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Urban Water Planning in Lagos, Nigeria: An Analysis of Current Infrastructure Developments and Future Water Management Solutions

By

Adaure S. Chiori

02/01/2018

Abstract:

The state of Lagos, Nigeria is one of several African cities facing a major water crisis. Despite being rich in water resources, access to water within the state is dreadfully low and a major public health threat. Currently, the Lagos Water Corporation, the primary supplier of water in the state, is facing a 320-million-gallon water demand gap due to the rapidly growing population within the city. Additionally, the water crisis is further exacerbated by deteriorating infrastructure, political instability, and poorly regulated water laws. The result of the water crisis in Lagos has led to detrimental consequences for its citizens as child mortality and water-borne disease-related deaths have grown exponentially. To combat this problem, the Lagos Water Corporation developed its Water Supply Master Plan with an aim to bridge the water demand gap and provide pragmatic solutions for water-related issues within the state. Unfortunately, this plan is heavily flawed and non-encompassing.

This paper will explore in detail the issues that aggravate the Lagos water crisis. Additionally, I will examine the Lagos Water Supply Plan and highlight its strengths and limitations, as well as provide probable solutions that can lead to a reform in the water crisis.

Urban Water Planning in Lagos, Nigeria: An Analysis of Current Infrastructure
Developments and Future Water Management Solutions

By

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B.S., Emory College of Arts and Sciences

A Capstone Submitted to the Graduate Faculty of Georgia State University in
Partial Fulfillment of the Requirements for the Degree

MASTER OF PUBLIC HEALTH

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APPROVAL PAGE

**Urban Water Planning in Lagos, Nigeria: An Analysis of Current
Infrastructure Developments and Future Water Management Solutions**

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Author's Statement Page

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Adaure S. Chiori

Signature of Author

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CHAPTER ONE

INTRODUCTION

The concept of urban water management was developed to combat the issues about rapid urbanization and population growth worldwide. It is loosely defined as the security and restoration of water resources to benefit the community, economy and the environment.¹ Water scarcity is a phenomenon that currently plagues the majority of the world's population, as several countries are finding it difficult to provide the necessary water demands of its population. However, developing countries are especially concerning as they lack the physical quantity of water and the quality of their available resources are abysmal.



Figure 1 Map of Lagos, Nigeria

¹ Urban water management. (2018). Water.wa.gov.au. Retrieved 25 April 2018, from <http://www.water.wa.gov.au/urban-water/urban-development/urban-water-management>

Lagos is the most populous city in Africa with an estimated population of 21 million people.² Lagos, which roughly translates to "lakes," is the primary port city of Nigeria, due to its location along the Atlantic Ocean.³ Located in South -West Nigeria, Lagos State was first established as a fishing and farming settlement in the 15th century and slowly expanded into the large coastal town it is today.⁴ Geographically, Lagos is comprised of a collection of small islands, separated by small creeks that empty out into the Lagos Lagoon, but is categorized into three main geographical areas —the Island, Lagos Island and the Mainland.⁵ Technically, Lagos state has five administrative division: Ikeja, Badagry, Ikorodu, Lagos Island and Epe, which were subdivided into 20 Local Government Areas (LGAs).⁶

Collectively, Lagos has a total land area of 3,577 square kilometers and an entire metropolitan area of 738 square kilometers.⁷ With an estimated population growth of 13% per annum, one of the most significant challenges faced by the Lagos government is overpopulation.⁸ One of the most significant ramifications of overpopulation is the depletion of natural resources brought on by the environments carrying capacity. Currently dubbed the “mega-city of slums,” approximately 66% of the population live in slums.⁹ Millions of Lagosians are living in squalid conditions with no reliable access to sustainable food, clean drinking water, electricity and adequate sanitation. Despite the influx of economic growth —annual GDP OF \$521.8 billion, more than half of the population lives on less than \$1.25 per day and have low

² Karuga, J. (2018). *15 Biggest Cities In Africa*. *WorldAtlas*. Retrieved 9 February 2018, from <https://www.worldatlas.com/articles/15-biggest-cities-in-africa.html>

³ Karuga, J. (2018). *15 Biggest Cities In Africa*. *WorldAtlas*. Retrieved 9 February 2018, from <https://www.worldatlas.com/articles/15-biggest-cities-in-africa.html>

⁴ *Lagos – a city of dreams and nightmares*. (2018). *D+C*. Retrieved 10 February 2018, from <https://www.dandc.eu/en/article/lagos-city-dreams-and-nightmares>

⁵ *Lagos - New World Encyclopedia*. (2018). *Newworldencyclopedia.org*. Retrieved 10 February 2018, from <http://www.newworldencyclopedia.org/entry/Lagos>

⁶ 2018). *Eaumegea.org*. Retrieved 12 February 2018, from <http://eaumegea.org/wp-content/uploads/2016/05/EN-Lagos-Monograph.pdf>

⁷ *Lagos facts, information, pictures | Encyclopedia.com articles about Lagos*. (2018). *Encyclopedia.com*. Retrieved 10 February 2018, from <http://www.encyclopedia.com/places/africa/nigeria-political-geography/lago>

⁸ *POPULATION OF LAGOS 2017*. (2018). *Populationof2017.com*. Retrieved 10 February 2018, from <http://populationof2017.com/population-of-lagos-2017.html>

⁹ *POPULATION OF LAGOS 2017*. (2018). *Populationof2017.com*. Retrieved 10 February 2018, from <http://populationof2017.com/population-of-lagos-2017.html>

access to education and healthcare.¹⁰Such appalling statistics make the water crisis stress the effects of the water crisis.

Potable water— water safe for consumption, typically comes from surface water or groundwater. Surface water refers to water derived from streams, lakes, rivers, and reservoirs, while underground aquifers hold the city's groundwater.¹¹ In most cases, governments or privatized water companies chemically treat and distribute either surface or groundwater for public consumption.¹² It is also common for individuals to use private wells to collect groundwater; however, this is a water source that is rare in developed nations.

Developing nations like Nigeria are struggling to parallel their water capacity with their rapid population incline. Despite having a total surface and groundwater capacity above 250 billion cubic meters, Nigeria is currently ranked as an economically water scarce country.¹³ Lagos State, in particular, has a coastline that is approximately 180 km long, with an average elevation of less than 15m above sea level.¹⁴As its name indicates, Lagos State's coastal areas consist of lagoons, creeks, and swamps and approximately 40% of its land area is covered by wetlands and water bodies with an average annual rainfall of 2000mm.¹⁵

Presently, Lagos has a total of 10 lagoons. The major surface water bodies are the Lagos, Ologe and Lekki Lagoons.¹⁶The other smaller ones are Kuramo Waters, Badagry, Five Cowries and Omu Creeks.¹⁷ In addition to these brackish water sources, Lagos has six other significant rivers (freshwater) that source its drink water: Ogun, Yewa, Aye, Owo, Oworu, and Osun.¹⁸ As

¹⁰ *Poverty in Lagos, Nigeria - The Borgen Project*. (2015). *The Borgen Project*. Retrieved 10 February 2018, from <https://borgenproject.org/poverty-lagos-nigeria/>

¹¹ *Potable Water - National Library of Medicine - PubMed Health*. (2018). *PubMed Health*. Retrieved 11 February 2018, from <https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0029892/>

¹² *Potable Water - National Library of Medicine - PubMed Health*. (2018). *PubMed Health*. Retrieved 11 February 2018, from <https://www.ncbi.nlm.nih.gov/pubmedhealth/PMHT0029892/>

¹³ (2018). *Waterresources.ng*. Retrieved 12 February 2018, from <http://www.waterresources.ng/wp-content/uploads/2017/02/Download.pdf>

¹⁴ (2018). *Waterresources.ng*. Retrieved 12 February 2018, from <http://www.waterresources.ng/wp-content/uploads/2017/02/Download.pdf>

¹⁵ (2018). *Waterresources.ng*. Retrieved 12 February 2018, from <http://www.waterresources.ng/wp-content/uploads/2017/02/Download.pdf>

¹⁶ (2018). *Waterresources.ng*. Retrieved 12 February 2018, from <http://www.waterresources.ng/wp-content/uploads/2017/02/Download.pdf>

¹⁷ (2018). *Waterresources.ng*. Retrieved 12 February 2018, from <http://www.waterresources.ng/wp-content/uploads/2017/02/Download.pdf>

¹⁸ (2018). *Eaumeqa.org*. Retrieved 12 February 2018, from <http://eaumeqa.org/wp-content/uploads/2016/05/EN-Lagos-Monograph.pdf>

is evident from its numerous water bodies, Lagos is a city blessed with aquatic splendor, and the lack of available drinking water has left its citizen perplexed and infuriated. Much work needs to be done about increasing access and availability to these abundant water sources, and the citizens of Lagos remain hopeful but very weary.

