

Strategies for achieving water security in Nigeria by 2050

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Abstract

Background: Water security denotes the capacity of the people to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development, for protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability. Nigeria has many rivers that cover about 10,812,400 hectares, and therefore water security should be assured all things being equal but burdened with an estimated 30% dysfunctional status of newly provided water supply infrastructure within the first year of provision.

Situation analysis: As of 2018, access to basic water supply services reached 67.9% with 87.3% for people living in urban areas and 59.7% for those in rural areas, while about 69 million people lack access to improved drinking-water sources, with attendant high prevalence of water-borne diseases, threat to the livelihoods, and low levels of school enrolment, especially among girls.

Forecast: Nigeria, with the fastest-growing population among the ten most populous countries in the world, is expected to have a population of 400 million by 2050. This rapid increase in population has been projected to stress the available water resources in the country if not adequately regulated and managed, thereby leading to an increase in water pollution, food shortage, and conflicts.

Challenges: The poor state of water supply infrastructure, climate change, numerous breakdowns of water supply infrastructures, inadequate measures for cost recovery, Skewed political will at state and local government levels.

Strategies to achieving water security: Revitalisation and strengthening of the water, sanitation and hygiene sector information management system, revision and activation of the national M&E framework with monitoring and evaluation indicators measurements, strengthening the

operation and maintenance system to support real-time maintenance of water supply infrastructures.

Conclusion: With the exponential rate at which water demand is increasing in Nigeria, this review considered the enactment of appropriate legislation, with enforcement arms, and the activation of the national M&E framework with monitoring and evaluation systems and indicators towards significant progress towards achieving household water security in Nigeria.

Keywords: Water security, Nigeria, situation analysis, forecasts to 2050,

Résumé

Contexte : la sécurité de l'eau dénote la capacité des populations à garantir un accès durable à des quantités suffisantes d'eau de qualité acceptable pour assurer les moyens de subsistance, le bien-être humain et le développement socio-économique, pour la protection contre la pollution d'origine hydrique et les catastrophes liées à l'eau, et pour la préservation des écosystèmes dans un climat de paix et de stabilité politique. Le Nigéria compte de nombreux fleuves qui couvrent environ 10.812.400 hectares, et par conséquent, la sécurité de l'eau doit être assurée toutes choses égales mais est dans un état pénible de dysfonctionnement estimé à 30% des infrastructures d'approvisionnement en eau nouvellement fournies pendant la première année de fourniture.

Analyse de la situation : En 2018, l'accès aux services d'approvisionnement en eau de base a atteint 67,9%, dont 87,3% pour les personnes vivant en milieu urbain et 59,7% pour ceux en milieu rural, tandis qu'environ 69 millions de personnes n'ont pas accès à des sources améliorées d'eau potable, avec accompagnateur de prévalence élevée de maladies d'origine hydrique, menace pour les moyens de subsistance et faible taux de scolarisation, en particulier chez les filles.

Prévisions : Le Nigéria, avec la population à la croissance la plus rapide parmi les dix pays les plus peuplés du monde, devrait avoir une population de 400 millions d'habitants d'ici 2050. Cette augmentation rapide de la population est prévue à mettre sous stress les ressources d'eau disponibles dans le pays si pas suffisamment réglementés et gérés, ce qui entraînerait une augmentation de la pollution de l'eau, des pénuries alimentaires et des conflits.

Défis : Le mauvais état des infrastructures d'approvisionnement en eau, le changement climatique, de nombreuses pannes des infrastructures d'approvisionnement en eau, des mesures inadéquates pour le recouvrement des coûts, une volonté politique faussée aux niveaux des États et des gouvernements municipaux.

Stratégies pour assurer la sécurité de l'eau : Revitalisation et renforcement du système de gestion d'information du secteur de l'eau, de l'assainissement et de l'hygiène, révision et activation du cadre national de S&E avec mesures des indicateurs de suivi et d'évaluation, renforcement du système d'opération et de maintenance pour soutenir la maintenance en temps réel de l'eau infrastructures d'approvisionnement.

Conclusion : Avec le taux exponentiel auquel la demande en eau augmente au Nigéria, cette revue a considéré la promulgation d'une législation appropriée, avec des armes d'application, et l'activation du cadre national de S&E avec des systèmes de suivi et d'évaluation et des indicateurs vers des progrès significatifs vers la réalisation de la sécurité de l'eau domestique au Nigéria.

