

Water Resource Management and Sustainable Development in Nigeria: Lessons from Israel

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Abstract

Water is a fundamental need with vast implications for sanitation and hygiene, agriculture and food production, industrialization, and development. The goal six of the Sustainable Development Goals (SDG) aims to fulfill all water needs by 2030. In spite of over 200 cubic kilometers of surface water and huge reserve of untapped underground water, over 60 million Nigerians are without access to clean water. Stress on water sources have also led to conflicts and violence in some flashpoint areas, particularly in the Northern part of the country. Israelis a leader in water resources development, management and sustainability. This, they have achieved through coherent policies, robust political oversight, Public-Private Partnership, enormous investment in water technology and cutting-edge innovations. This study examines the impact of water resource management on water security and sustainable development in Nigeria. It draws lessons from the impact of water resource management in sustainable development drive of the State of Israel.

Keywords: Water Security, Sustainable Development, Nigeria, Israel, International cooperation.

Introduction

Water drives economic growth, supports healthy ecosystems, agriculture, energy production, sanitation and sustainable waste management. The significance of water to economic growth, healthy living and the prevention of the spread of infectious diseases, manufacturing and industrialization cannot be overstated. Water is an indicator of life, a lack or under-supply of it increases the risk of infectious diseases, poor industrialization, poor personal and community hygienic, poor food production, conflicts, human rights abuses, and poverty. Over a million deaths annually have been attributed to unsafe water and poor sanitation, with 90% of the deaths occurring in children under the age of five in developing countries (WHO, 2019). The goal six of the SDG aims to fulfill, particularly, all domestic water needs by 2030. In spite of the fundamental significance of water, a resource naturally made available in its abundance in the country, its poor management and under-utilization is continuing to undermine the socio-economic development of Nigeria (Odume & Slaughter, 2017; Salau, 2017; Independent, 2018; Oyebode et al, 2015; Oyebande, 1978). Though Nigerians of different communities had always seen to their water needs in precolonial times

through the maximization of the different water sources made naturally available to them, like streams, springs, ponds, rain water, and the wells they have dug for themselves, particularly in the northern region, efforts to manage and deliver water in a modern network system was introduced by the British colonial government.

The fundamental philosophy behind the consideration of the development, management and supply of water resources was the improvement of the quality of drinking water and the reduction of the debilitating effect of water-borne diseases on the population, particularly in centres located along major trade and transportation routes serving the export-oriented colonial economy (Mabogunje, 1965). In 1910, the construction of the first water treatment plants, in Iju on the Ogun River, was commenced to serve the colonial administration in Lagos, the hub of colonial administration and economy, eventually becoming active by 1915. Since then, water management and supply has gone through different stages, phases and dimensions of growth with the establishment of water treatment plants in many cities and urbanizing communities. At independence, close to 70 cities were already enjoying modern water supply in some form (Ayoade, 1975). Giving the rural urban population drift in response to the character of the colonial economy, the water needs of urban centres continued to increase, leading to a rise in water consumption from 52,238 cubic metres recorded in 1953 to over 215,768 cubic metres in 1960 (Ayoade, 1975).

Any real effort towards the development of a comprehensive plan for water security as a necessary aspect of advancing national development came with the first National Development Plan (NDP) covering 1962 to 1968 (Ayoade, 1975; Onibokun, 1985). The concept of organizing water resources management around River Basins in Nigeria started in 1963 when the Food and Agriculture Organization (FAO) conducted a study of the land and water resources of the Sokoto-Rima River Basin in the North-West (Ojiako, 1985). It was followed by the founding, in 1964, of the Lake Chad Basin Commission by the four countries bordering the Lake Chad i.e. Nigeria, Chad, Niger Republic and Cameroun. The realization of the potentials of the Chad Basin led to the conduct of further feasibility studies in 1965, by FAO and United Nations Educational Scientific and Cultural Organization (UNESCO) (Ojiako, 1985). For an item so fundamental to a comprehensive development, the attention given to it in the national development plan was very largely insignificant. Before independence, particularly between 1955 and 61, the total amount expended for water was one million naira, which constitutes just 0.9% of the overall or total national expenditure (Ojiako, 1985). With independence, the expenditure for water schemes improved marginally. The percentage of national expenditure reserved for water schemes did not significantly improve. In the first NDP which covered the years 1962 to 1966, a little over 49 million naira was mapped out for water projects. This amount constitutes 3.6% of the total national expenditure (Ojiako, 1985). In fact, over the next phases of development plans, i.e. the second NDP (1970-1974), the third NDP (1975-1980) and the fourth NDP

(1981-1985), data shows (second NDP: budget total, 3 billion naira, water scheme budget, 930 million (4.9%); third NDP: budget total, 32.8 billion naira, water scheme budget, 148.6 million (2.8%); fourth NDP: budget total, 82 billion naira, water scheme budget, 1028 million (1.2%) a downward spiral in the amount mapped out for water schemes, in the light of the total expenditure of government over the periods of the plans, after an initial hike in the second NDP (Ojiako, 1985). For instance, after reserving 4.3 percent of the total national expenditure for water schemes in the second national development plan, the third and fourth national development plans saw a decline in the chunk of the national expenditure allocated to water schemes. While 2.8 percent of the total expenditure in the third national development plan was allotted to water schemes, it declined to 1.2 percent in the fourth national development plan (Ojiako, 1985).

