrated

¹⁶⁸ Ibid, 1305.

¹⁶⁹ Ibid.

¹⁷⁰ Ibid.

¹⁷¹ "Creating the Foundations for Equitable Growth: Mexico 2006-2012," 305.

water supply augmentation, conservation and utilization.”¹⁷² Unlike in the Mexican case where the majority of power was delegated to the local level, the IPP effort did not seek to abolish the MPWWR, but sought to strengthen its institutional capacity; as discussed above, efforts to change such a large, historic organization are extremely difficult.¹⁷³

In Egypt, the main duties of the WUAs would include “scheduling of water delivery on *mesquas*, perform maintenance and resolve disputes, [and] increase communication links between farmers and government officials.”¹⁷⁴ A new branch of the MPWWR called the Irrigation Advisory Service (IAS) would oversee the WUAs. While literature on the IIP effort alludes to a grand devolution of power to the WUAs, the local responsibilities have essentially stayed the same. The problem still lies in the unresponsiveness of the MPWWR to the local demands of the farmers. The effectiveness of the Mexican WUA system lays in their distributional and financial autonomy. One of the keys to the Mexican success is the effectiveness of CONAGUA at ensuring that the national and local governments work together. The Mexicans effectively eliminated the power of the MAWR and consolidated its institutional responsibilities in CONAGUA, giving it a largely advisory role. A joint report between the MPWWR and USAID evaluating the administrative capability of the IIP expresses doubts about the ability of the government to provide sufficient staff to educate farmers about efficient water management practices; initial IIP reports showed inadequate staffing levels and high

¹⁷² "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807." *Ministry of Public Works and Water Resources; US Agency for International Development: Agricultural Policy Reform Program* (1998): n. pag. Web. 1 Dec. 2012. <http://pdf.usaid.gov/pdf_docs/PNACE917.pdf>.

¹⁷³ Ibid.

¹⁷⁴ Hvidt, Martin. "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations." *Liquid Gold Paper* 3 (1998): 23-37. Print, 24.

turnover rates.¹⁷⁵ The paper states that this effort “must be supported and championed at a high level within the responsible governing agency.”¹⁷⁶ However, the MPWWR has not fundamentally changed as an organization to make it better suited to manage these essential aspects of the irrigation sector; it still retains the power structures that have proven to be costly and ineffective at gathering information, delegating water appropriately, and monitoring the quality, flow and waste of the water. A similar devolution of power from the MPWWR to the IAS, similar to the Mexican case, should be considered.

Furthermore, the IIP effort sought to implement policies that would recover ‘a portion’ of governmental costs of operation and maintenance of the irrigation system, and also cover 100 percent of costs for *mesqua* upkeep.¹⁷⁷ The USAID and MPWWR report points to several market failure considerations that could thwart the success of this cost recovery effort. These include lack of farmer knowledge and awareness of the IIP program, high transaction costs, lack of credit and property rights issues.¹⁷⁸ It is estimated that the implementation of the IIP effort costs approximately \$1092/hectare of land with the majority of the costs emanating from necessary *mesqua* improvements. Without a clear delegation of property rights to the local level and an assurance that reliability will be improved, these poor, rural farmers have no incentive to pay for these improvements. Because leadership at the local level is still responsible to the MPWWR through the IAS teams, there is no incentive to become financially autonomous when the government can still be relied upon to absorb some local costs.

¹⁷⁵ "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807," 4-11

¹⁷⁶ Ibid.

¹⁷⁷ Ibid.

¹⁷⁸ Ibid.

The IIP effort also included components of physical change. The IIP advocated a continuous flow in the branch and distributaries canals; previously only principal and main canals ran continuously and other branches ran on a rotational basis.¹⁷⁹ This was an attempt to address complaints of inadequate, unreliable, and uneven distribution of water through the canal system. Where this IIP- advocated continuous flow was implemented, all communities faced water shortages at the expense of the few under the pilot program. This was due to the fact that the MPWWR staff did not initially understand the hydraulic capabilities needed to maintain continuous flow, which were not adequate in many of the canal branches.¹⁸⁰ However, those participating in the IIP pilot programs experienced a marked increase in reliability. Hvidt reports that within the IIP program, “the presence of a well-functioning continuous flow regime in the branch canals was the single most important factors contributing to security of water control at farm level.”¹⁸¹ If these infrastructure improvements can be made on a nationwide level, continuous flow irrigation would significantly improve reliability in the water delivery services. However, this is a very expensive undertaking. As the USAID and MPWWR reports concludes, “even though farm level benefits of the IIP may appear attractive, farmers have little chance of realizing these benefits without concurrent MPWWR action to improve the main system and provide better irrigation delivery service.”¹⁸² While improvements have been reported in the areas of water reliability and equitable distribution of the resource in the pilot areas with continuous flow, WUAs cannot fully embrace their responsibility for

¹⁷⁹ Hvidt, "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations," 25.