Mots-clés : Sécurité hydrique, Nigéria, analyse de situation, prévisions jusqu'en 2050

Introduction

Global water crisis

The importance of water for maintaining healthy ecosystems and socio-economic development cannot be over emphasized. According to UN-Water [1], population growth and associated development results in an increase in water demand for domestic, agriculture and industrial purposes and the possibility of conflicts among governments and users. Sustainable water management is key to achieving other Sustainable Development Goals (SDGs) and in particular, the SDG 6 which is to 'Ensure availability and sustainable management of water and sanitation for all' [2]. Water management issues resulting from "imbalances between availability and demand, degradation of groundwater and surface water quality, intersectoral, competition, and inter-regional conflicts" have been at the forefront of global discussions for decades [3].

Guppy and Anderson [2] posited that "water is a pressing societal and geopolitical issue", and that 40% of the world's population will be living in water-stressed areas by 2030. The six inter-related contexts that were identified to be responsible for the looming water crisis include water scarcity and insecurity, water-related disasters, water, sanitation and health (WASH) crisis, water infrastructure deterioration and

destruction, unsustainable development, and ecosystem degradation.

Using the 'Falkenmark indicator' or 'water stress index', White [4] defined water scarcity in terms of the total water resources that are available to the population in a defined geographical region and measured water scarcity as the volume of renewable freshwater / person / year. If the volume of renewable water is below 1,700 m³/head/year, that country is said to be experiencing water stress; below 1,000 m³ it is said to be experiencing water scarcity; and below 500 m³, absolute water scarcity". UN-Water described water scarcity as "scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to ensure a regular supply or due to a lack of adequate infrastructure" water was also regarded as "the route out of poverty for individuals and communities; hence, the need to manage it to achieve sustainable development globally [5].

Guppy and Anderson [2] reported that there would be a 40% gap between water demand and available water by 2030. It was predicted that about 3.9 billion people (out of 9.7 billion) will live in severely water-stressed basins by 2050. This has been attributed to pressure on water resources due to rapid population growth, excessive water abstraction, use, and climate change. Mekonnen and Hoekstra [6] also showed that about 66% of the global population faces severe water scarcity for, at least, a part of the year while around one billion people experience severe water scarcity throughout the year.

Overview of global water security

UN defined water security as "the capacity of a population to safeguard sustainable access to adequate quantities of potable water for sustaining livelihoods, human well-being, and socio-economic development, for ensuring protection against water-borne illnesses and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" [7]. In like manner, Siwar and Ahmed [8] described water security as a broad concept with various dimensions including household water security, economic water security, urban water security, environmental water security and resilience to water-related disaster. These dimensions define the concept of national water security and will be adopted in this paper.

Household water security

Household water security dimension focuses on access to adequate potable water, improved sanitation and hygiene at the household level [9]. It has been

identified as an essential factor in ensuring the health and enhancing the economy of the family. It is the focus of attention by several developments driven assisted programmes in Nigeria, especially UNICEF. The goal is to provide households with sustained improved access to safe and affordable water sources at reasonable distances from the home.

Economic water security

Dimension is concerned with the productive use of water for economic growth. This encompasses the efficient use of water for food production in agriculture. A threat to water security has long been identified as a threat also to the food security of a nation [10]. Other considerations on economic water security are related to its use in industries and energy sectors of the nation's economy.

Urban water security

According to Hoekstra *et al.* [11], urban water security can be 'measured through indicators of water supply, wastewater treatment, and drainage, with factors added for urbanisation rate and river health'. Other factors such as high population density and its associated water demand that may exert demand beyond the natural supply within urban water stress settlements need to be adequately considered. They also emphasized the need for employing 'integrated water' approaches which will contribute immensely to the attainment of the full potential of water-sensitive design, rainwater harvesting, recycling, reuse, pollution prevention and other innovative urban water approaches.

The environment water security

Entails the use of water in a sustainable way, from the geographical and administrative perspectives. Environmental water security measures the health of surface water resources

Drivers of water insecurity

The main drivers to water insecurity include urbanisation, population explosion, economic development, water pollution, changes in living standard, unregulated over-abstraction of groundwater, and climate change [12,13]. Studies have shown that these drivers are expected to bring about an increase in the level of water shortage as a result of the increasing water demand [12, 14]. According to the IPCC [15], the vulnerability of freshwater resources portends severe consequences for social, economic, and ecological systems. However, the implications and vulnerability to be experienced are expected to vary based on factors

such as water availability and utilisation, the geographical location, demographic changes, existing management and water management legal frameworks, institutions, existing governance structures, and the resilience of ecosystems. Water security is therefore essential to humanity and supports public health, economic growth, environmental sustainability, political stability, and disaster risk reduction (United States Agency for International Development (USAID), under the Sustainable Water Partnership, SWP).