Development of River Basins water management schemes, following the promulgation of the Decree 25 in 1976 by the Federal Military Government, marked a milestone in the development of comprehensive water resources schemes for national development in Nigeria. The decree established 10 River Basin Development Authorities (RBDAs), with the 11th River Basin Authority established by Decree 27 promulgated in the same year. The RBDAs so established include: Lake Chad in Maiduguri, Sokoto-Rima in Sokoto, Anambra-Imo in Owerri, Hadejia Jamaera in Kano, Benin-Owena in Benin City, Cross River in Calabar, Niger Delta, in Port Harcourt, Lower Benue in Makurdi, Ogun-Oshun in Abeokuta, and the Niger Basin in Minna. The Niger Basin was later split to the Upper Niger in Minna and the Lower Niger in Ilorin. These Basins were conceived to harness the water resources of the country for effective conservation and utilization (Ayoade, 1975). In spite of numerous attempts of succeeding governments to harness the vast surface and underground water resources available to Nigeria, the country still falls short, significantly in meeting its water needs for the socioeconomic development of the country. This study examines the impact of water resource management on water security and sustainable development in Nigeria. It draws lessons from water resource management and its impact on sustainable development in the state of Israel.

Literature Review

Nigeria is endowed with enormous water resource as is evident in the volume of rainfall, surface and underground water deposits (Ezeabasili et al, 2014; Idu, 2015) and yet, the gap between water needs and water supply appear to be widening (Chukwu, 2015). Water resources development in Nigeria is threatened by both natural factors such as outcomes of climate change and hydrological extremes, and anthropogenic factors such as pollution of water bodies with industrial wastes, oil spillages, and salinization of surface and ground waters through irrigation and fertilizers (Idu, 2015). These natural and anthropogenic

threats to water sources trigger variations in the physiochemical and biological characteristic of the water, ultimately impairing the quality of the water (Chukwu, 2017).

The dearth in the water management and supply system in Nigeria has led to many citizens resorting to self-help and exploiting the underground water resources in an unstructured and uncoordinated, and unsustainable manner (Akpoy & Muchie, 2011). As noted by Omole (2013), over 60% of Nigerians with access to drinking water now get it from underground sources. He also noted that sustainable groundwater use in Nigeria is challenged by funding, weak institutions, poor data management system, poor implementation of groundwater exploitation regulation, in addition to hydrological factors. Many private business ventures have emerged from the decadence of water management and supply Nigeria. For most poor and rural dwelling citizens, access to clean water supply has continued to be a challenge. As contended by Obeta (2019), the dependence on private for-profit water ventures to meet the water needs of the population is unsustainable. This further indicates the failure of policy. The uncoordinated exploitation of ground water may have other consequences, considering that geological and other anthropogenic conditions may affect the quality of the water. Some of the private individuals and business concern usually don't have the capacity to treat the water before making it available for human consumption. This is the case in most urban areas in Nigeria, where groundwater quality is affected by the geochemistry of the environment, rate of urbanization, industrialization, landfill and dumpsite leachates, and heavy metals (Ocheri et al, 2014; Olorunfemi et al, 2015). Other fundamental challenges to water resources in Nigeria include wetland degradation (Uluocha and Okeke, 2004), climate change (Coulibaly et al, 2018) among others.

Sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations General Assembly, 1987, p. 43). As the world continues to explore economic prosperity, sustainable development goals seek to mainstream the environmental interest of future generations in the economic activities of the present generation. Sustainable development debates have largely centred around the effect of economic activities and industrialization on the environment (Polasky et al, 2019; Bartniczack & Raszkowski, 2018). The goal six of United Nations 2030 agenda for sustainable development, aims at ensuring availability and sustainability of water and sanitation for all.

Scholars like Sharma et al, (1996), Biswas (1991), Kundzewicz (1997), Mwanza (2003), have variously explored issues of water management and security for sustainable development. The significance of water resources in developing countries, more so in sub-Saharan Africa cannot be overstated (Sharma et al, 1996). The depletion of water bases like rivers and lakes calls for an efficient management and exploitation of the resource. Thus Kundzewicz (1997) held that sustainable development requires integrated multi-sector approach which should incorporate hydrological and non-hydrological components such as the environment, base

of the economy, character of socio-cultural and institutional subsystems. He further observed that the significant role of water in achieving sustainable development is being undermined by its subsuming, in many States, in other institutional components i.e. Agriculture, environment, interior, etc. this was the case in Nigeria before the creation of Ministry of Water Resources in 1976, 16 years after independence. He argued that water resource management is fundamental to actualizing the goals of sustainable development.

Mwanza (2003) noted that transboundary nature of water basins, variability of climate and rainfall, water scarcity, water pollution, environmental degradation and increasing demand are some of the features necessitating efficient water resources management in Africa. The role of water in sustainable development policies is fundamental. Thus, water security issue is a global one that affects all, requiring an interconnected response framework that should be global in design, embodying within it, a variety of national and regional responses (Biswas, 1991). The response must, as he observed, pay attention to increased investment, technology, diffusion of expertise and increased international cooperation.