1.1) Lagos Water Supply (Urban Water Supply)

In 1910, Lagos State launched its first water treatment and distribution operations with the inception of the Lagos Water Corporation (LWC), formerly known as Federal Water Supply¹⁹. Under Federal Government jurisdiction, the LWC constructed its first water treatment and distribution facility located on the Lagos Mainland, Iju Waterworks. With a design capacity of approximately 2.4 million gallons per day (mgd), the treatment plant was able to provide potable water to colonial residents located in the wealthiest communities in Lagos. Before the inception of Iju Waterworks, the supply of clean, drinkable water was a substantial burden for the Lagos state government. Throughout the nineteenth century, Lagos residents utilized spring and well water, introduced by Sir John Glover, a colonial governor of Lagos.²⁰ In the late nineteenth century, a former colonial surgeon insisted on remedial measures for the monitoring and regulation of public well water.²¹ From then on, public wells were to be clay-padded or cemented and drawn through a pump as opposed to a traditional bucket on a string.²²

¹⁹ Lagos State Water Corporation. (2018). *Lagos State Water Corporation*. Retrieved 12 February 2018, from <http://watercorporation.lagosstate.gov.ng/>

²⁰ Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries*. Books.openedition.org. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²¹ Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries*. Books.openedition.org. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²² Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries*. Books.openedition.org. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

The need for potable, piped water to the state received urgency by the colonial government once water quality became a cause for medical concern. After several attempts to find adequate water sources, the federal government reluctantly decided on Iju, a suburb north of Lagos.²³ The government-funded waterworks was providing clean, treated water to Lagos residents through cast iron trunks approximately 28 inches in diameter.²⁴ Since its inception in the early 1900's, the Iju waterworks has expanded its capacity from 2.4 million gallons per day (mgd) to its current size of 210 mgd, with pipelines spreading widely across the mainlands and the Lagos metropolitan.²⁵ By the end of the colonial period, the amount of water from the Iju waterworks was no longer adequate to meet the ever-growing demand for water in Lagos. The state government decided to construct a second water treatment and distribution facility in Ishasi, which gained its raw water supply from the Owo river.²⁶ With an initial water capacity of 4 mgd, Ishasi waterworks was primarily developed to provide water for the residents of "Festival Village," a residential estate that housed participants of the All Black and African Festival of Arts and Culture in 1977.²⁷

In 1980, the state government developed a water board, whose primary purpose is to manage the freshwater resources of the state and keep up with the growing demands for potable water for its residents.²⁸ The conception of the water board brought about the construction of ten mini-waterworks located throughout the state. Mini waterworks were designed to supplement the supply from Iju and Ishasi by providing water to newly developed commercial and residential areas within the state. They were constructed to feed directly into the already established water

²³ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²⁴ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²⁵ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²⁶ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²⁷ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

²⁸ Olukoj, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

networks, as a means to improve water access to the communities.²⁹ In addition to building these mini waterworks, the water board also expanded its tertiary distribution networks, to further aid in improving customer access.³⁰

In December 1991, the Lagos State government commissioned the first phase of the construction of Adiyin Waterworks, the most significant water treatment facility in the West Africa Sub-region. Presently, the facility has a design capacity of 70 million gallons per day, but it aims to have a capacity of 140 million gallons per day by the completion of its phase 2 expansion.³¹ The water treatment plant is located in Agbado, Ogun State, a small town on the outskirts of Lagos State. Presently, the treatment facility sources its raw water from River Ogun and distributes its clean water from the reservoirs to residents in the central metropolitan area of the state.³²

1.1.1) Governance and Regulatory Framework

In addition to ensuring sufficient water supply and treatment to the residents of Lagos, there are several political and administrative authorities in place to implement and enforce policies related to sustaining and regulating water services:

1). Lagos State Water Corporation (LWC)³³

The Lagos Water Corporation is - one of the many public authorities of water supply in Lagos. They are also the principal supplier of water throughout Lagos State. In addition to water supply,

²⁹ Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

³⁰ Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

³¹ Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

³² Olukoju, A. (2018). *Chapter three. Water supply in the nineteenth and twentieth centuries. Books.openedition.org*. Retrieved 12 February 2018, from <http://books.openedition.org/ifra/830>

³³ *Lagos Water Corporation*. (2018). *Lagoswater.org*. Retrieved 10 March 2018, from <https://lagoswater.org/>

the LWC develops pragmatic solutions to solve the many challenges faced in Lagos public water supply. The LWC quality assurance department provides systematic monitoring and evaluation of the public water supply through hourly chemical testing. The LWC master plan serves as a blueprint for the development and assurance of safe, reliable drinking water in Lagos.

2). Lagos State Environmental Protection Agency (LASEPA)³⁴

The Lagos State Environmental Protection Agency is the environmental regulatory body for the state of Lagos. The primary objective of this governmental agency is to safeguard the environment by protecting its wildlife, forest, water, air, and land. LASEPA works with other federal agencies and industries to enforce national water and air regulatory standards. Their water department is in charge of surveying and monitoring underground and freshwater sources to determine pollution levels and collect baseline data.

3). Lagos State Water Regulatory Commission (LSWRC)³⁵

The Lagos State Water Regulatory commission was initially conceptualized in 2004 by the state government in a bid to address the issues relating to the availability and distribution of clean, potable water to Lagos State residents. Their sole responsibility is to regulate the activities of the state water resource agencies and wastewater management. LSWRC aims to protect the interest of the consumers by continually surveying the functions of water supply and sewage services and reviewing their standards of performance. The commission also seeks to prevent all forms of water pollution through the adequate treatment and disposal of agricultural and industrial waste.

³⁴ Welcome To LASEPA Official Website. (2018). *Lasepa.gov.ng*. Retrieved 10 March 2018, from <http://lasepa.gov.ng/>

³⁵ Lagos State Water Regulatory Commission (LSWRC). (2018). *Lagos State Water Regulatory Commission (LSWRC)*. Retrieved 10 March 2018, from <http://lswrc.lagosstate.gov.ng/>

4). Lagos State Waste Water Management Office (LSWMO)³⁶

The Lagos State Waste Water Management Office is a department derived from the Lagos State Ministry of Environment. Established in September 2010, the LSWMO was incorporated (into the Lagos Water corporation) after the state government felt the need for refinement in wastewater treatment and regulations. Before the conception of LSWMO, Lagos state was producing an average of 1.5 million cubic meters of wastewater per day with no adequate means of treatment or disposal. The development of the LSWMO has led to the execution of plans and policies that address all wastewater management concerns in urban and semi-urban areas of the state. Additionally, the office also monitors, supervises and regulates all public and private wastewater infrastructure within the state. Currently, there are ten wastewater treatment plants across the state, and the new office aimed to further establish unprecedented improvement of the wastewater sector through infrastructure development and enforced sewage management policies.

5). Lagos State Environmental Sanitation Enforcement Agency (LSESEA)³⁷

The Lagos State Environmental Sanitation Enforcement Agency was established in 1991 to address problems of poor sanitary conditions of slum settlements within the state. The LSESEA exercises its power of authority through the arrests and prosecutions of persons that commit offenses that endanger the environment and its laws.

6). Lagos State Ministry of Environment (LSMOE)³⁸

³⁶ *Lagos State Waste Water Management Office (LSWMO)* . (2018). *Moelagos.gov.ng*. Retrieved 10 March 2018, from <http://moelagos.gov.ng/agencies/lagos-state-waste-water-management-office/>

³⁷ *Environmental Services* . (2018). *Moelagos.gov.ng*. Retrieved 10 March 2018, from <http://moelagos.gov.ng/departments/environmental-services/>

³⁸ *Lagos State Ministry of the Environment - committed to sustainable environment.*. (2018). *Moelagos.gov.ng*. Retrieved 10 March 2018, from <http://moelagos.gov.ng/>

The Lagos State Ministry of Environment is a national ministry established in 1979 primarily mandated to create a healthier, cleaner city. MOE consists of several environmental divisions that collaborate to ensure ecological prosperity within the state. The Zero Tolerance Division works as a regulation unit by carrying out minor enforcements to fix observed infractions. They also work with the Ministry of Justice to prosecute those that refuse to comply with laws about the environment.

1.2) **CURRENT WATER CRISIS**

The Lagos water crisis has been a source of bewilderment to the rest of the world as Lagos is a small city surrounded by water, yet there is very little access. Currently, the approximate water demand in the state of Lagos is 540 million gallons per day (mgd), with the state providing only 220 million gallons per day (mgd).³⁹The challenges faced in Lagos water supply are not unfamiliar, as they are common in most rapidly urbanized developing nations. The poor operational efficiency of water treatment facilities, low cost-recovery, increasing population size and poor governance are just a fraction of the challenges that are faced by the Lagos Water Corporation.⁴⁰

Since the inception of the Lagos Water Corporation in 1910, the Lagos government has been unable to meet the growing water demands of the Lagos population. The provision of

³⁹ WHO | *The determinants of health*. (2018). *Who.int*. Retrieved 27 February 2018, from <http://www.who.int/hia/evidence/doh/en/index3.html>

⁴⁰ *Lagos Water Crisis: Alternative Roadmap for Public Water Sector*. (2018). *ReliefWeb*. Retrieved 26 February 2018, from <https://reliefweb.int/report/nigeria/lagos-water-crisis-alternative-roadmap-public-water-sector>

potable, piped water is considered by the World Health Organization (WHO) to be an essential determinant of public health. However, exponential population growth has hindered the government's ability to do so.⁴¹ The 320 mgd gap in the water sector is disconcerting and calls for a massive rehabilitation of water policies and conservation across the state. The majority of the population has resorted to gaining access to water through building private boreholes, water tankers, wells, water sachets, water carts and other methods of informal water supply. This method of access considerably concerns because such water sources are at high risk for contamination during floods and are not subject to the same quality standards and treatment methods as piped water.⁴² Informal water supply in Nigeria, although illegal, has been successful in providing water to majority of the population, especially those living in informal settlements. As piped systems within Lagos have had problems matching population growth, vendors perform a parallel service by collecting water from water channels illegally and distributing and selling this water in poor, urban neighborhoods.⁴³ A major concern with this method of distribution is that the source of water for these water vendors differ significantly. Although some vendors collect treated water from broken or faulty pipes, other vendors have been known to source their water from contaminated water bodies and treat it using ineffective purification techniques such as boiling.⁴⁴ As a result of this, the Lagos government has been working to meet the water demand, so as to eliminate the informal market.