¹⁸⁰ "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807."

¹⁸¹ Hvidt, "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations," 29.

¹⁸² "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807."

the operation and maintenance of the canal system until infrastructure improvement occurs.

While the continuous flow aspect of the WUAs did improve demand-side access to water in pilot areas, Martin Hvidt identifies several areas where continuous flow could be harmed by the bureaucratic tendencies of the MPWWR. Implementing the continuous flow aspect of the IIP on a national scale would be extremely expensive as it requires substantial changes to the existing infrastructure such as the introduction of automatic gates. If this updated infrastructure were not implemented rapidly, which is likely given the ineffectiveness of the organization, there would be a preferential allocation of water to branch canals that could support the flow.¹⁸³ The IIP effort found that there is a marked lack of expertise among construction contracts able to work on the canal infrastructure, making the cost of improvement very high with contracts frequently running their allotted time by over by a year or more.¹⁸⁴ During summer months when water is more scarce, the MPWWR employees in charge of allocation may be influenced by large and influential farmers who “are very outspoken when it comes to obtaining their allocated share – and if possible a larger share – of the available water.”¹⁸⁵ This is especially relevant given the organization’s tendency to engage in patronage. If the engineer in charge of implementing the continuous flow is coerced by these powerful farmers, then other canal branches will receive less water. Due to a lack of administrative supervision within MPWWR, the gate keepers have significant amounts of freedom when deciding how to

¹⁸³ Hvidt, "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations," 33.

¹⁸⁴ "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807."

¹⁸⁵ Hvidt, "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations," 33.

allocate the water and can often earn supplemental income by accepting bribes.¹⁸⁶ Given the corrupt tendencies of the MPWWR and its lack of regulation of its low level staff members, the progress achieved through these IIP pilot programs are in danger of being nullified due to the inadequacies of this organization. This administrative corruption would be irrelevant if this power were awarded to WUAs with supervision by an independent IAS and run by community members with an incentive to equitably allocate water.

This prototype has been referred to as “revolutionary in the Egyptian context” for its potential to increase crop yield, reduce the time needed to irrigate one hectare, and decrease labor costs; however, it has been demonstrated that these efforts are inadequate.¹⁸⁷ It is helpful to consider modifications that can be made to these pilot programs to make WUAs more effective as they are not impossible to overcome. It is also beneficial to briefly look at other aspects of Egypt’s irrigation and agricultural systems that can be improved on a more macro level.

X. Policy Considerations

a. Macro- Level Improvements

i. Abandon Reclamation Programs

It cannot be the policy of the Egyptian government to promote the irrigation of desert land to grow food and create incentives for relocation to reduce population density in the Nile Basin. While the Nile Delta is a highly productive agricultural region, the

¹⁸⁶ Ibid, 35.

¹⁸⁷ "APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807."

Sinai Peninsula and the southern desert do not possess inherently fertile soils.¹⁸⁸ The New Valley project alone is expected to claim as much as 5 bcm per year of the Nile's water and will require between \$60-90 billion to support agriculture, industry and tourism in the region over the next 20-30 years.¹⁸⁹ Academics are asking serious questions about whether these projects will "increase or decrease the net social benefits generated with Nile River water" as it has been proven that water is more productive and delivery costs are much cheaper in the Nile Delta than the Sinai Peninsula.¹⁹⁰ Wichelns conducts a regression analysis to determine which land produces the largest economic return for its share of the Nile. He argues that a cost-benefit analysis of these reclamation projects must include competing demands for limited capital and water, and Egypt's growing unemployment problem.¹⁹¹ He concludes that "public and private investments in new production and processing activities in the Nile Valley and Delta may generate net social benefits more quickly and in greater magnitude than projects in the northern Sinai and southern desert."¹⁹² Therefore, the Egyptian government must refrain from purposely diverting precious water to sub-optimal agriculture areas; instead they should consider other methods of attaining food security such as improved use of water and selection of crops, and should mechanisms for reducing population growth and density such as family planning or increased birth control access. Waterbury suggests an alternative solution. He argues that a more logical solution for Egypt is an increase in its import of grain. He explains that Egypt is the riparian state that is in the best position to pursue this option to

¹⁸⁸ Wichelns, Dennis. "Economic Analysis of Water Allocation Policies Regarding Nile River Water in Egypt." *Agricultural Water Management* 52.2 (2002): 155-175. Print, 157.