The UN-Water developed a conceptual framework consisting of four elements (Figure 1) for assessing water security. The features include: 'drinking water and human well-being; ecosystems; water-related disasters & climate change; and economic activities & development' [7]. These elements were considered in a broader context of "good governance, transboundary cooperation, financing, and peace and political stability" as seen in Figure 1 [7].



Fig. 1: Water security [7]

This framework was used by Gheuens *et al.* [16] in assessing disaster-risk, water security strategies and challenges and in small Island developing states (SIDS). They classified the elements into two groups viz:

- a) Water, sanitation and hygiene (WASH), climate change, disasters and ecosystems;
- b) Cooperation for shared water systems, economic development, financing, political stability and governance.

Situation analysis of water security in Nigeria

Nigeria has abundant water resources used. The country has several small and big rivers, lakes and dams, with seasonal and annual varying volumes. According to Ita and Sado [17], major rivers cover about 10,812,400 hectares which constitute about 11.5% of the estimated total surface area of 94,185,000 hectares. The country has a total rainfall which decreases from the coast northwards, with the south having an annual rainfall ranging from 1500mm to 4000mm and the north from 500mm to 1500mm [18]. Reservoirs and Dams in Nigeria are mostly used for irrigation, domestic water supply, and hydro-electric power generation. One major factor that distinguishes the southern from northern Nigeria is in the distribution of water resources. While 95% of the dams in the country are in the north and central Nigeria where rainfall is low, the south and west are characterised by big rivers, lakes and seas [19]. The distribution of water bodies in Nigeria makes her quantitatively water-rich. However, the water resources in the country are prone to multiple natural and anthropogenic pollution. In most cases, these factors are preventable if given the necessary attention by the three tiers of government and the catchment communities.

As of 2018, access to basic water supply services reached 67.9% of the population with 87.3% for people living in urban areas and 59.7% for those in rural areas [20]. An estimated 69 million people lacked access to improved drinking-water source [20], while about 75% of the urban population is served by improved water supply [21]. In this area, people often collect water from vendors who trek a reasonable distance after collecting water in containers. The challenge of having access to clean and safe water is most severe in northern Nigeria where only about 30% of the population has access to safe drinking water and adequate sanitation [22]. This adds to a high prevalence of water-borne diseases, a threat to farmers' livelihoods, and low levels of school enrolment, especially among girls in the area. The human resources required to manage Nigeria's water resources are not equitably distributed. Also, the country is blessed with abundant water resources which are primarily untapped [23]. Despite the abundance in water resources, government at all levels (federal, state and local) have not been able to successfully integrate them to ensure equitable and sustainable access to affordable, adequate, safe, and improved water supply to her population.

Despite all efforts by stakeholders in Nigeria, the status of WASH in the country is very poor. The WASH-NORM [24] showed that 68% and 42% of

the population respectively uses basic drinking water and sanitation services; about 56 million people drink water from polluted sources while 47 million inhabitants still practice open defecation [23]. The report also emphasised that there is a lot of disparity in access to basic water supply services by geopolitical zone, state and wealth quintile

Water scarcity and inter-boundary conflict in Nigeria

According to Adebawale [25], "Over 180 million people living in countries affected by conflicts, violence and instability did not have access to basic drinking water, out of which 3.6 million people were from north-east Nigeria where the Boko Haram insurgency has damaged about 75% of WASH infrastructure" The impacts of climate change and emergencies occasioned by insurgencies in Nigeria constituted an increasing threat to water security and disparities in access. Vulnerable groups, including isolated communities, poor households, people with disabilities, women and girls, bear the brunt of inadequate WASH services