⁴¹ WHO | *The determinants of health*. (2018). *Who.int*. Retrieved 27 February 2018, from <http://www.who.int/hia/evidence/doh/en/index3.html>

⁴² *Water quality in tanks, bores, and dams*. (2018). *Betterhealth.vic.gov.au*. Retrieved 27 February 2018, from <https://www.betterhealth.vic.gov.au/health/healthyliving/water-quality-in-tanks-bores-and-dams>

⁴³ *Informal Water Vendors and the Urban Poor*. (2018). *Google Books*. Retrieved 26 April 2018, from https://books.google.com/books/about/Informal_Water_Vendors_and_the_Urban_Poo.html?id=DteiNAAACAAJ

⁴⁴ *Informal Water Vendors and the Urban Poor*. (2018). *Google Books*. Retrieved 26 April 2018, from https://books.google.com/books/about/Informal_Water_Vendors_and_the_Urban_Poo.html?id=DteiNAAACAAJ

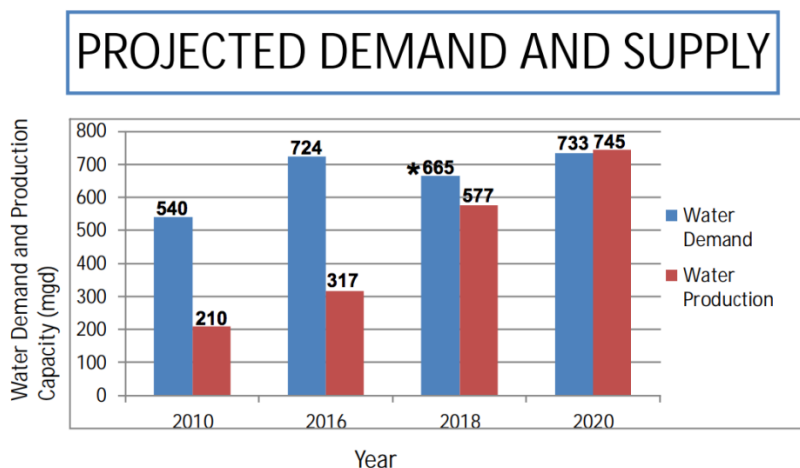


Figure 2. Projected Water Demand and Supply (2010-2020)

Four primary drivers lead to the limited water supply in Lagos and its inferior water quality.

1. Ageing Water Infrastructure

Despite the numerous property expansions that most of the major water treatment plants in Lagos have undergone, the infrastructure is outdated or in need of substantial repairs. A significant amount of treated water is lost during the distribution process, due to faulty or broken pipes. This also leaves room for contaminated surface runoff to penetrate the pipes, affecting the integrity of the water quality. According to the LWC, sporadic electricity supply is to blame for the deteriorating infrastructure.⁴⁵ Additionally, poorly funded projects within the water corporation have led to stalled infrastructure developments that render them useless and non-functioning.⁴⁶

Poorly planned distribution networks and service lines have proven to be a significant burden on Lagos water supply. Currently, less than 10 percent of households

⁴⁵ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 1 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

⁴⁶ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 1 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

in Lagos have access to public water connections, and fewer than 30 percent have access to community pipes.⁴⁷ Despite being introduced in the early 1900's, inadequate investments towards transmission and distribution mains have led to failing water supply.

2. Failing Policies and Regulations

Policy failures in Nigeria are the reason it is one of the most underdeveloped in the world, despite the country's numerous resources and wealth. Water policies and regulations that were introduced in the early 90's have failed to have a lasting impact on the Lagos water crisis⁴⁸. Most of the plans proposed lacked a defined framework with no set guidelines for poverty reduction, instead, were solely beneficial to the rich and political appointees. Additionally, the government fails to ensure public participation in policymaking regarding water such as a citizen's utility board, water board or alternative social dialogue.

3. Poor Budget Allocation

According to the Lagos State Water Master plan conceived by the Lagos Water Corporation, a total of \$2.5 billion is needed to allow the corporation to supply the required access to the Lagos population.⁴⁹ The Lagos State government has repeatedly failed to allocate the necessary funds towards water and water management, and in 2011, it was reported there was no budget allocated to the water corporation.⁵⁰ It is clear that the state government is still in denial about its current grapples with water stress as it still

⁴⁷ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria*. (2018). *PM NEWS Nigeria*. Retrieved 1 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos>

⁴⁸ *Nigeria Water Sector Reform Programme*. (2017). *Nwsrp.gov.ng*. Retrieved 26 April 2018, from <http://nwsrp.gov.ng/part.php?n=2>

⁴⁹ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria*. (2018). *PM NEWS Nigeria*. Retrieved 1 March 2018 /

⁵⁰ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria*. (2018). *PM NEWS Nigeria*. Retrieved 1 March 2018 /

places a low priority on funds for water. In 2016, the current Lagos Governor, Akinwunmi Ambode, created a 2016 budget - which he dubbed "the People's Budget."⁵¹ This budget was set to deliver on the promise of "Lagos Works for all," however, very little of the budget is geared towards water management and supply.

4. Inadequate Power Supply

Currently, more than 95 million Nigerians (over half of the population) do not have access to electricity, and those that do have the power supply, suffer from frequent, persistent power outages that can impact most facets of daily living.⁵² Despite being Africa's largest economy by GDP, the entire country has an available operating capacity of approximately four thousand megawatts (MW), practically incomparable to the four billion megawatts of electricity generated in the United States in 2016.⁵³ This lack of generated electricity has proven to be disruptive to water production in Lagos. The "epileptic" electricity supply hampers production and bumps up costs due to heavy reliance on diesel generators.

Freshwater pollution has been at the forefront of the Lagos water crisis for several years. It has been reported that industrial wastes account for 70 percent of the pollutants in freshwater in developing countries.⁵⁴ The Lagos Lagoon is mainly a target for several environmental and ecological challenges.

⁵¹ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria*. (2018). *PM NEWS Nigeria*. Retrieved 1 March 2018

⁵² *Power Africa in Nigeria | Power Africa | U.S. Agency for International Development*. (2018). *Usaid.gov*. Retrieved 1 March 2018, from <https://www.usaid.gov/powerafrica/nigeria>

⁵³ *Power Africa in Nigeria | Power Africa | U.S. Agency for International Development*. (2018). *Usaid.gov*. Retrieved 1 March 2018, from <https://www.usaid.gov/powerafrica/nig>

⁵⁴ *Freshwater 101: Pollution*. (2010). *Nationalgeographic.com*. Retrieved 2 March 2018, from <https://www.nationalgeographic.com>



Figure 3. Lagos Lagoon 2017 (Source: Stella Chiori)

The degraded condition of surface water and groundwater is due to unregulated wastewater discharge, commercial activity, and surface runoff. This is very concerning as such freshwater are used as primary water sources for many Nigerians living in informal settlements. Water pollution can pose health risks to humans as well as its ecosystem.

1) Water-borne diseases

The effects of drinking polluted water can be detrimental to human health. According to the World Health Organization, more than 3.4 million people die annually as a result of water related illnesses, making it the leading cause of death worldwide.⁵⁵ Disease-causing microorganisms in polluted water known as pathogens are often linked to fecal matter in the water.⁵⁶ Exposure to such liquids can cause respiratory disease, cancer, diarrheal

⁵⁵ WHO: *Waterborne Disease is World's Leading Killer*. (2009). VOA. Retrieved 3 March 2018, from <https://www.voanews.com/a/a-13-2005-03-17-voa34-67381152/274768.html>

⁵⁶ (2018). *Who.int*. Retrieved 3 March 2018, from http://www.who.int/water_sanitation_health/resourcesquality/watpolcontrol.pdf?ua=1

disease and can also be linked to rare cardiovascular disorders.⁵⁷ As of 2015, 18 percent of child deaths under-five are caused by diarrheal illnesses linked to contaminated water, and a relative contribution of such cases occur in developing cities like Lagos.⁵⁸

Nitrogenous chemicals from water polluted by agricultural runoff have been linked to cancer and cancer-related deaths.⁵⁹ In other cases, water-related diseases can also be transmitted directly, through person-to-person contact with an infected individual.

2) Ecosystem Failure

Freshwater ecosystems are an essential part of life as they play an integral part in our food web. In addition to supplying our drinking water, freshwater bodies are home to several animal species that have become imperiled over the past decades. The operations of human activities which have led to polluted freshwater bodies have a resultant effect on freshwater ecosystems. Harmful substances such as pesticides, heavy metals, and hydrocarbons released into these waters cause infections and large-scale mortalities in aquatic organisms.⁶⁰ Large-scale aquatic death has impacts on water quality which can be dangerous for ingestion. Similarly, the consumption of diseased fish can affect humans and other predators.⁶¹ Groundwater contamination caused by agricultural runoff has been scientifically proven to cause reproductive damage within aquatic organisms as well as other wildlife that are exposed to it.⁶² Such disruptions in the food chain can lead to extensive ecosystem destruction.

