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CHALLENGES AND SOLUTIONS TO WATER AND SANITATION IN NIGERIA: A REVIEW

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ABSTRACT

Access to water and sanitation are critical components of public health and socio-economic development, as well as pointers to the fulfilment of Sustainable Development Goal 6 (clean water and sanitation). This review paper presents a critical assessment on the situation and challenges facing access and availability of water/water sources and their sanitary conditions. Considering that Nigeria is the most populated black race, the significant government efforts and international interventions made in the area of water, sanitation and hygiene, many communities are still lacking access to safe water and adequate sanitation facilities. The research observes that about 70% of Nigeria's population have access to water but more than half of the sources are contaminated thus reflecting the current challenges facing the Nigeria's water and sanitation sector. Some of the challenges highlighted include overpopulation/urbanization, poor government funding and investment, absence of solid waste management systems, climate change/variability amongst others. Positive recommendations such as investment by government agencies to provide funding, private-public partnerships to enhance/expand existing infrastructure, public awareness on water usage and sanitation and provision of water regulatory frameworks were suggested as possible solutions to the enumerated challenges.

KEYWORDS: Water, Sanitation, Sustainable Development Goals, Water supply, Water quality, Challenges, Solutions

1. INTRODUCTION

Water is regarded as one of the most important/essential resource needed for human consumption, ecosystem sustainability and plant existence/sustenance. Though, from existing statistics it may appear to be in abundance, its accessibility remains insufficient to meet the demands of the teaming and growing population. According to [1] the distribution of water on the earth's surface is extremely uneven; the earth has over 70-75% of its surface covered by water in the forms of oceans, seas, glaciers etc. but only a meagre amount of 1% is available as freshwater for human use and consumption all hidden in varying amounts within different surface and subsurface reservoirs. In considering the availability and accessibility of water for human consumption, the condition (quality and sanitation) is very critical so that water associated diseases and disease-causing pathogens can be reduced to the barest minimum. Water quality refers to the chemical, physical and biological characteristics of water based on the standards of usage [2]; it describes the condition or state of water including physical, chemical and biological characteristics usually with respect to its suitability for a particular purpose such as drinking and swimming [3]. Water sanitation refers to the public health conditions related to drinking water, water treatment and disposal of human excreta and sewage [2]. According to [4] sanitation generally involves the provision of facilities and services for the safe disposal of human urine and faeces; it is the maintenance of the hygienic conditions of water through services such as solid waste collection/disposal and wastewater treatment; inadequate quantity and quality of water supply have serious impact(s) on water resources management and environmental sustainability [5]. Sanitation systems aim to protect human health by providing a clean environment that will stop or prevent the transmission of disease(s) especially via fecal-oral route.

From United Nations [6], in 2022, 2.2 billion people still lack safely managed drinking water, including 703 million without a basic water service; 3.5 billion people lack safely managed sanitation, including 1.5 billion without basic sanitation services; and 2 billion lacking basic handwashing facility; including 653 million without handwashing facility at all. Access to potable and safe drinking water for all has always been the only way in which mankind can stay away from diseases and disease-causing pathogens especially water-borne diseases. A minimum of 2 billion people worldwide drink water from sources contaminated with faeces, almost half of the world's population lack access to safely managed sanitation services, 29% do not have a handwashing facility with soap and water at home, yielding unsafe WASH practices which cause an estimated 1.4 million deaths yearly [7].

In Africa, 2% of the total population have access to improved water supply and 60% have access to improved sanitation, but the situation in the rural area is worse with only 47% of their population having access to improved supply and 45% having access to improved sanitation [8]. According to the 2023 Africa Sustainable Development Report, 411 million Africans still lack access to safe water, and almost three-fourths do not benefit from safely managed sanitation services [9]. On average across 39 countries, water supply ranks fourth among the most important problems that Africans want their government to address, trailing unemployment, management of the economy, and health; water supply is of particular concern among rural residents and the poor, who suffer major disadvantages on all indicators of access to clean water and sanitation; only 38% of citizens give their government passing marks on its provision of water and sanitation services [10]. The indicators both on a global and continental scale show that the sixth sustainable development goal (SDG6) (ensuring availability and sustainable management of water and sanitation for all by 2030) is still long shot from being achieved.