Efficient water resource management is necessary for water security. The key factors that have been implicated in the definition of water security include availability, access, and conflicts or disputes associated with water (Wouters, 2010). Water security therefore entails availability and access to water within the context of safety and security. It is the sustainable, management and use of water systems to meet present water needs. Water resource management system in Nigeria is multi-layered with a central authority for the management of water resources residual in the ministry of water resources, a water resource ministry at the state level, while the local governments are responsible for distributing water to rural areas (Ezeabasili, 2014). The challenges of water resource management in Nigeria has been severally blamed on the paucity of data (Adeaga et al, 2006), deficit of implementation of the integrated water management system (Adeoti, 2014).

Israel is considered a global leader in sustainable development (Wu & Li, 2019). Water resource management plays a significant role in its recognition as a global leader in sustainable development (Harary, 2016). Israel sustainable water management strategy has made the desert bloom, leading to improvements in agricultural production which accounted for about 1.3 billion dollars in the 2018 export of vegetables and fruits alone (Abraham et al, 2019). Agriculture and rural development, supported by efficient water management is proving to be one of the mainstays of the development drive of the state of Israel. Water resource management employs a set of integrated water management strategies (Oziransky et al, 2014). Nigeria also apply a form of integrated water resource management strategy that have not managed to record as much success in meeting water need goals as is the case in Israel. This deficit has been blamed on implementation (Adeoti, 2014).

Water resource management in a manner that leads to water security is fundamental to the functioning of a modern state and the survival of its peoples in both urban and rural areas (Ibrahim & Nmadu, 2012) in the long run, giving its far reaching implications on sanitation (Aboelnga, 2019), family and community health (Muta'a Hellandendu, 2012), agriculture (OECD, 2010), industrialization (Akpor & Muchie, 2011).

Water Needs and Deficiency in Nigeria

With increasing water needs, occasioned by increasing population estimated at 200 million people, efficient water resource management in Nigeria has become necessary. Nigeria is a West African country bordered by Cameroon, Niger Republic, Chad and the Atlantic Ocean. Its major drainage which is the Niger River flows through the Niger Republic and discharge through the deltas and into the Atlantic Ocean. The Lake Chad, another major surface water body for Nigeria, is principally shared with the Chad Republic.