⁵⁷ (2018). *Who.int*. Retrieved 3 March 2018, from http://www.who.int/water_sanitation_health/resourcesquality/watpolcontrol.pdf?ua=1

⁵⁸ *WHO | Child mortality*. (2018). *Who.int*. Retrieved 3 March 2018, from http://www.who.int/pmnch/media/press_

⁵⁹ Haseena, M., Malik, M., Javed, A., Arshad, S., Asif, N., & Hanif, J. (2018). Water pollution and human health. *Environmental Risk Assessment And Remediation*, 1(3). Retrieved from <http://www.alliedacademies.org/articles/water-pollution-and-human-health-7925.html>

⁶⁰ B, A. (2018). *The effects of pollution on fish health*. - *PubMed - NCBI*. *Ncbi.nlm.nih.gov*. Retrieved 3 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/2>

⁶¹ B, A. (2018). *The effects of pollution on fish health*. - *PubMed - NCBI*. *Ncbi.nlm.nih.gov*. Retrieved 3 March 2018, from <https://www.ncbi.nlm.nih.gov/pubmed/2>

⁶² *Causes and Effects of Water Pollution*. (2018). *Gogreenacademy.com*. Retrieved 3 March 2018, from <http://www.gogreenacademy.com/causes-and-effects-of-water-pollution/>

One of the main challenges of combating freshwater pollution in Lagos is the failure to enforce regulations. The LSWRC has several mandates in place to ensure the protection of its water resources, yet not many of these are administered. Nigeria as a whole has assumed a “control and command” approach to water resource management.⁶³ There is little to no community engagement involved in the Lagos water sector. In many instances, civilians are merely unaware of the dangers of water pollution and waste management. There are also very little collaborations between the federal, state and local government agencies, leading to conflicting mandates concerning water regulations.⁶⁴

In cities such as Lagos, where unequal wealth distribution is at its highest level in decades, wealth distorts access to basic needs such as food (including water), shelter and clothing. Despite it, national growth over the decades, approximately 62 percent of Nigerians live on less than \$1.25 per day.⁶⁵ Political instability, overpopulation, lack of education and healthcare are some of the catalysts of poverty in most urban cities. For a majority of the population, living in Lagos can seem almost impossible. Two out of three residents live in the city’s slums — informal settlements that house makeshift homes made of wood and scraps.⁶⁶ Due to increasing urban population growth within the metropolis, a majority of these slum dwellers are forced to live on the city’s coastlines, on homes elevated on wooden stilts as insurance against seasonal flooding. In such settlements, access to clean water, food, and healthcare are virtually nonexistent.

⁶³ *How Nigeria is wasting its rich water resources.* (2017). *The Conversation*. Retrieved 3 March 2018, from <http://theconversation.com/how-nigeria-is-wasting-its-rich-water-resources-83110>

⁶⁴ *How Nigeria is wasting its rich water resources.* (2017). *The Conversation*. Retrieved 3 March 2018, from <http://theconversation.com/how-nigeria-is-wasting-its-rich-water-resources-83110>

⁶⁵ *Nigeria.* (2018). *World Bank*. Retrieved 3 March 2018, from <http://www.worldbank.org/en/country/nig>

⁶⁶ *Slum Dwellers In Africa's Biggest Megacity Are Now Living In Canoes.* (2017). *NPR.org*. Retrieved 3 March 2018, from <https://www.npr.org/sections/goatsandsoda/2017/05/15/528461093/slum-dwellers-in-africas-biggest-megacity-are-now-living-in-canoes>

Over the past decade, the record number of millionaires in Nigeria has increased about 305 percent, mostly due to the oil and finance industry.⁶⁷ With the sudden influx of stratospheric wealth, informal settlements have become the target of a government eviction campaign motivated by the development of luxury real estate to accommodate the nouveau riche. For the past five years, the state government has repeatedly ordered the forceful evacuations of slum dwellers, rendering thousands of residents homeless and destitute.⁶⁸

Currently, all of the remaining slums in Lagos are not recognized by the government as legal settlements. Therefore, they are not entitled to necessary government provisions — such as piped water. Slum dwellers are forced to drink and bathe in waters that lack adequate treatment. Surface waters within the slums are filled with human waste and other waste products, which dramatically increase the spread of waterborne diseases and a host of other sanitation-related health problems.

Women and children living in slums are subject to higher levels of human rights violations than men. They are more likely to encounter transgressions such as domestic violence, sexual harassment, and unemployment. Water is primarily a driving force of gender inequalities between men and women living in slums. Culturally, Nigerian women take on the role of domestics within the home — even those living in slums. Therefore, women and young girls spend several hours in the day fetching water to meet their family's needs. Because these slums are not formally planned by the state, wells and community taps are few and far between. Such time-consuming tasks are consequential to the education and finances of women and young

⁶⁷ *Poverty in Lagos, Nigeria - The Borgen Project*. (2015). *The Borgen Project*. Retrieved 3 March 2018, from <https://borgenproject.org/poverty-lagos-nigeria/>

⁶⁸ *Poverty in Lagos, Nigeria - The Borgen Project*. (2015). *The Borgen Project*. Retrieved 3 March 2018, from <https://borgenproject.org/poverty-lagos-nigeria>

girls.⁶⁹ Having instant access to clean and sustainable water sources can empower thousands of women by improving their access to education and job opportunities.⁷⁰

⁶⁹ *Empowering Women through Water*. (2018). *The Water Project*. Retrieved 4 March 2018, from <https://thewaterproject.org/water-scarcity/water-womens-empowerment>

⁷⁰ *Empowering Women through Water*. (2018). *The Water Project*. Retrieved 4 March 2018, from <https://thewaterproject.org/water-scarcity/water-womens-empowerment>

CHAPTER TWO

CURRENT WATER SUPPLY INITIATIVES

2.1) Lagos Water Supply Master Plan (2010-2020)

The call for Lagos water supply reforms began in the late 2000's as issues concerning water availability began to rise. The Lagos Water Corporation developed its "Water Supply Master Plan 2010-2020", a proposed 10-year plan to bridge the gap between water supply and water demand. As previously mentioned, the Lagos Water Corporation is currently unable to meet the population demand for clean water and is nowhere near a desirable trajectory to achieving the United Nations Sustainable Development Goals (SDG's).⁷¹ The Sustainable Development Goals is an agenda that seeks to combat the greatest global challenges worldwide. They consist of 17 goals and 169 targets that range from eradicating poverty to providing quality education worldwide.⁷² The main challenges that have prevented water supply initiatives in the past were growing populations, water resources and willingness to pay.⁷³ Therefore, the new master plan was constructed with these challenges in mind. The framework of the master plan is based on three segments; infrastructure developments, policy reform and water privatization.

Water scarcity is becoming a global crisis as several countries are being faced with the realization of their dwindling freshwater sources. In 2017, Cape Town, South Africa, one of Africa's most renowned tourist destinations garnered worldwide attention for being the first

⁷¹ Lagos Water Corporation. (2018). *Lagoswater.org*. Retrieved 4 March 2018, from <https://lagoswater.org/>

⁷² Sustainable Development Goals. (2018). UNDP. Retrieved 26 April 2018, from <http://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

⁷³ Lagos Water Corporation. (2018). *Lagoswater.org*. Retrieved 4 March 2018, from <https://lagoswater.org/>

major city to run out of the water. The Cape Town crisis quickly became a cautionary tale to other developing countries that have failed to deal with their grapples with water stress.

By 2050, the Lagos population is expected to reach approximately 50 million, which is mainly concerning due to its current resource management issues.⁷⁴

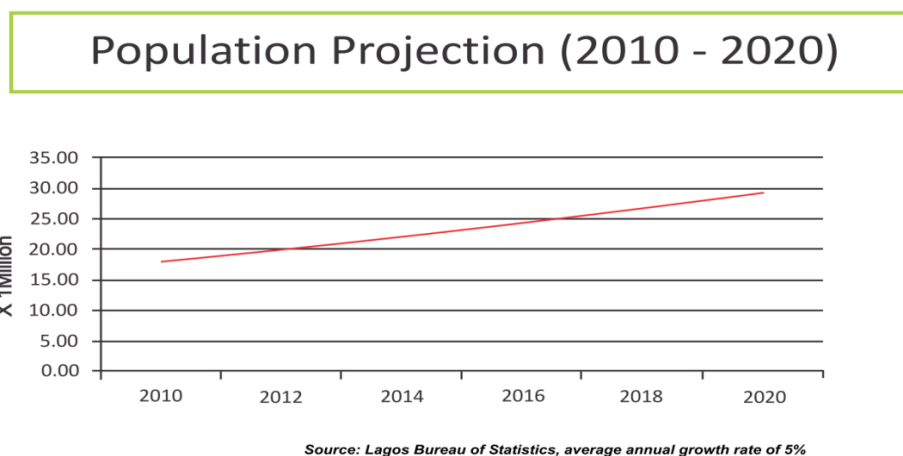


Figure 4. Forecasted population for Lagos State (2010-2020)

Producing sufficient water for the population of Lagos is particularly crucial as public health and wellness rely heavily on clean, potable water.