2. Nigeria Water and Sanitation Scenario

Provision of access to clean water with adequate sanitation/sanitation facilities is fundamental and critical for public health and economic development and Nigeria the black most populous country in the world with population exceeding 200 million people, faces a significant gap in water and sanitation infrastructure. A considerable portion of the population lacks access to clean drinking water and improved sanitation facilities [7]; poor access to improved water and sanitation in Nigeria is a contributing factor to high morbidity and mortality rates among children below the age of five and this accounts for over 70% of water borne and water related diseases. Sustainable and equitable access to safe drinking water remains a challenge in Nigeria, with over 86% of Nigerians lacking access to a safe water drinking source. Although about 70% of Nigerians are reported to have access to basic water services, more than half of these water sources are contaminated, while only 26.5% of the population use improved drinking water sources and sanitation facilities [11]. 73% of the country's population have access to a water source but only nine liters of water on average is available to a Nigerian daily, while nearly one-third of Nigerian children do not have enough water to meet their daily needs [12]. In 2018 Nigeria's water sanitation and hygiene sector was declared to be in a state of emergency and approximately 60 million Nigerians were living without access to basic drinking water. 80 million people have no access to improved sanitation facilities, while 167 million cannot access basic handwashing facilities. In rural areas, 39% of households lack access to at least basic water supply, while only half have access to improved sanitation and almost a third (29%) practice open defecation – a fraction that has marginally changed since 1990 [13]. About 68% or 62 million people do not have access to basic water supply services, while 27% or 51 million people depend on unsafe water sources such as rivers, unprotected wells and springs, ponds, etc. Open defecation remains a menace to the country as 47 million people still practice it, making Nigeria the second country with the largest number of people practicing open defecation globally. Access to sufficient and

potable water free from pathogen contaminations in households is a challenge as 9 out of 10 families (91%) consume fecal-contaminated drinking water at home [14] and just 3% of the population in rural areas access a minimum of 12 liters of water per person per day [15]. Water supply and sanitation are not provided efficiently in Nigeria [16]. Meanwhile, 81% do not have access to safely managed sanitation facilities with proper sewerage systems whereby fecal sludge is safely disposed of and properly treated, and 79% of the population do not have proper handwashing facilities to enable them practice good hygiene which minimizes contamination of drinking water in households.; about 70% of drinking water at source and point of consumption within households are contaminated with E.Coli [17]. The water and sanitation situation in the country is one plagued with many issues and problems.

3. Challenges of Water Supply and Sanitation

Given the circumstances facing the country (developing) the pertinent challenges facing the water supply and sanitation situation include the following;

3.1 Increased Population due to Urbanization

Nigeria is the most populated country in Africa and the 7th in the world, and has been projected to have a population of over 400 million people in 2050, which is expected to be the 3rd largest in the world [18]. Nigeria's population is growing at an inter-censal rate of 3.2% and has total fertility rate (TFR) of more than 5 children per woman [19]. This rapid growth or expansion of population places immense pressure on existing water and sanitation infrastructure there by proliferating slums and ghettos. Over 50% of the population in Nigeria resides in urban centers and the population is continually on the rise resulting in high population densities which make it difficult to expand water and sanitation services quickly enough to meet population demands leading to water shortage, poor sanitation and associated public health hazards. Rapid urbanization is a critical challenge to the provision of water and sanitary services to urban centers. The planned urban settlements, due to population growth, the water and sanitary services provided deteriorate to point zero due to the fact that the service provision capacity has been exceeded. Also, unable to keep up with the speed of population growth, many urban centers have experienced a substantial increase in the numbers living below the poverty line in informal or unplanned settlements (slums) which by extension translate to unavailability of clean water and sanitary services in those settlements [20]. This has accounted for the development and growth of slums and ghettos where the standard of living is poor and exposure to diseases are high.

3.2 Poor Infrastructural Investment from Government

Inadequate infrastructure and investment remain a key challenge, with many water and sanitary facilities either non-functional, dilapidated or poorly maintained. According to a report from world bank, an estimated 29% of Nigeria's population have access to safely managed drinking water services, thus

reflecting the investment gap in the area of water and sanitation [21]. All the sectors of the country depend highly on the government virtually for everything though they may sound autonomous they still resort to funding provided by the government to finance water supply and sanitation projects. On the other hand, the government is saddled with many responsibilities which has caused it to neglect the affairs and needs of the water/housing sectors which is to provide healthy and affordable living conditions (portable water and shelter) for the masses. On the other hand, the existing infrastructure are in very bad conditions and have been dilapidated and cannot meet up with demands of the rising population.