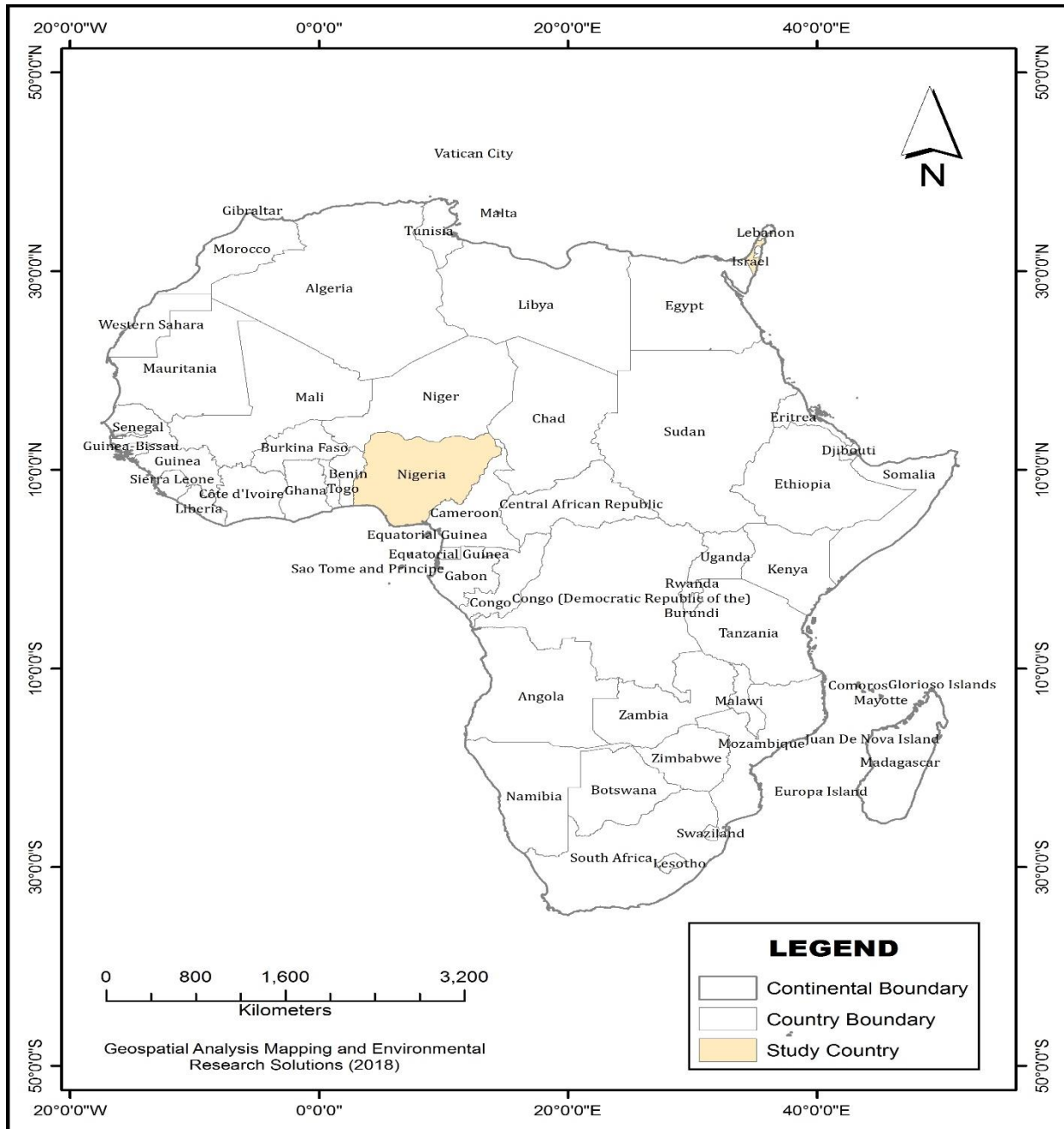


Figure 1:Map of Africa, highlighting study country

Source: Designed by the authors

The River Niger, River Benue and the Lake Chad water bodies are dominant in the hydrology of Nigeria. As at 2017, the volume of the surface water of Nigeria was estimated at around 214 billion cubic meters per year, which has largely remained consistent with recorded data on the volume and production of surface water in the country since 1972 (Knoema, 2017). On the other hand, the total potentials of renewable groundwater resources in Nigeria is

estimated at 155.8 billion cubic metres annually (FGN, 2014). The recharge potentials of both surface and groundwater vary across the country, owing to the difference in the manifestations of climatic conditions. While recharge is low in Northern Nigeria given low rainfall and high evapotranspiration, it is higher in the south for the opposite reasons. The North-East, for instance, has the lowest recharge potentials for groundwater at 4.8 bcm/year, while the South-East has the highest at 32.8 bcm/year (Tijaniet al, 2018). The figure below shows the major bodies of surface water and Rivers in Nigeria.