2.1.1) Infrastructure Developments

In 2015, the LWC began carrying out rehabilitation and expansion projects in many of the water treatment facilities around the state. Some of the projects include; replacement of old pipes, the extension of water mains and construction of booster stations. The major projects

⁷⁴ Thomas Page, f. (2018). *Lagos 2050: Megacity is preparing to double in size* - CNN. CNN. Retrieved 5 March 2018, from <https://www.cnn.com/2015/08/27/africa/lagos-population-2050/index.html>

underway are the expansions of six major waterworks— Afiyan, Odomola, Isashi and Ota-Ikosi and the constriction of 2 desalination plants — Yewa and Ibeshe. The master plan is to take place in 3 different phases: short term, medium term, and long-term.

Short Term (2010-2016)

Before any infrastructure developments commenced, the Lagos State government took steps to solve the significant issue of power supply to the primary water treatment facilities. Both Iju and Afiyan waterworks were connected to the Independent Power Plant (IPP) of 12.15 MW as well as receiving supplemental electricity from the national grid.⁷⁵ The first active step taken towards increasing water production was the construction and commissioning of the Ota-Ikosi Regional Water Scheme, a 4 MGD water treatment plant located on the outskirts of the city.⁷⁶ Additionally, the state constructed a 2 MGD mini waterworks, which in conjunction with Ota-Ikosi can supply clean water to over ten communities in Ikorodu, a city in north-east Lagos State, located along the Lagos Lagoon.⁷⁷

⁷⁵ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 5 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

⁷⁶ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 5 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/> *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 5 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

⁷⁷ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria.* (2018). *PM NEWS Nigeria.* Retrieved 5 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

Details of Schemes – Short Term (2010 – 2016)

S/n	Project	Intake Point	Source	Expected Year of Completion	Design Capacity		Coverage Area / Axis	Additional Population to be Served
					(mld)	(mgd)		
1	Adiyan Phase II Plant & 95 km Trunk; 2,369 km Distribution Network	Akute	River Ogun	2016	317.8	70	Agege, Alimosho, Shomolu, Kosofe, Ojo, Ikorodu, Lagos Island, Victoria Island, Isolo	2,333,333
2	Odomola Phase I Plant & 67 km Trunk ; 247km Distribution Network	Igbonla/Lekki Lagoon	River Osun	2016	113.5	25	Epe, Eti-Osa, Ibeju-Lekki, Victoria Island, Ikoyi, Lagos Island	833,333
3	Upgrading Isashi to 12mgd Plant & 30 km Trunk ; 120km Distribution Networks	Isashi	River Owo	2015	36.32	8	Amuwo Odofin, Festac, Ojo, Satellite Town, Ijanikin	266,666
4	Ota-Ikosi Plant & 45 km Trunk ; 40km Distribution Network	Igbede	River Aye	2013	18.16	4	Ota-Ikosi, Agbowa, Imota	133,333
TOTAL A					485.8	107		

Figure 5. Detailed order of water construction and expansions for 2010-2016 (source: Lagos Water Corporation Masterplan)

Additionally, the Adiyan Waterworks Phase II expansion is underway to provide an additional daily supply of 70 million gallons of water. Despite its 2016 deadline, the Adiyan Waterworks Phase II expansion is estimated to be 70 percent complete due to a N60 billion (about \$187m) deficit.⁷⁸ However, the state government has promised that the completed expansions will provide a significant boost in the provision of water within the state.

Medium Term (2017-2018)

The medium-term plans of the master plan propose to provide additional water coverage area within the lower-income communities within the state. The Odomola Phase II

⁷⁸ BASSEY, J. (2017). *Adiyan Water Works phase 2 requires N60bn to complete* - *BusinessDay: News you can trust. BusinessDay: News you can trust.*

expansion aims to supply water to approximately 3.5 million people living on the Island and Mainland.⁷⁹

Details of Schemes – Medium Term (2017 – 2018)

S/n	Project	Intake Point	Source	Expected Year of Completion	Design Capacity		Coverage Area / Axis	Additional Population to be Served
					(mld)	(mgd)		
1	Odomola Phase II Plant & 500 km Distribution Network	Igbonla/Lekki Lagoon	River Osun	2018	408.6	90	Epe, Eti-Osa, Ibeju-Lekki, Victoria Island, Ikoyi, Lagos Island	3,600,000
2	Adiyan Phase III	Akute	River Ogun	2017	317.8	70	Isheri-Oke, magodo, Mile 12, Ikorodu, Ikorodu-Agric.	2,800,000
3	Yewa I (Desalination) Plant & 60 km Trunk; 200 km Distribution Network	Ajilete	River Yewa /Lagoon	2018	227	50	Badagry, Ojo, Agbara, Oto-Awori, Ijanikin, Imeke Iworo, Sibir, Kirikiri, Old Ojo, Ilado	2,000,000
4	Ibeshe (Desalination) Plant & 60 km Trunk; 200 km Distribution Network	Ibeshe	Majidun /Lagoon	2018	227	50	Bayeku, Ogijo, Odogunyan, Oriokuta, Ikorodu Port, Igbogbo, Ilemere, Osoru, Oke-Ota, Ijede, Isiwu	2,000,000
TOTAL B					1180.4	260		

Figure 6. Detailed order of water construction and expansions for 2017-2018 (source: Lagos Water Corporation Masterplan)

The Lagos State government has proposed a large-scale collaboration with Perk Water, a private ocean desalination company to build its first significant desalination plants, Yewa and Ibeshe.⁸⁰ Desalination plants are fast becoming the answer to coastal cities such as Cape Town and Lagos due to their endless saltwater resources and proximity to oceans. The method of desalination has been proven to be useful in creating high-quality drinking water by removing salt from seawater through the process of osmosis.⁸¹ One of the most significant advantages of the implementation of desalination plants in Lagos is that it will preserve the limited freshwater supplies. Desalination plants are very costly and require an initial investment of \$288 million per plant.⁸²

⁷⁹ BASSEY, J. (2017). *Adiyan Water Works phase 2 requires N60bn to complete* - BusinessDay: News you can trust. BusinessDay: News you can trust. Retrieved 5 March 2018, from <http://www.businessdayonline.com/adiyan-water-works-phase-2-requires-n60bn-complete/>

⁸⁰ Perkins, B., Perkins, B., & Perkins, B. (2016). *Lagos Facility and Desalination Plant proposed; becomes a priority for Nigeria*. Perk Water.

⁸¹ Perkins, B., Perkins, B., & Perkins, B. (2016). *Lagos Facility and Desalination Plant proposed; becomes a priority for Nigeria*. Perk Water

⁸² Perkins, B., Perkins, B., & Perkins, B. (2016). *Lagos Facility and Desalination Plant proposed; becomes a priority for Nigeria*. Perk Water

According to the LWC Master Plan, both the Yewa and Ibeshe desalination plants are projected to have a design capacity of 100 MGD and provide water to a total of 4 million Lagosians.⁸³

Long-Term (2019-2020)

The third and final phase of the LWC Masterplan is proposed to finalize the projects necessary to supply constant and adequate water to Lagos State residents. With a total projected design capacity of 168 mgd, this long-term plan will skyrocket supply to 745mgd, resulting in a surplus of 12mgd water production.⁸⁴

Details of Schemes – Long Term (2019 – 2020)

S/n	Project	Intake Point	Source	Expected Year of Completion	Design Capacity		Coverage Area / Axis	Additional Population to be Served
					(mld)	(mgd)		
1	Odomola Phase III Plant & 20 km Trunk; 80 km Distribution Network	Igbonia	River Osun	2019	431.3	95	Epe, Eti-Osa, Ibeju-Lekki, Victoria Island, Ikoyi, Lagos Island	3,800,000
2	Upgrading Isashi (12-35mgd) Plant & 50 km Trunk; 120 km Distribution Network	Isashi	River Owo	2019	104.42	23	Amuwo Odofin, Festac, Ojo, Satellite Town, Ijanikin	920,000
3	Yewa II (Desalination) Plant & 20 km Trunk; 50 km Distribution Network	Ajilete	River Yewa /Lagoon	2020	227	50	Badagry, Ojo, Agbara, Oto-Awori, Ijanikin, Imeke Iworo, Sibiri, Kirikiri, Old Ojo, Ilado	2,000,000
TOTAL C					762.72	168		

Figure 7. Detailed order of water construction and expansions for 2019-2020 (source: Lagos Water Corporation Masterplan).

A series of further expansions within the Odomola waterworks are expected to be completed by the end of 2019. The third phase of the project is expected to include an 80km extension in the

⁸³ Lagos Water Corporation. (2018). *Lagoswater.org*. Retrieved 4 March 2018, from <https://lagoswater.org/>

⁸⁴ Lagos Water Corporation. (2018). *Lagoswater.org*. Retrieved 4 March 2018, from <https://lagoswater.org/>

distribution network pipes as well as a 95mgd capacity increase in the water reservoir.

Additional upgrades to the Yewa desalination plant are also expected to add water coverage to many informal settlements such as Kirikiri, Sibiri, Old Ojo, and Ilado.