3.3 Absence of Reliable Data on Water Resources and Availability

There are no reliable and dependable data that can be used as reference material to develop a data base or inventory of the water resources available in the country, because of this adequate and functional water management systems/structures cannot be designed to harness and harvest the surplus water resources being wasted/lost to the environment as runoff. The nation is blessed with quite a number of rivers which can be reliably diverted and used to meet the water demands of the population but because there is no reliable information database the true water generation and delivery capacity of the nation cannot be ascertained. Also because of this inadequacy, data is also not available to develop water distribution systems which can offer the opportunity of distributing water to proper outlets or plants which can perform some form of pre-treatment before they are disposed into waterbodies causing less contamination/pollution.

3.4 Corruption/Corrupt practices in the Water Supply and Sanitary Service sector.

According to Usman [20] corruption translates to inefficient use of funds provided for water supply facility maintenance, general operations, staff remuneration and development projects. Services involving water management and distribution are handled by the various ministries of water resources of the state which have other sub-offices, but because of personal interest(s), bureaucracy and bottlenecks, some of the funds required for capital projects (water supply, access and sanitation) which will benefit the masses, are diverted for personal gains or purposely mismanaged, so that the intended projects are not delivered or achieved. Other corrupt practices will be the use of low level or grade of materials to develop infrastructure for water supply systems, over-padding of contracts associated with water supply and abandoning of existing water projects.

3.5 Poor Water Supply and Distribution Systems

Before now there used to be some functioning water supply and distribution services in the various states but with the increase in the population/urbanization and the individual quest for portable water, many individual households have resorted to the exploration of boreholes to meet their water demands. The supply of water from the water corporation to the LGAs is not sufficient thereby making many to rely on

commercial and private boreholes which often time is expensive, bearing in mind that majority of the people live on earnings that is less than N25,000 (\$145) in a month [22]. This is largely because the state governments have failed in their responsibility to grant access to water and have failed in metering and maintaining already existing water management and distribution facilities to meet the water demand(s) of the general public. A glaring example is the present day inactivity of the IWADA (Imo Water Development Agency) of which was very active in the 90's and 2000's. another issue is the abandoned elevated water tanks (EWTs) that are located at Orji and fire service all these were outlets to regulate, manage and provide portable water to the populates of Imo State and same is the fate of other states of the federation.

3.6 Absence of Public Toilets and the knowledge of Water sanitation

As quoted a large amount of the population still practice open defecation (a report from UNDP, (2023) shows that globally over 892 million people still engage in open defecation); Open defecation is still a great concern in Nigeria as one-third of the rural areas, and 12% of urban areas practice it and open waste disposal in unguarded sanitary landfills of which is a major contributor to the pollution/contamination of waterbodies/groundwater especially in the rural area via runoff. Due to grossly inadequate access to toilet facilities, 23.5% of the country's population practices open defecation, which leads to contamination of water bodies because of percolation or movement of excreta, especially during the rainy season. Since water treatment is poor, especially in rural areas, contaminated water is either consumed through drinking, washing fruits, cooking food, bathing, washing, and domestic cleaning, creating a public health situation of morbidity because of poor health [23]. In mostly the rural areas inhabitants have not been given the full knowledge of the implications of open defecation so there do not have an inkling or knowledge of the level of damage they are doing by polluting and contaminating existing fresh water.

3.7 Poor Funding to support the construction of water treatment and disposal systems

Due to the increase in population, funding has always been an issue in the area of providing the basic facilities like water treatment plants, sanitation facilities and sewage disposal systems to guarantee the safety/quality of water bodies within our environs. Existing water supply projects suffer from poor funding or neglect in terms of operations and maintenance leading to high level water loss from the system or epileptic services thereby creating an artificial demand and resulting in new water supplies being sourced, the costs of which are channeled to the consumer through a tariff rate not commensurate with services delivered and hence consumers disenchantments and unwillingness to pay [5]. Though there are a lot of initiatives, policies and projects that have been initiated to ensure sanitation and general hygiene for sustainability of water resources, those policies or projects have only been imprints on documents that have not received full or adequate funding to implement or conclude them. There are 2.31 million water points in Nigeria, 81% was constructed by non-governmental actors, 75% are self-supplied, 43% of these

are boreholes and less than one-fifth have provisions for people living with disabilities [24]. Most of the WASH initiative have a great deal of their programs funded by Non-Governmental Organizations (NGOs)/private individuals and their funds are only budgeted to meet a certain percentage of the people mostly rural dwellers.