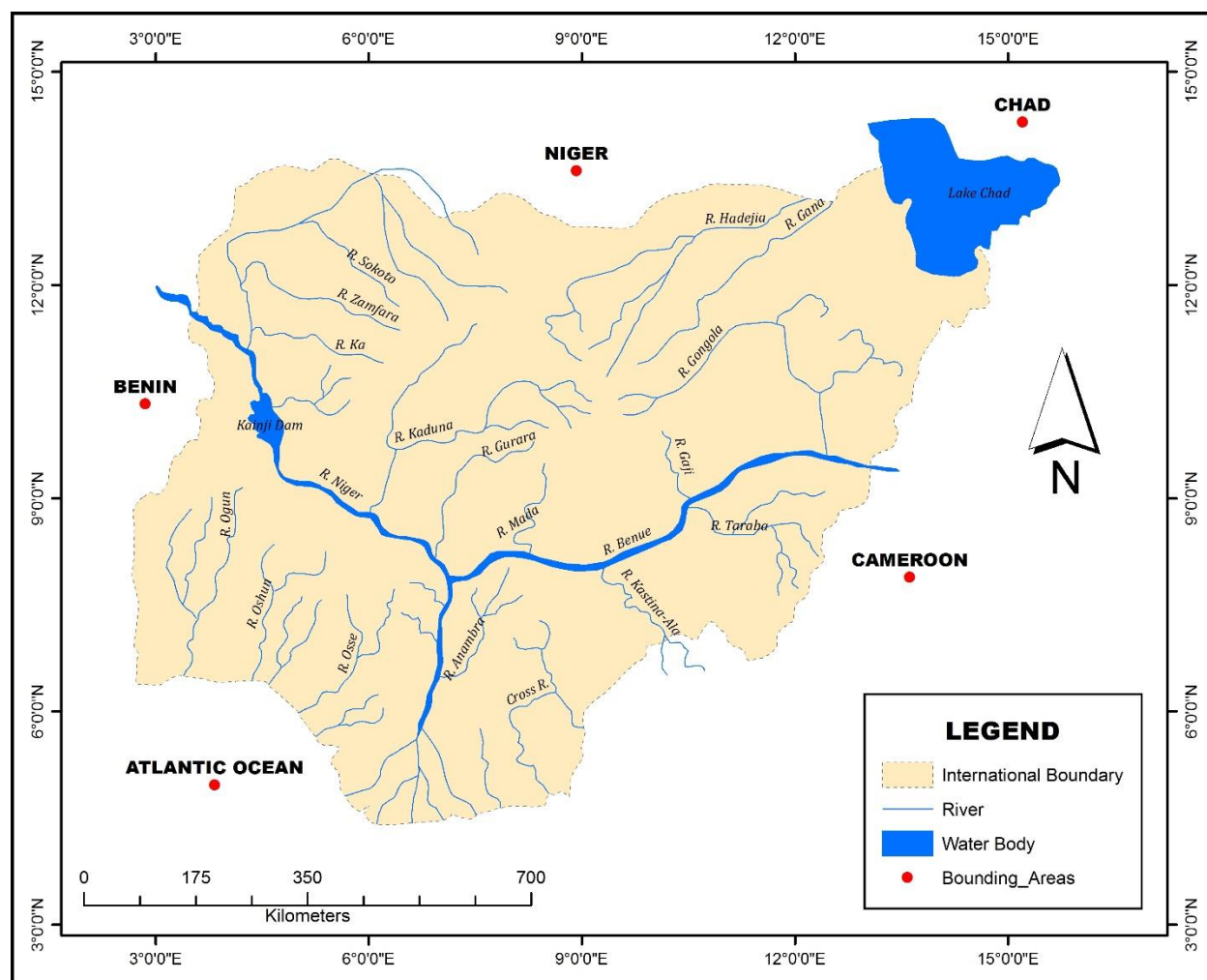


Figure 2: Hydrological Map of Nigeria

Source: Designed by the authors

Access to water generally for all economic use and clean drinking water is still a prevailing challenge across Nigeria. The Nigerian state has largely failed in its responsibility of providing potable water to the population, leaving about 2/3 or close to 70% of the population to resort to self-help in addressing their water needs (MICS, 2018). The situation is worse in the Northern part of the country where about 30% or less of the population have

access to their daily water needs (Owoseye, 2018; USAID, 2019). In comparison with the urban areas where about half the population have access to potable water, close to 80% of the rural population lack access to potable water, leading to reliance on streams and ponds which may not be safe (Khatri & Tyagi, 2014). In 2013, Paul Orhii, the Director General of National Agency for Food and Drug Administration and Control (NAFDAC) estimated that it costs Nigerians over 8 billion Naira to satisfy their daily drinking water needs (Obuh & Uzor, 2013). This situation worsens the condition of a population with close to 100 million people living below \$1.90/day, with about 56 million (63%) rural dwellers and 40 million (36%) urban dwellers living in extreme poverty (World Poverty Clock, 2020). The limited access drinking water with its attendant consequence on sanitation and hygiene, is estimated to cost Nigeria about \$1.3 billion in healthcare spending, and the loss of productive time (Odume & Slaughter, 2017). The underdevelopment of water resources is also implicated in the sanitation and hygiene of millions of Nigerians. In a 2018 survey by the ministry of water resources and the National Bureau of Statistics concluded that only 44% of the population have access to basic sanitation facilities, most of which are enjoyed by urban dwellers. Water deficiency and poor sanitation contributes to the spread of infectious diseases like diarrhea and flu.

Water is also fundamental to agriculture and industrialization. Agriculture is an important sector of the economy of Nigeria, second only to the oil sector. Two third of the country's work force are engaged in the agricultural sector (FAO, 2020). The country is endowed with vast arable land, a robust labour force and bountiful water resources, yet a considerable volume of the agricultural produce needs of Nigeria are imported owing to the inability of domestic production to meet national demand. Over the past 20 years, Nigeria, has spent over 40 trillion naira on food imports, averaging about 2 trillion naira every year (Iloani, 2019), putting it in the top 10 of imported goods. 77% of Nigeria's land area is agricultural land of which only about half of it is being utilized (FOA, 2016). The enormous water resources of Nigeria clearly show a potential for an all-year-round food production. Industrialization and socio-economic development are also largely driven by water. Mineral extraction and manufacturing are among the water intensive sectors. Globally, the demand of water by industries is rising, and as Nigeria continues in its march of industrialization, it will need to improve on its capacity of water exploitation and management.

The funding of water resource development in Nigeria does not commensurate with its aspirations and stated objectives as current average annual national commitment of 86 billion Naira (\$220 million) does not commensurate to the annual investment requirement of 974 billion Naira (\$2.5billion) necessary to meet SDG objective by 2030 (Falaju, 2017). In line with the Millennium Development Goals (MDG) and the commitment of the government of President Goodluck Jonathan in 2010, 75% of the population should have access to safe drinking water by 2015 (Akpe, 2012). Sadly, in 2011, the year after the commitment by

President Goodluck Jonathan, the budgetary allocation to the Ministry of Water Resources was slashed by almost half. Since then, the budgetary allocation for water resource development has shown a consistent pattern of inconsistent commitment with the lowest allocation in fiscal year 2015, in comparison with allocations in all the other fiscal years between 2010 and 2020, as indicated in table 1 below.

Table 1: Budgetary Allocation for Water Resources Development in Nigeria

Year	Budget (₦)	Budget for Water Resource Development	Percentage of Budget
2010	4.4tn	112bn	2.5%
2011	4.2tn	62bn	1.4%
2012	4.7tn	39bn	0.8%
2013	4.9tn	88bn	1.7%
2014	4.9tn	51bn	1.0%
2015	4.4tn	13bn	0.02%
2016	6.0tn	53bn	0.8%
2017	7.4tn	111bn	1.5%
2018	9.1tn	155bn	1.7%
2019	8.9tn	73bn	0.8%
2020	10.5tn	100bn	0.9%

Source: Compiled by authors from Nigeria Budget Office, and Budget records.

Table 1 shows the trajectory of national funding for water resources development. It also reveals the degree of commitment of governments since 2010 to the development of water resources as far as funding is concerned. The highest percentage of the national budget that has been dedicated to the funding of water resources development since 2010 was 2.5% of the total budget in 2010. 1.4% in 2011, 0.8% in 2012, 1.7% in 2013, and 1.0% in 2014. In the first year of president Muhammadu Buhari's first tenure, the percentage of national budget dedicated to water resources development fell to 0.02%. In the three years after that, it rose slowly to 0.8%, 1.5%, and 1.7% respectively. The percentage of budget dedicated to water resources development in 2019 and 2020 has not indicated that the government intends to prioritize the sector. 73 billion naira (0.8%) out of a total budget of 8.9 trillion naira in 2019, and 100 billion naira (0.9%) out of a total budget of 10.5 trillion naira in 2020, did not indicate significant positive change in the prioritization of the sector by government.