¹⁸⁹ Ibid.

¹⁹⁰ Ibid, 156.

¹⁹¹ Ibid, 172-173

¹⁹² Ibid.

increase food security given their “stronger, more diversified economy and better infrastructure.”¹⁹³ The country already imports 60 percent of its food and international food prices rose 37 percent from 2008 to 2010; however, trade-based solutions must be considered as the country’s poorest are feeling the effects of this price increases, and the inevitable decrease in the volume of subsidized food.¹⁹⁴

ii. Strengthen Informational Linkages Between Local Users and Government

The last national census of agricultural activity was completed in 1961. The exact area of unused arable and cultivated land is unknown. An effective system to determine community water systems does not exist. Given Egypt’s limited water resources, this type of informational gap is unacceptable. The government must be able to identify the land and crops that are most suitable for a specific area, and provide incentives for farmers to heed its advice. Additionally, a priority system must be established for allocation to the various communities, and water quality standards must be implemented and maintained to prevent the excessive pollution of canals. This type of information will require cooperation between the federal government and the local WUAs to gather information on cropping patterns and determine whether these current allocations are sustainable and efficient.

iii. Methods to Increase Nile Discharge

As discussed above, if collective action between the riparian states can be achieved, it is important to consider the additional discharge that can be utilized through joint development projects. Primarily, the feasibility of the Jonglei Canal project should be

¹⁹³ Waterbury and Whittington, "Playing Chicken on the Nile?" 159.

¹⁹⁴ Glain, "Egyptian Farmers Make Themselves Heard."

reassessed and less arid locations should be considered as alternative to the Aswan High Dam.

b. Micro-Level Improvements

i. Reduced Role of MPWWE and Further Autonomy to the WUAs

Egypt must follow in Mexico's footsteps and significantly reduce the role and power of the MPWWE in water allocation. Although the MPWWE could be especially effective at gathering information from various communities to develop nation-wide strategies, local leaders within the WUAs should be responsible for the equitable allocation of water to various canals. If local community members are forced to continue consulting with the MPWWE over shortages, quality, pricing, etc., there is no accountability. If there is distributional autonomy, the WUA has incentives to modify its behavior as there is transparency and accountability at the local level. As Mahmoud Moustafa points out, "instead of rights to property, [the Egyptian] government... [is] trying to transfer responsibility for the property, while retaining fundamental ownership rights."¹⁹⁵ The strengthening of local property rights within WUAs, as exemplified by the Mexican case, is essential to create incentives for farmers to manage their allocation of water responsibly and invest in the expensive infrastructure improvements necessary to implement continuous flow. If the government could gather enough information about the water need of each area and divide communities into clearly defined units, it could provide each area with a specific quota of water based on need and as a percentage of a sustainable national usage. The community would have clear and undeniable property

¹⁹⁵ Moustafa, Mahmoud M. "Can Farmers in Egypt Shoulder the Burden of Irrigation Management?" *Irrigation and Drainage System* 18 (2004): 109-25. Print, 110.

rights to this amount of water. It would then be up to the local community to devise a system of distribution, perhaps based on historic productivity, plot size or general need, and levy fees for this water. This money would cover the operating costs of the local organization and pay for the maintenance of the local infrastructure. The government would have to ensure that the proper legal framework exists to settle disputes and ensure the strength of these property rights. Given the similarities between the two countries in terms of demographics, cultivated lands and characteristics of the irrigation systems, Egypt should be able to implement reforms with similar success to Mexico.

ii. What is Water Worth?

As of now, irrigation water is largely managed as a free resource with guaranteed access rights which has led to inefficient water allocation and practices. There is currently disequilibrium between supply and demand, and government subsidization significantly contributes to over use. It is essential for Egypt to treat water as an economic good with, as Doss and Milne point out, “prices based on supply and demand rather than a subsidized administered price or, no price at all.”¹⁹⁶ Water allocation and pricing must reflect the scarcity of the good in order to address supply problems. It is necessary for the WUAs to estimate the value of water, the opportunity cost of its depletion, and the operation and management costs incurred; this price can be reflected in the price charged to the residents.¹⁹⁷ This economic analysis must be conducted in conjunction with the national government. If water can be priced and allocated through a private market, then inefficient use at the local level will be greatly reduced.