2.1.2) Policy Reform

Policy reforms concerning water and sanitation are essential to sustaining the efforts to combat water scarcity. Failure to ensure democratic governance within the sector and lack of public participation has led to a series of policy failures within the state. The Lagos water master plan is heavily reliant on a pro-privatization policy reform, which is centered around the commodification of water.⁸⁵

2.1.3) Water Privatization

The water crisis in Lagos opened the door to an essential paradigm shift in potable water supply within the city. The idea of privatizing State-owned water resources was first considered in 1995 when the World Bank's International Finance Corporation (IFC) proposed the concept of large-scale privatization of water within the state.⁸⁶ Since its inception, the public water sector has failed in meeting a small portion of the demand for water supply and sanitation for its residents. Majority of the population — often low-income households, end up purchasing their water from private water vendors at an exponential rate. Public-private partnerships' (PPPs) within the water sector provide a contractual relationship between the private and public sectors committed

⁸⁵ *Global Water Scarcity: Bridging The Demand Gap In Lagos - PM NEWS Nigeria*. (2018). *PM NEWS Nigeria*. Retrieved 5 March 2018, from <https://www.pmnewsnigeria.com/2018/02/23/global-water-scarcity-bridging-the-demand-gap-in-lagos/>

⁸⁶ *World Bank Group - International Development, Poverty, & Sustainability*. (2018). *World Bank*. Retrieved 5 March 2018, from <http://www.worldbank.org/>

to ensuring developments that are sustainable and beneficial.⁸⁷In theory, PPP partnerships are a no-brainer; private investors provide financial support where public water authorities fall short. However, PPP partnerships are often conflicting because the public body aims to serve the interests of its people while the private sector is solely profit-driven.⁸⁸ Over the past five years, the LWC has committed itself to creating strategies that will make its sector more appealing to investors — resuscitation of Adiyari and Iju waterworks. By collaborating with private investors, the LWC aims to alleviate the burden of substantial infrastructure development costs and divert those funds to other essential projects within the state. Aside from the economic and technological benefits of water privatization, its social benefits are yet to be demonstrated. Water privatization has the potential to increase significantly the level of service within the water corporation but at the expense of the millions of people that will be unable to afford their exorbitant costs. As of today, the Lagos government is yet to commence water privatization tactics due to overwhelming public opposition. However, current governor, Akinwunmi Ambode has promised alternative solutions to the water crisis.

2.2) Case Study: Abidjan, Côte d'Ivoire

The history of water privatization in Côte d'Ivoire is relevant to urban water management research within Africa because it is one of the oldest cases of a somewhat successful adaptation of water privatization within Western Africa. Water access was comparable to that of several developed nations, piped water was potable and disease-free, and water service disruptions were

⁸⁷ LAGOS, P. (2018). *LAGOS, PPP MODEL AND WATER SUPPLY – Lagos State Government. Lagosstate.gov.ng*. Retrieved 5 March 2018, from <https://lagosstate.gov.ng/blog/2017/02/19/lagos-ppp-model-and-water-supply/>

⁸⁸ LAGOS, P. (2018). *LAGOS, PPP MODEL AND WATER SUPPLY – Lagos State Government. Lagosstate.gov.ng*. Retrieved 5 March 2018, from <https://lagosstate.gov.ng/blog/2017/02/19/lagos-ppp-model-and-water-supply/>

infrequent.⁸⁹ Before its PPP agreement, all of Abidjan's water came from a freshwater aquifer located about 60 meters underground the city's north.⁹⁰

In 1960, the same year Nigeria received its independence, the state government of Abidjan set up a concession with a private water firm, *Société de Distribution d'Eau de Côte d'Ivoire* (SODECI) to assume full responsibility of all their urban water systems within the state.⁹¹ This was a particularly perplexing alliance because Abidjan has always proven to be a strong competitor within the urban water sector in West Africa. As a country, Côte d'Ivoire has still produced sufficient revenue to support any necessary developments and investments concerning their water supply. The primary motivation for their PPP partnership with SODECI was to alleviate their persistent macroeconomic crisis in an attempt to free up finances necessary for other investments within the state.⁹² In other words, the contractual agreement led to a shift in responsibility for investment from the state governments budget to that of the private operator, SODECI. Results from the water reform were quite successful and continued to be successful today. Performance indicators from the water systems improved or remained unchanged, and the ones concerning water coverage gap has since continued on a downward trend.⁹³ According to the World Bank, water production and responsibility grew from 8.9 billion m³/year to 65 billion m³/year between 1960 and 1980, making its privatization agreement very beneficial.⁹⁴ Although water privatization in Abidjan has been deemed a success story, a similar outcome may not be

⁸⁹ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹⁰ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹¹ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹² Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁸⁷ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁸⁸ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁸⁹ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

possible for Lagos. The following are several plausible reasons why PPP within Côte d'Ivoire is not a credible blueprint for Lagos water production:

2.2.1) Political Stability

Compared to other West African nations, Côte d'Ivoire was always somewhat stable politically and socially.⁹⁵ However, Nigeria, with its abundant resources and economic strength, has been entrapped in a political crossroads since its independence. Even at the state and local levels, a combination of parochial leadership and prior decades of military interregnum has led to years of political tension and malaise. Additionally, the economic and political framework within the country is pervaded by decades of systemic corruption and abuse of office.⁹⁶ Even today, lack of political transparency and poor leadership decisions have left the country in an entire state of hopelessness and frustration. A successful PPP agreement is contingent on political stability. Investor confidence in such a partnership is a prerequisite for success; therefore, Nigeria's current state of government will lead to uncertainty for potential investors.

2.2.2) Economic Stability

After its independence, the Ivorian government took the pragmatic approach of collaborating with its former colonial power, France. It adopted a considerable amount of its policies and regimes for several years and still to this day. This agreement between the two countries was mutually beneficial in many ways. Firstly, it allowed for the Ivorian government to utilize

⁹⁵ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹⁶ Fagbadebo, O. (2018). Corruption, Governance and Political Instability in Nigeria. *Economic And Policy Review*, 14(1). Retrieved from <https://www.ajol.info/index.php/epr/article/view/39291>

international resources from France to supplement any economic needs or debts.⁹⁷ Secondly, the adaptation of French policy attracted several French companies to invest in the country, adding to their already booming economy.⁹⁸

Nigeria is currently facing one of the worst economic recessions since its inception. Following a sudden drop in its gross domestic product (GDP) in 2016 in conjunction with weak global oil prices, the economy is in complete turmoil. Because the country's economy is heavily reliant on crude oil exports — approximately 70% of its revenues, the economic recession has taken a significant toll and is yet to recover.

Economic stability is essential for PPP partnerships because the private sector has to ensure that the consumers will pay for the product.

2.2.3) Stable Institutions

In addition to economic and political stability, Côte d'Ivoire is backed by an efficient bureaucracy. Due to their strong alliances with France, the Ivorian government has always been able to depend on the French government for all forms of support.⁹⁹ Their policies towards France allowed them to heavily rely on expatriates for technical and managerial experience within the water sector.¹⁰⁰ Therefore, the Ivorian water sector had already established a stable water institution that did not require a hefty initial investment. This stable institution is especially appealing to private investors because a majority of the local workers within the water sector are well-trained and knowledgeable about their work. The Lagos state water sector is hampered by damaged and outdated equipment in need of significant rehabilitation.

⁹⁷ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹⁸ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

⁹⁹ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

¹⁰⁰ Menard, G. (2000). *Reforming water supply in Abidjan, Cote d'Ivoire: mild reform in a turbulent environment*. Documents.worldbank.org. Retrieved 8 March 2018

Additionally, the conflicting mandates within the federal and state local sectors have been known to cause further instability within the institution. The shaky framework in which the Lagos water corporation was established on needs to be reformed for privatization to be successful.

2.2.4) Public Support

The Lagos water privatization plan has caused immense civil opposition since its proposition. On June 26th, 2016, hundreds of civilians marched across the Lagos metropolis chanting songs in solidarity in protest of the state governments impending plan. Front lining the protest was the Friends of the Earth Nigeria (FOE) group, a civil rights action group dedicated to defending the human ecosystems, regarding governmental laws of human rights.¹⁰¹ One of the major concerns of the civilians was the government's insistence on indicting people with private boreholes.¹⁰² Currently, more than half of the Lagos population relies on private boreholes for water access, as piped water distribution is sporadic and unreliable. Also, a majority of the population is unable to afford the exorbitant costs of privatized water. The protestors drafted a petition addressed to the speaker of the Lagos State House of Assembly, Mudashiru Obasa, proposing a plan for achieving universal access to potable water in the State. However, their recommendations were negated.¹⁰³

Another primary concern of civilians concerning water privatization is the impending rate increase of water for investors to maximize profits. As previously mentioned, over half of the population lives in extreme poverty — living on less than \$1.90 a day. Increasing the already

¹⁰¹ Nigeria - Friends of the Earth International. (2018). *Foei.org*. Retrieved 10 March 2018, from <http://www.foei.org/member-groups/africa/nigeria>

¹⁰² Ezeamalu, B. (2016). *Protests in Lagos over proposed water privatization - Premium Times Nigeria*. *Premium Times Nigeria*. Retrieved 10 March 2018, from <https://www.premiumtimesng.com/news/more-news/207743-protests-lagos-proposed-water-privatization.html>

¹⁰³ Ezeamalu, B. (2016). *Protests in Lagos over proposed water privatization - Premium Times Nigeria*. *Premium Times Nigeria*. Retrieved 10 March 2018, from <https://www.premiumtimesng.com/news/more-news/207743-protests-lagos-proposed-water-privatization.html>

costly rates of water will significantly affect low-income families and small business owners in Lagos. For privatization to be successful, water will be treated as a commodity, rather than a human right. Such high water rates will force people to choose between food and water access, or force people to drink untreated water out of desperation. Such choices can lead to epidemic disease breakouts which the state is currently unable to sustain. The Nigerian economy is not stable enough to cushion potential risks associated with water privatization. Furthermore, private water companies are solely accountable to their investors and shareholders, not their consumers. Therefore, improving public water systems is both possible and preferable.