Legal and Institutional Frameworks of Water Resources Management in Nigeria

The literature on management of water resources is vast. These include all such policies, legislations, plans and actions to define or regulate the exploitation, distribution and use of water resources in the country. They include the following:

- i. The land Use Act and Associated Legislations
- ii. The National Water Policy
- iii. Establishment of regulatory Agencies in the water resources sector
- iv. Involvement of private for-profit water service providers.

One of the important frameworks to consider in the management of water resources in Nigeria is the land tenure regime. This is important because exploitation of ground water would necessarily follow after the land tenure system in place at a particular time. Customary land titles confer rights of water resources whereas large water bodies are common property. Some ethnic nationalities, like the Yoruba, culturally, recognizes the owner of a property through which a stream flows as the owner of the stream. However, the owner is obliged to allow villages access. However, those not flowing through the property of any person in particular belongs to the entire community (Ajai, 2012).

The government is vested with vast powers on land ownership, significantly giving it authority over land resources like groundwater. The Water Resource Decree of 1993 gives the federal authorities exclusive right to all water courses, both surface and ground, that affects at least two states. However, the decree also allows the people to access and use the water for domestic purpose. It also allows people who have rights of occupancy of a property to exploit and use the groundwater beneath the property (FGN, 1993). The Land Use Act is the foundational legal framework for water resource exploitation in Nigeria (FGN, 2004a).

The National Water Policy of 2004 is a guiding instrument for the management of water resources in Nigeria. The objective of the policy was to further the exploitation and management of the national water resources in a sustainable manner to meet the needs of both the present and future generations. Hence, it is a harmony of other frameworks like Water Act of 1993, the preparation of the National Water Resources Master Plan in 1995, the Water Resources Management Reform Programme commenced in 1997. The policy framework is an attempt harmonize and consolidate water objectives in a clear and coherent blueprint (FGN, 2004b). Sadly, the effort has not resulted in better water resource management and the gap between water needs and supply for most Nigerians appear only to increase.

The government of Nigeria, over time, has set up regulatory institutions and agencies for the exploitation and management of water resources. In 1976, the government established the National Water Resources Institute (NWRI) and the River Basin Development Authorities

(RBDA) and in 1977 a federal ministry of water resources was first established in response to droughts experienced in the 70s (Handidu, 1990). The ministry was charged with policy formulation and general oversight of the sector, the NWRI was developed as a research institute with a responsibility to advance more efficient ways of water resource maximization, while the RBDAs were to provide water to communities for agricultural, domestic, and industrial consumption purposes.

In 1988, the Federal Government established the Federal Environmental Protection Agency which later became the Ministry of Environment (Adelegan, 2004). In 2007, the government also established the National Environmental Standards and Enforcements Agency with the responsibility of protecting and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general (NESREA Establishment Act, 2007). This agency regulates issues bordering on environmental pollution and the regulation of industrial waste disposal which could affect the quality of both ground and surface water. The Water Resources Decree of 1993 also recognizes the hazardous nature of arbitrary exploitation of water resources without recourse to expert evaluation. Different states and local government authorities have Water Board Corporations and other agencies responsible for regulating the exploitation and distribution of water resources in their domain.

In spite of the numerous policies, legal and institutional regimes evolved by government for the management of water resources to satisfy national water needs, the deficiency persists. This is probably the case because satisfying water needs appears to be one of the least priorities of government as the aspirations are not duly pursued with a purposeful systematic funding (as captured in table 1) and implementation. Thus far, many communities do not have access to water fit for consumption and all issues relating to this reality is largely the failure of government, and economic conditions of the people.

Water Resource Development and Management: Lessons from Israel

Israel's geographical realities and limited sources of fresh water meant that it is seriously challenged by water shortage. The Negev desert, for instance, makes up more than half of the country's total land area. Other dominant features of the terrain of Israel includes hills, mountains and semi arid zones. The Joranan River which it shares with the Hashmite kingdom of Jordan is its major water source (CBS, 2004). Other drainage systems include Lake Kinneret, Yarqon, Qishon, and Yarmūk, a tributary of the Jordan (FAO 2008). The volume of the surface water is estimated at 0.3 billion cubicmetres and the groundwater volume estimated at 0.5 billion cubic meters (World Data Atlas, 2017).