Table 1: Nigeria Water Supply and Sanitation Scenario

Water coverage (broad definition)	67% (2015)
Sanitation coverage (broad definition)	33% (2015)
Continuity of supply	not available
Average urban water use (L/person/day)	not available
Average urban water and sanitation tariff (US\$/m³)	Flat residential fee of USD 3 per month in Lagos and USD 11 per month in Kaduna (2007)
Share of household metering	24% in Lagos, 16% in Kaduna (2007)
Annual investment in WSS (water supply and sanitation)	Naira 82.5 billion (USD 0.5 billion) in 2010, corresponding to US\$3/capita/year
Share of external financing	Mainly by external donors
Institutions	
Decentralization to municipalities	No decentralization to the municipal level
National water and sanitation company	No
Water and sanitation regulator	No
Responsibility for policy setting	Federal Ministry of Water Resources and State Ministries of Water Resources and 36 State Water Agencies (water supply), unclear (sanitation)
Sector law	No
No. of urban service providers	36 State Water Agencies
No. of rural service providers	Water and Sanitation

	Committees (number not AVAILABLE).
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Source: [30]

Table 1 gives a clear picture of the situation of water supply and sanitation in the country, it shows the contributions of service providers, amount of money invested in sanitation, the impact of federal and state ministries and other agencies as well as data regarding water usage and consumption. It can also be observed that the corresponding figures are not encouraging.

3.7 Absence of Advanced Water Treatment Plants for the populace.

In most advanced and developed countries, most of their water supply and distribution systems are equipped with water treatment plants that provide initial treatment and monitor the quality/condition of water being provided to the public for consumption and other purposes. [25] stated that the water supply infrastructure, which handles treatment, pumping, storage and distribution of safe drinking water, faces challenges of quality and damage from catastrophes like floods and other crises which lead to contamination and disease infestation. Obviously, water treatment plants are not existent in most developing countries where water is harnessed from direct sources (surface or subsurface). Rather, the luxury of water treatment plants is available to urban rich households who can afford them let alone rural dwellers who have the highest need for portable water.

3.8 Absence of Integrated Solid Waste Disposal System

One of the objectives of United Nations sustainable development goals (SDGs) is to by 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management [9]. Meanwhile, roughly 40% of the world's waste ends up in open dumpsites, particularly in cities in middle and lower-income countries lacking proper waste collection systems, up to 90% of waste is openly dumped in many African cities, and 45% in the region of Latin America and the Caribbean [26]. It is obvious that the goal of waste management has not yet been fully achieved as we can still see open trucks which are not covered being used to move solid wastes to open dump sites which in turn generate carbon monoxide emission and other greenhouse gases during incineration and also generate leachate that infiltrates into the soil to undermine the quality of groundwater. This is because there are so many open dumpsites and no integrated solid waste management/ disposal systems that can properly handle waste characterization and dispose municipal wastes effectively and efficiently.

3.9 Climate Change

The gradual rise in the global average temperature has resulted to issues like ozone layer depletion, global warming and accumulation of greenhouse gases in the atmosphere which have altered the natural rainfall

patterns of many climatic regions resulting in high incidents of sunlight and heightened rainfall durations leading to flooding. Most climate change products are water-related, including irregular rainfall patterns, decreasing ice sheets, increasing sea levels, floods, and droughts [27]. Nigeria faces increased climate variability, with more frequent droughts and floods which adversely affect water resources, reduces water availability and increase contamination risks especially in flood prone areas. The regular occurrence of floods generates sediment laden runoffs which degrade water quality and sanitary conditions thereby requesting for water treatment processes which are non-existent.

3.10 Institutional and Governance issues

Weak governance structures and poor regulatory enforcement are major hindrances to progress in Nigeria's water and sanitation sector, this implies that there are no definite frameworks created by government agencies to track metering and regulation of water as regards per capita consumption and there are quite a number of institutions at federal, state and local levels that are involved in water management, thus resulting in overlapping roles and responsibilities.

4. Recommendations/Solutions

Having enumerated the challenges facing water supply and sanitation in the nation it is also important to chart a road map or course to creating solutions to the problems mentioned. Some of the ways that the challenges can be addressed include;

4.1 Provision of Equitable access to Water, Sanitation and Hygiene services

According to a survey from [28], there are 2.04 million water facilities in Nigeria, 70% are self-supplied i.e. constructed by non-government actors and 67% are boreholes. Because of this issue there is no equitable access to water since it is only affordable to those who can afford them. Because it is only available to those that can afford them, they are also the people who have access to the sanitary and hygiene services because they are in concordance. To meet the rising demand, public-private partnerships (PPPs) can be leveraged to bridge funding gaps and introduce innovative water technologies like solar powered water systems and community managed water schemes have shown promise in rural areas [29].