CHAPTER THREE

2017 ENVIRONMENTAL BILL

Following significant opposition from Lagos state civilians on the proposed water privatization partnerships, the Lagos State government, to appease the public, signed a bill into law to improve water access and sanitation issues in Lagos.¹⁰⁴ The primary motivating factor in passing the Environmental Management and Protection bill was to reduce water-borne related diseases in children in Lagos.¹⁰⁵ Majority of the State's laws were no longer feasible under the current conditions on the state. Therefore, a framework to improve the environmental crisis was fundamental. According to the present governor, Akinwunmi Ambode, the environmental bill is expected to¹⁰⁶:

- Improve the chronic unemployment crisis—a projected target of 27,500 jobs for Lagosians
- Improve waste collection, processing, and disposal services around residential properties
- Improve and create incentives for Community Sanitation Workers (CSW)—Tax reliefs, improved healthcare, life and accident insurance benefits
- Provide vocational training for informal water providers—cart pushers, sachet water sellers, landfill scavengers, etc.

¹⁰⁴ AMBODE SIGNS ENVIRONMENTAL MANAGEMENT, P. (2018). *AMBODE SIGNS ENVIRONMENTAL MANAGEMENT, PROTECTION BILL INTO LAW – Lagos State Government. Lagosstate.gov.ng*. Retrieved 10 March 2018, from <https://lagosstate.gov.ng/blog/2017/03/01/ambode-signs-environmental-management->

¹⁰⁵ AMBODE SIGNS ENVIRONMENTAL MANAGEMENT, P. (2018). *AMBODE SIGNS ENVIRONMENTAL MANAGEMENT, PROTECTION BILL INTO LAW – Lagos State Government. Lagosstate.gov.ng*. Retrieved 10 March 2018, from <https://lagosstate.gov.ng/blog/2017/03/01/ambode-signs-environmental-management-protection-bill-into-law/>

¹⁰⁶ Osas, A. (2017). *How New Environmental Law will Benefit Lagosians. THISDAYLIVE*. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

- Improve sanitation strategies and standards across the state
- Introduce a Public Utility Levy (PUL), a waste management service fee to be paid by residents of the state to manage the cleaner Lagos initiative

3.1) Protests and Backlash

Most civilians have remained hopeful since the passing of the bill, but many civil rights groups have vowed to protest. Many fear that the bill is a guise of introducing PPP into the water sector slowly. A concerning clause in the law calls for a six-month jail term or N100,000 fine to civilians that allow others to access their water.¹⁰⁷ Such a law could potentially criminalize drinking water for millions. Informal water distribution has stepped in to meet the desperate need for water in the majority of the urban slums. Those that are unable to pay exorbitant amounts of money for state utility provisions will bear the risk of criminal charges.¹⁰⁸ The government claims that such laws were created to dissuade the masses from not paying their water fees. However, the state is yet to provide affordable water for such people and is in turn, punishing them for fending for themselves. Other objections to the bill stem from a fear that people will not have the ability to afford the costs, therefore, forfeiting their right to water.¹⁰⁹ Furthermore, activists protested against the government's lack of utilizing citizen participation during law-making processes.¹¹⁰

¹⁰⁷ Editor, O. (2017). *How New Environmental Law will Benefit Lagosians*. THISDAYLIVE. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

¹⁰⁸ Editor, O. (2017). *How New Environmental Law will Benefit Lagosians*. THISDAYLIVE. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

¹⁰⁹ Editor, O. (2017). *How New Environmental Law will Benefit Lagosians*. THISDAYLIVE. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

¹¹⁰ Editor, O. (2017). *How New Environmental Law will Benefit Lagosians*. THISDAYLIVE. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

CHAPTER FOUR

FUTURE SOLUTIONS

For the Lagos state government to successfully confront the development and management of its water resources, it has to construct its reform by embracing a people-centered approach and ensuring an integrated planning process. Now, more than ever, water reform is quite crucial. Population projections estimate that the Lagos population will more than double in the next ten years and at the current rate of water production, the water crisis is sure to have devastating effects. It is essential to work in the spirit of urgent cooperation and innovation, to prepare for a sustainable future. Possible solutions are discussed below.

4.1.1) Efficient Agricultural Practices

It is estimated that Nigeria uses 69% of its freshwater resources for agricultural resources.¹¹¹

¹¹¹ Editor, O. (2017). *How New Environmental Law will Benefit Lagosians*. THISDAYLIVE. Retrieved 10 March 2018, from <https://www.thisdaylive.com/index.php/2017/03/09/how-new-environmental-law-will-benefit-lagosians/>

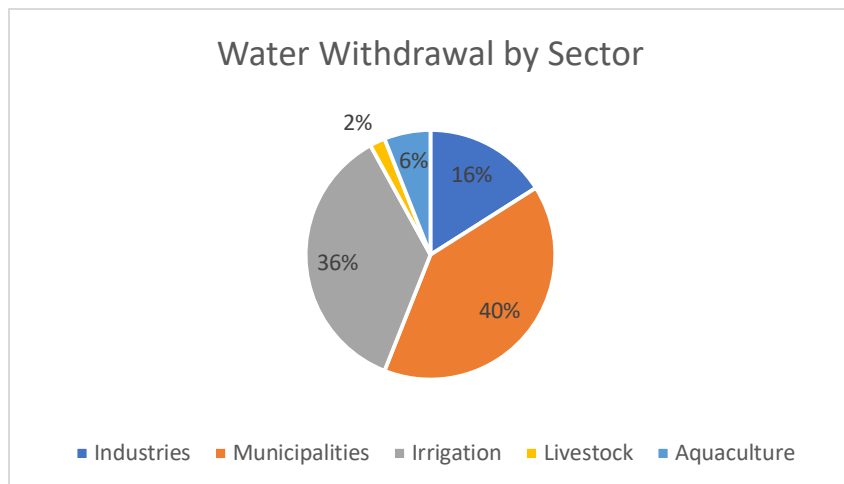


Figure 8. Water Usage in Nigeria (Total 12 475million m³, 2010) Source: UN Water

A study conducted by the Food and Agriculture Organization (FAO) found that 75% of the farms they studied used surface water techniques —canals and drainage systems, 19% used sprinkler systems and 6% used informal irrigation systems.¹¹² It has been shown that surface irrigation results in a 55% water loss due to evaporation, especially in arid climates.¹¹³ Techniques to compute and monitor how much water is needed by crops —soil monitoring, lysimeter, eddy covariance, etc. are not utilized in the agricultural sector in Nigeria.¹¹⁴ Such resources are necessary for a more sustainable approach to agriculture. Most farmers in Nigeria have their farms bequeathed unto them. Therefore, most of their practices are inherited from previous generations and are often archaic in nature. It is essential that the Nigerian government helps develop more efficient irrigation systems and modern agricultural methods that conserve water.

¹¹² (2018). *Fao.org*. Retrieved 11 March 2018, from <http://www.fao.org/docrep/003/t0800e/t0800e0a.htm>

¹¹³ Evans, R., & Sadler, E. (2008). Methods and technologies to improve the efficiency of water use. *Water Resources Research*, 44(7). doi:10.1029/2007wr006200

¹¹⁴ Evans, R., & Sadler, E. (2008). Methods and technologies to improve the efficiency of water use. *Water Resources Research*, 44(7). doi:10.1029/2007wr006200

4.1.2) Sanitation

In Lagos, the benefits of proper sanitation are yet to be widely recognized. This neglect is evident from the dirty streets and overflowing gutters that are visible on its streets. Despite its disastrous adverse effects, sanitation is not prioritized by the Lagos government.¹¹⁵ It is essential that the government implements practical technologies and ensures the communities can use and maintain them. By collaborating with local community chairpersons or other leaders and educating them on the benefits of sanitation, there is sure to progress. However, the government must be willing and able to commit wholeheartedly to long-term investments and support to these communities. Sanitation is a significant undoing within the water crisis, and it is mostly attributed to lack of awareness and culture of hygienic living. However, a resolution is possible if the government provides the infrastructure for people to efficiently and adequately dispose of waste.

4.1.3) Government Co-operation

The control of water resources in Nigeria is divided between the three tiers of government — federal, state and local.¹¹⁶ The federal government is responsible for managing and protecting our water resources, the state governments deal with urban water supply, and the local governments are primarily responsible for rural water supply.¹¹⁷ For decades, the federal and state governments have attempted to reform water management and supply in the country. However, little has been done to implement initiative or meet intended goals. One major

¹¹⁵ WaterAid Nigeria - *What we do - The crisis - Sanitation*. (2018). *Wateraid.org*. Retrieved 11 March 2018, from <http://www.wateraid.org/ng/what-we-do/the-crisis/sanitation>

¹¹⁶ Umezulike, C. (2017). *Challenges in The Nigerian Water Sector – If the Problem is not Lack of Comprehensive Regimes, then what is it?*. *Connecteddevelopment.org*. Retrieved 11 March 2018, from <http://www.connecteddevelopment.org/1963-2/>

¹¹⁷ Umezulike, C. (2017). *Challenges in The Nigerian Water Sector – If the Problem is not Lack of Comprehensive Regimes, then what is it?*. *Connecteddevelopment.org*. Retrieved 11 March 2018, from <http://www.connecteddevelopment.org/1963-2/>

downfall of the government is the inability to provide the necessary financial resources to improve the water sector. This is not due to the lack of funds, rather the diversion and squandering of the allotted funds. Additionally, all three levels of government need to work together to craft concise policies and ratify enforceable laws.