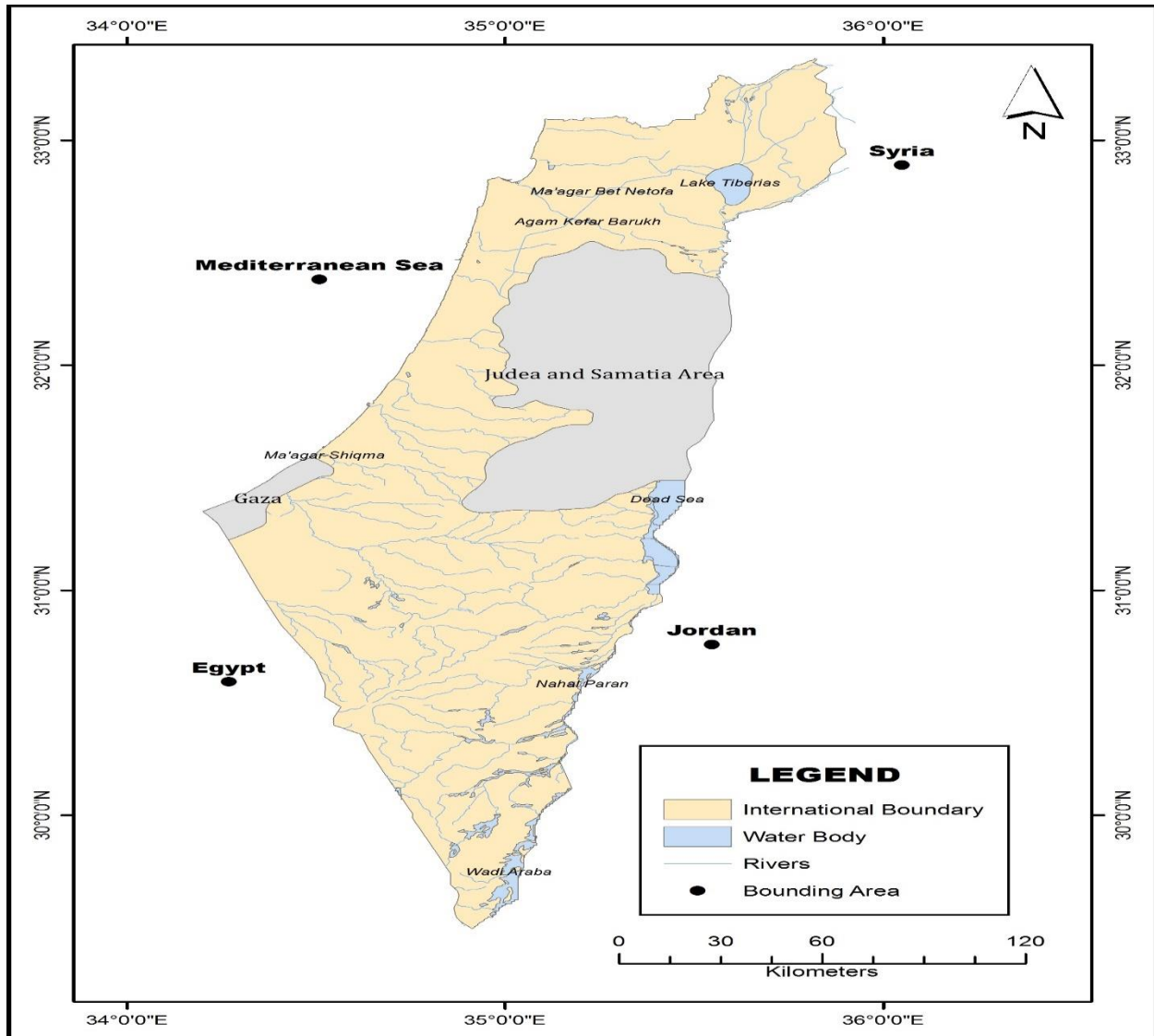


Figure 4:Hydrological Map of Israel

Source:Designed by the authors

However, Israel has gotten around its natural shortcomings through the combinations of a coherent water resource exploitation policy, institutional repositioning, innovative technologies and funding of the development of water resource infrastructure. Almost 100% of the population of Israel have access to safe drinking water. this feat was achieved through efficient water management, reuse of treated waste water for irrigation, large scale desalination of sea water, national bulk water conveyance structure, and institutional reforms leading to self-sustainability of the water resource development sector, with over 90% of waste water retreated after being collected (WHO/UNICEF, 2015).Following a number of major water crises in the state of Israel, by the year 2000, the government adopted a radical approach which outlined a roadmap to water security to be achieved over time.

Though it was a politically risky approach as it led to the increase in water tariff for end users, it led to the systematic development of infrastructure and the self-sustainability of the water resource sector. Between 1985 and 2005, the bulk of water used in Israel were from natural sources. However, by 2014, almost half of water used in Israel are both from recycled waste water and desalinated sea water (Marin et al, 2017). As at 2020, Israel's annual water supply consists of 565 Million Cubic Meters (MCM) of recycled wastewater, 200 MCM of desalinated sea water, 180 MCM of brackish water, 660 MCM surface water and 1075 MCM of groundwater (Israel Ministry of Foreign Affairs, 2020). The recycled waste water is largely used for irrigation and some aspect of industrialization. It also built a network of 230 reservoirs for recycled waste water and have been able to reduce water waste to the barest minimum domestically, agriculturally, and industrially. Israel ranks first globally in waste water recycling (Israel Ministry of Foreign Affairs, 2020). The public and private sector in Israel has also been working harmoniously towards solving the national water challenges. Recently, an Israeli start-up evolved a technology to extract water from air.