¹⁹⁶Doss and Milne, "Water As An Economic Good: An Approach to the Egyptian Economy,"2.

¹⁹⁷ Ibid, 16.

Additionally, an effective market and price for water will decrease the likelihood of farmers growing water-intensive crops. Based on national averages, the production of rice, sugar cane and fruits, which are grown abundantly in Egypt, have the three highest water consumption figures per hectare of crops.¹⁹⁸ After Egypt altered its planned agriculture sector in favor of a more liberal decision-making process, many cotton and maize farmers switched to rice production for its higher profitability; this resulted in amount of land used for rice production doubling. Doss and Milne show that the irrigation of more than approximately 500,000 hectares of rice would use 20 percent of Egypt's Nile water.¹⁹⁹ For both the purposes of decreasing water usage and increasing food security, the continued use of water to grow these water-intensive species is unsustainable and does not maximize land productivity. If a water pricing and quota system were implemented, it is likely that farmers will shift away from these species because they will be unable to afford the water to maintain them. However, if this reduction is not sufficient, the government may have to return to centrally-planned agricultural quotas and restrictions.

iii. Invest in Modernizing Canal Infrastructure

In order to replicate the continuous flow mechanism which is essential to the success of the IIP effort, there must be a series of improvements to the canal infrastructure. This will include the installation of automatic downstream control gates to correctly allocate water from the AHD to various canals. Additionally, as Hvidt explains, a significant majority of the current canals must be "redug and downsized, improvements in earthwork must be undertaken and all new *mesqua* intakes must be reconstructed and

¹⁹⁸ Ibid, 10.

¹⁹⁹ Ibid.

aligned on a standard level.”²⁰⁰ While this will inevitably be an expensive undertaking, the development of uniform canal infrastructure is essential to the long-term reliability and sustainability of the irrigation sector. Because the government cannot be relied upon to rapidly and effectively implement these reforms, it is suggested that the IIP should only work “to plan and facilitate” these efforts and the WUAs should work directly with local, private firms to organize the design and construction of the *mesqua* improvements.²⁰¹ This can be paid for, in part, by the fees levied at the local level; however, as discussed, the success of raising local funds is dependent on the strengthening of property rights. An effective and modern regulatory system within the canals can significantly reduce wastage and will allow the government to efficiently manage and monitor output from the AHD.

XI. Conclusion

The countries of the Nile Basin are on a collision course that could result in disastrous military action to determine control. In the wake of the Arab Spring, the Egyptian government has lost much of the regional clout that allowed it to maintain its enormous share of the Nile as outlined by the 1959 agreement. Population and economic growth in upstream countries, specifically Ethiopia, have resulted in intensified calls for a more equitable water-sharing agreement. However, any water taken by upstream countries would be a direct reduction in Egypt’s allocation. A 13- year stalemate in the NBI prompted Ethiopia to begin building the GRD without Egypt’s consent. This dam

²⁰⁰ Hvidt, "Implementing New Irrigation Technology in Upper Egypt: Political and Bureaucratic Considerations," 33.

²⁰¹ APRP - Water Policy Reform Activity Contract PCE-I-00-96-00002-00 Task Order 807."

will provide Ethiopia with enormous hydroelectric and irrigation power; however, the completion of this dam will also result in a certain reduction of the water that reaches Egypt's borders. Egypt's population and agriculture sector rely heavily on the maintenance of this status quo and also the face the mounting effects of climate change, rising food prices and immense population growth.

In order to avoid a severe water crisis, Egypt must look to improve efficiency within its own borders. Primarily this will involve the devolution of power to the local level through the implementation of WUAs. However, the IIP pilot program that Egypt implemented did not establish a framework that could plausibly result in the necessary water-savings. This is due to its failure to reduce the power of the MPWWR and delegate enough power to the community level the WUAs; the pilot program failed to create distributional and financial autonomy within the WUAs and they lacked proper community-wide incentives to reduce water usage. It is essential to take examples from the successful Mexican irrigation reform efforts and combine these with other modifications and policy shifts with the agriculture and irrigation sectors in to save enough water to provide for the growing population in Egypt; these efforts may avoid shortages when the GRD and other upstream development projects are completed.

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