4.1.4) Innovative Technology

Innovations in smart water technology have drastically increased as the global water crisis continues to spread. Many countries are forging ahead by embracing creative ideas and cutting-edge technology to make water accessible. A city such as Lagos can significantly benefit from wise investments in innovative technology. Such innovations include:

- Personal Filter Straws- This piece of technology is a portable water purifier that allows individuals to drink water from any source, except salt water.¹¹⁸ Its filter is made from patented media that has been proven to remove chlorine, lead, mercury, E. coli, algae, fungus, cholera, etc.¹¹⁹ This straw can protect vulnerable populations from water-borne diseases that are responsible for approximately 50% of neonatal deaths in Nigeria.¹²⁰
- Solar Stills- Solar stills is a green energy product that uses natural energy from the sun to purify water.¹²¹ Although they are currently being used worldwide, Nigeria is still yet to implement this efficient and sustainable invention. Solar stills have been proven to increase the provision of clean, drinkable water and are known to reduce energy costs and pollution within residences.¹²²

¹¹⁸ Samo, J., & Samo, J. (2016). *10 Clean Water Solutions For Developing Countries - BORGEN*. BORGEN. Retrieved 11 March 2018, from <http://www.borgenmagazine.com/10-clean-water-solutions/>

¹¹⁹ *THE STRAW | WATER IS LIFE*. (2018). *Waterislife.com*. Retrieved 11 March 2018, from <http://waterislife.com/clean-water/the-straw>

¹²⁰ *Children dying of water-borne diseases in Nigeria - UNICEF - The Nation Nigeria*. (2017). *The Nation Nigeria*. Retrieved 11 March 2018, from <http://thenationonline.net/children-dying-water-borne-diseases-nigeria-unicef/>

¹²¹ *Solar Still Basics*. (2018). *Solaqua.com*. Retrieved 11 March 2018, from <http://www.solaqua.com/solstilbas.html>

¹²² *Solar Still Basics*. (2018). *Solaqua.com*. Retrieved 11 March 2018, from <http://www.solaqua.com/solstilbas.html>

- Rainwater harvesting-Rainwater harvesting is currently being utilized in a few cities within Nigeria but has received little attention. It is a technology used to collect and store rainwater from rooftops, land surfaces and other catchments such as underground check dams.¹²³The collected water is then treated using a low-cost water treatment system that is both easy to use and maintain. Lagos receives an annual average of 60 inches of rainfall, a sufficient amount of beneficial rainwater harvesting.¹²⁴

The lack of awareness of the government on affordable, innovative water technologies is telling of their nonchalant attitude towards the water crisis within the country. Cities like Cape Town, South Africa have fully embraced innovative solutions to combat their current drought crisis. Given its aging infrastructure and climatic pressures on water, the future of the Nigerian water crisis relies on significant innovation in technology, policy design, and implementation.

¹²³ Lade, O., & Oloke, D. (2015). Rainwater Harvesting in Ibadan City, Nigeria: Socio-economic Survey and Common Water Supply Practices. *American Journal Of Water Resources*, 3(3), 61-72. Retrieved from <http://pubs.sciepub.com/ajwr/3/3/1/>

¹²⁴ *Rainfall in Lagos, Nigeria Average Precipitation and Wet Days*. (2018). *Lagos.climatemps.com*. Retrieved 11 March 2018, from <http://www.lagos.climatemps.com/precipitation.php>

CHAPTER FIVE

PUBLIC HEALTH IMPACT OF URBAN WATER MANAGEMENT

Clean water is one of the leading components of public health, in addition to sanitation and good hygiene. The human right to water must be protected and fulfilled for Lagos to make the economic gains it needs to secure the future for its people. The benefits of a superior water management strategy are evident in developed nations like the United States. According to the World Health Organization, since 1990, approximately 2 billion people have gained access to potable water. However, many remain desperate for a similar fate.¹²⁵ The eradication of the water crisis is sure to be challenging yet fulfilling. Some of the benefits of clean water include:

- Health - The main benefit of having access to clean water is the protection against preventable water-borne diseases. According to the UN, 1.8 billion people drink water from a contaminated source, resulting in the deaths of 340,000 children under five worldwide.¹²⁶ The potential to save more lives from being lost is worth exploring. Similarly, clean water is a necessary component of neonatal and post-natal care in mothers. It ensures that newborns are given the safest and most beneficial start to life. Poor health caused by consuming unsafe drinking water is known to lead to reduced productivity. Most people suffering from water-borne related illnesses are often left debilitated and are unable to work, go to school and take care of their families. Money for

¹²⁵ *Water, Sanitation, and Hygiene | UN-Water. (2018). UN-Water. Retrieved 11 March 2018, from <http://www.unwater.org/water-facts/water-sanitation-and-hygiene/>*

¹²⁶ *Water, Sanitation, and Hygiene | UN-Water. (2018). UN-Water. Retrieved 11 March 2018, from <http://www.unwater.org/water-facts/water-sanitation-and-hygiene/>*

medication and hospital bills usually have to replace other essentials, like food or clothing.

- Economic Prosperity - We often underestimate how impactful clean water is on our economy. In addition to providing a health benefit, clean water is also an economic necessity. Without it, our industries, agriculture, schools, and communities would suffer. In turn, clean water provides job opportunities for millions of people worldwide. Safe drinking water has also been proven to impact education positively; water-borne related illnesses prevent children from regularly attending school and studies show that children who attend school are demonstrated to have increased learning potential that proves to be beneficial in the workforce. Additionally, the burden of ill health is known to cause lost economic contribution and lower productivity within industries.¹²⁷ Such burdens are especially concerning as the economic wage gap within Lagos is substantial; therefore, failure to put an end to the water crisis will make the escape from poverty even more grueling.
- Female Empowerment - Several organizations, such as *The Water Project*, have made it their mission to educate on the dangers of water scarcity on women and young girls. Traditionally, women take on the role of domestics within the household, spending hours a day to collect water for their family's needs. Such tasks are physically demanding and time-consuming and often take a considerable toll on education and job opportunities.¹²⁸

¹²⁷ *The Importance of Clean Water and Health | The Water Project.* (2018). *The Water Project.* Retrieved 11 March 2018, from <https://thewaterproject.org/why-water/health>

¹²⁸ *Empowering Women through Water.* (2018). *The Water Project.* Retrieved 11 March 2018, from <https://thewaterproject.org/water-scarcity/water-womens-empowerment>

Being near a water source increases a woman's economic productivity and learning abilities, in turn, improving their prospects for their futures. Prioritizing water access and treatment will also help close the gender wage gap; the more educated and skilled the women are, the more likely they are to be considered for jobs dominated by their male counterparts.

Conclusion

In the developing world, it is easy to take for granted something as accessible as water. Approximately 46% of freshwater resources in the United States is used for industrial and recreational purposes; an amount that is not close to feasible for the Lagos government. Despite being surrounded by freshwater and saltwater, the city of Lagos barely provides enough drinking water for its rapidly increasing population. Public water supply in a developing nation is an arduous task, but it essential for the health of the economy and the quality of lives of the citizens within it. Current water demand estimates for the city of Lagos are astounding and call for immediate rehabilitation of water policy and distribution. Proactive strides within the water sector are crucial to stopping a further decline in quality of infrastructure.

During my short internship at the Lagos Water Corporation, I noticed a theme of poor maintenance culture within the organization. This unfortunate habit was further reinforced by the poor work morale of the staff of the LWC. None of the staff expressed any inclination to improve the state of the water sector due to poor working conditions and substandard wages. It is essential for the corporation to maintain a sustainable work environment for its staff to increase

productivity and profit. It is essential that the LWC also improves its management by eliminating stressors in the workplace that could potentially have devastating effects on productivity.

Although the LWC has attempted to ensure sustainable water supply through the implementation of the Master Plan, their suggested timelines of the projects have all failed to meet their deadlines, and some of their strategies have yet to be fulfilled. Future research is required to determine the effects of small-scale privatization within the Lagos water sector, ideally for the mini waterworks facilities within the state. Similarly, more study should be conducted to determine if public-public partnerships (PUPs) within the state. PUPs promote stronger communities through knowledge and resource sharing within public sectors. These partnerships are essential to preserving the needs of the community by eliminating the profit-seeking corporations.

Although urban water management in Lagos is currently at a standstill, its future is not grim. Some of the core strategies to ensuring a sustainable water supply plan should take into account new, innovative technologies that have been proven to have positive trends within the water sector. Additionally, adopting policies that are centered around its citizens are the only way that they will be executed. Taking into consideration the people's needs, concerns and fears will foster trust and co-operation between the government and its communities. That being said, it is vital for proper governance to be at the forefront of the Lagos water crisis, all allocated funds should be carried out by the law. Now more than ever the Lagos government needs to show its people it is committed to their right to water. The road to success is not easy but is sure to be rewarding for Lagos and its people.

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