Israel Water Resource Management: Policies and Structure

Building on development infrastructure laid since independent, Israel government decision no. 246in2003, laid out a strategic plan for mainstreaming sustainable development agenda in the developmental framework of the state "that combine a dynamic economy, wise use of natural resources, protection of ecosystems, and the granting of equality of opportunity to all, in order to respond to the needs of the present and future generations, both as a follow-up to Government decision no. 2426 of August 4, 2002, and in the spirit of the World Summit on Sustainable Development held in Johannesburg in August-September 2002." Water resource management was prominent in the plan as it featured in almost every major item like energy production, environment, health, transportation, housing, agriculture and rural development.

Israel is considered a global leader in sustainable development (Wu & Li, 2019) for efficient use of water while making the desert bloom through sustainable exploitation and management of water resources (Harary, 2016; (Abraham et al, 2019). Israel is currently leading the world the implementation of innovative sustainability measures like drip irrigation, sustainable energy powered desalination, waste water recycling and use, and domestic water efficient fittings (Megersa & Abdulahi, 2015). Thus, the success of Israel's water resource management is most visible in its agricultural and biodiversity development (Ginsberg, 2006; Ghermandi & Messalem, 2009).

The 1959 Water Law of Israel that reserves the propriety of all water (runoff, wastewater, sewerage) on both private and public property that could be harnessed commercially to the state, forms the legal foundation of water management in the country (State of Israel Water Authority, 2012). The state of Israel adopts an Integrated Water Resource Management

(IWRM) model that includes a Public-Private Partnership (PPP) and harnesses government regulatory and oversight control plus private sector funding to satisfy the water needs of the people (Meir, 1994; Becker & Ward, 2014). Israel Water Authority is the regulatory body responsible for the administration, operation and development of water resources. The authority itself is under the supervision of the Water Authority Council made up of representatives from Ministry of Infrastructures, Energy, and Water, Environmental Protection, Finance, Interior, Health and the Water Authority. The Water Authority as a regulatory body coordinates the activities of public (government owned companies like Mekorot) and private players in the sector (Avgar, 2018). The private sector brings in much needed expertise, funding and profit driven innovation for both water exploitation, distribution, and conservation (Marin et al, 2017). Mekorot, the government owned company in coordination with regional water authorities, under the rationing directives of the Minister for Infrastructure, Energy, and Water, is largely responsible for water distribution to the critical sectors of Israel development (agriculture, biodiversity, industry, domestic), while private companies cover the areas Mekorot is unable to cover. The private companies are also active in desalination and the treatment of wastewater for reuse, as most of the desalination plants are owned by private companies. Thus, to ensure the viability of these private water plants, the government pays for whatever quantity of water they are able to generate within specified periods. Of a total 2,346 MCM consumed in 2016, 55% was consumed by the agricultural sector, domestic and public use 34%, industry 5% and 6% went to the Palestinian Authority and Jordan (Avgar, 2018).

Marin et al (2017) concluded the success of Israel in its water security efforts to be owed to institutional and regulatory reforms closely augmented by massive investment in infrastructure. Thus, the unique feature of water resource management in Israel include: sound regulations and robust oversight, public education and awareness on efficient water use and conservation, strong control and enforcement of water allocations, comprehensive and reliable data, massive sustainable investment in infrastructure, integration of a PPP model that allows investors to Build, Operate and Transfer (BOT) and also allows for Build, Own and Operate (BOO) into the water resource development regulatory framework. This comprehensive strategy has evidently helped Israel achieve water security in their drive for sustainable development. In spite of the enormous water resource of Nigeria, the problem of water security still persists. Table 2 shows the water resource indicators of Nigeria and Israel. It explains the volume of water resources of both countries, and the status of their water challenges.

Table 2: Nigeria and Israel water resources indicators

	Nigeria	Israel
Population	193.3 million	8.6 million
Geographical Environment	Tropical rainforest, mangrove, savannah	Desert and Arid
Major water bodies	Niger River, Benue River, Lake Chad	Jordan River, Lake Kinneret
Estimated volume of surface water	214 billion cubic meters	0.3 billion cubic
Estimated volume ground water	87 billion cubic meters	0.5 billion cubic meters.
Estimated depth of Average precipitation	1,150 mm	435 mm
% of population with due supply of daily water needs	30%	95%
Percentage of recycled waste water	5%	90%
Water security assessment	Insecure	Secure

Source: Author’s compilation from: World Data Atlas, fluencecorp.com, Israel Ministry of Foreign Affairs data

Conclusion

This paper assessed the impact of water resource management and sustainable development in Nigeria. It also drew parallel between the water resource development challenges of Nigeria and that of Israel and how the two countries approached the challenge. Sustainability is the future as the international community transits to sustainable use of resources in a manner that takes the needs of the generation of the future into account. We observed that water resource is cardinal to the sustainable development of all sectors of the economy and political system, and the general wellbeing of the people. While Nigeria is naturally endowed with enormous water resources, most of its citizens and its national economy has been suffering from thirst and water deficiency. Israel on the other hand, is a country that has significantly overcome its water security challenges by meeting almost 100% of its daily water needs, in spite of the natural constraints and the natural limitations to water availability. This feat they have achieved through coherent, consistent and progressive water resource development policy regime, PPP, prudent management of scarce water resources, robust oversight functions of political regulatory mechanisms, innovative water conservation, wastewater recycle and reuse, and sea water desalination technologies. Nigeria should understudy the strategy of Israel in water resource development which could be useful in satisfying its national water appetite.

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