4.2 Strengthen the efforts to eradicate the practice of open defecation

As has been reported by [9], about 892 million people globally are still practicing open defecation. It is not new that open defecation has been an age long practice all over the world, but its incessant discharge into waterbodies arising from runoff and other environmental activities have raised the awareness that this is the main human activity that undermines the quality of water and exposes those who consume it to various waterborne and water related diseases of which diarrhea and typhoid are chief sicknesses. Promotion of behavioral change(s) is required through campaigns and educational programs to reduce the

harmful consequences of open defecation and improve hygiene practices. Through NGOs and government led campaigns this practice should be explained and its implications exposed to the population especially rural community dwellers.

4.3 Increase the Awareness and Practice of Water Use and Total Sanitation.

The greater percentage of the population lacking access to water and sanitation are those residing in the rural areas. The awareness has to be created through community led teams via workshops and seminars to educate the rural dwellers on the proper practice of water use and consumption as well the sanitary conditions attached. The proper knowledge of the practical use of water and sanitation requirements will ensure safer sources of drinking water and limited wastage of the resource for environmental sustainability.

4.4 Regulation on the use and consumption of water

Water is a lifesaving resource and it has been termed a highly mismanaged resource as there is actually no form of regulation to account for what is available, what is consumed and what is remaining. Mostly because water facilities are used and developed by individuals/private entities there are no tariffs or water taxes to regulate the usage of water, so anyone having access to it see it as unlimited. Policies should be enacted to monitor water usage by creation of tariffs that guarantee how water usage and consumption can be regulated. Centralized regulatory bodies have to be created to oversee water and sanitation services nationwide so as to assure coordination, accountability and monitoring of water use rates to institute transparency and reduction in corruption associated with water management agencies.

4.5 Ensure sustainability of water services in rural communities

Rural communities are the worst hit when it comes to water services and its sustainability. This calls for the installation of structural and technical infrastructure to meet the needs of the rural communities when it comes to water availability and sustainability. This is seen through the water-supply schemes/projects executed by federal institutions like Anambra Imo River Basin Development Authority (AIRBDA) and the likes for the supply of water. Such activities should be sustained and executed in more communities so that water services and sustainability is continuous.

4.6 Inclusion of water safety plans as guidelines for drinking water quality

This involves a review of the assessment of existing systems (water treatment systems), identification of appropriate control measures and supporting programs. Improvement of operational monitoring and management of those systems so that they can accommodate more parameters and analyze multiple samples.

4.7 Development of a reliable data base of water resources available within the states and nation.

Most water management and conservation structures are developed based on the available and reliable data base of water resources existing within a catchment area. The use of tools like remote sensing and geographic information system (GIS) are therefore required to harness all the available sources of ground and surface water so that based on the data acquired infrastructures like water distribution systems and reservoirs can be designed and put in place to store water for future purposes. Inflow hydrographs can be generated through same database for the prediction of flood and design of flood control structures.

4.8 Collaboration between Governmental and Non-Governmental agencies to fund water sanitation projects.

The major ingredient for the execution of projects have always been the aspect of funding, government should run collaborations with non-governmental agencies either through counterpart funding or other methods to fund the installation of water supply and sanitary frameworks to ascertain access to water and good sanitary conditions for the population. The private sector can also be involved through build and operate agreements to erect water structure(s) as well so that there is availability of water to everyone.

5. CONCLUSIONS

Judging from the statistics and records obtained from relevant literature, Nigeria faces significant challenges in its water and sanitation sector as well as in achieving SDG6, but with right interventions progress can be made by through; provision of equitable access to water, sanitation and hygiene services, strengthening of the efforts to eradicate the practice of open defecation, increasing the awareness and practice of water use and total sanitation, regulating the use and consumption of water, ensure sustainability of water services in rural communities, inclusion of water safety plans as guidelines for drinking water quality, development of a reliable data base for water resources and collaboration between governmental and non-governmental agencies to fund water/ water sanitation projects. Water availability is an all-important factor for determining the extent of development in a society and its sanitation and access is another catalyst that ensures lesser outcomes of waterborne or water related diseases which are determinant factors that reduce infant mortality and morbidity rates. Furthermore, encouraging public awareness and community participation will encourage long-term sustainability of water services and address challenges that can help Nigeria improve public health, reduce poverty and promote economic growth.

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