The geographical flashpoints where conflict over water is ongoing [26] include North and Northeast, Middle Belt and the Niger delta. In Northern Nigeria, "militant group is also known to use water as a weapon, poisoning the freshwater sources of their opposition". In the middle belt, the report claimed that "Water-related violence has been responsible for more casualties than the violent insurgency waged by Boko Haram". However, in the Niger Delta, the report claimed that "the militant groups attacked oil infrastructure due partly to conflict over rights to land and waterways, thus causing oil spillage into waterways and associated environmental pollution, food insecurity and malnutrition. Despite the current state of water resources in Nigeria, there are quite a number of strengths and opportunities that can be built on to improve water security in the country (Table 1)

Forecast of water security in Nigeria for 2050

The global population according to UN [27] has been projected to reach 9.7 billion by the year 2050 while Nigeria population, on the other hand, is expected to have increased to over 400 million. This vast population is expected to compete for the limited water resources since only 2.5% of all water is freshly available for human use. This indicates that water is a finite resource which cannot cater for the growing population. Water usage increased six-fold in the 20th century as the global population tripled; conversely, water demand has been projected to increase

Table 1. SWOT Analysis of the present state of water security

Strengths

- Availability of many perennial water resources such as rivers, lakes and dams
- Presence of external development partners to strengthen the water resources management sector.
- Availability of the human resources to sustainably implement water security and related programmes
- Having the technological capabilities to implement, monitor and evaluate the intervention projects
- Availability of research, regulatory and implementation institutions to carry out water-related research and implement the recommendations.

Weaknesses

- Water and soil pollution due to inadequate sanitation, and excessive use of pesticides and fertilisers
- The poor state of water supply infrastructure
- Lack of wastewater treatment plants for the sewage/wastewater
- Poor quality of treated water and leakages in the piped network for water distribution
- Low investments in operation and maintenance
- Non – involvement of the intended beneficiaries
- Lack of bulk and property water supply meters
- Lack of regulations (regulatory laws) and a regulatory system to promote household water security
- Operation of water supply utilities on non-commercial principles
- Non-efficiency of water pricing in terms of cost recovery for service provision
- intensive cost on water supply investment,
- Large volumes of unaccounted for water wastages

Opportunities

- Local and international educational institutions offering training opportunities
- Commercialisation, and or privatisation of the water sector (operation and maintenance)
- Recycling of municipal water to water home and public gardens and in the toilet
- Recycling sewage water for agricultural and industrial purposes

Threats

- Climate Change
- Corrupt practices in the water supply sector
- inadequate measures for cost recovery
- Increase in population growth
- Water supply shortages
- Failure to appreciate that water is a finite resource
- The ever-increasing rate of urbanisation resulting in shortages of water supply
- Weak political will and low institutional capacity to manage water resources and water supply services

between now and 2050 by over 400% from manufacturing, and 130% from household use [28]. According to the U.N [27] report, Nigeria presently occupies the seventh place in the world largest countries and has the fastest-growing population among the ten most populous countries worldwide. The report projects the population may surpass that of the United States shortly before 2050. This rapid growth in the population of Nigeria will stress the existing water resources if not properly regulated and managed, thereby leading to an increase in water pollution, food shortage, and conflicts.

Major challenges to be addressed to achieve water security

Achieving water security in Nigeria by 2050 is a huge task, in view of population growth and the national developmental agenda. As of now, the water security concerns are superficially considered, without due considerations for the more complex and deep-rooted

issues. The major approaches for sustainable water resources development against 2050 are outlined and presented in Figure 2, including:

Rain water harvesting and groundwater recharge.

In the national policy on water, rain water harvesting and groundwater recharge are not given adequate importance as it deserves. However, every community in Nigeria taps the resource during the season as it varies (3 months to 10 months in a year) in different parts of the country. With no proper management, rainwater as runoff is a source of floods and pollution of precious fresh water resources [29].

Wastewater is an untapped resource which needs to be recycled.

At least 60 to 80 per cent of fresh water used by populations in Nigeria goes out untreated as

wastewater (greywater, blackwater or industrial effluents) carrying a large quantity of waste products. It is a major source of water pollution and also a drain on reusable resources. There are no functional treatment plants serving the 36 States in the Federation except less than 30 smaller units serving specific communities or industries. This wastewater is a major resource amenable for treatment by modern technology and yet goes untapped as waste into surface waters and sea [30].

essential practices, which include scope definition, water risk assessment, identify and implement water security activities targeting water risks, progress monitoring and evaluation (USAID), & Sustainable Water Partnership (SWP) (nd)

Short term plans

- Assess the status of the hydrological network and its efficacy to meet the needs and requirements of the services

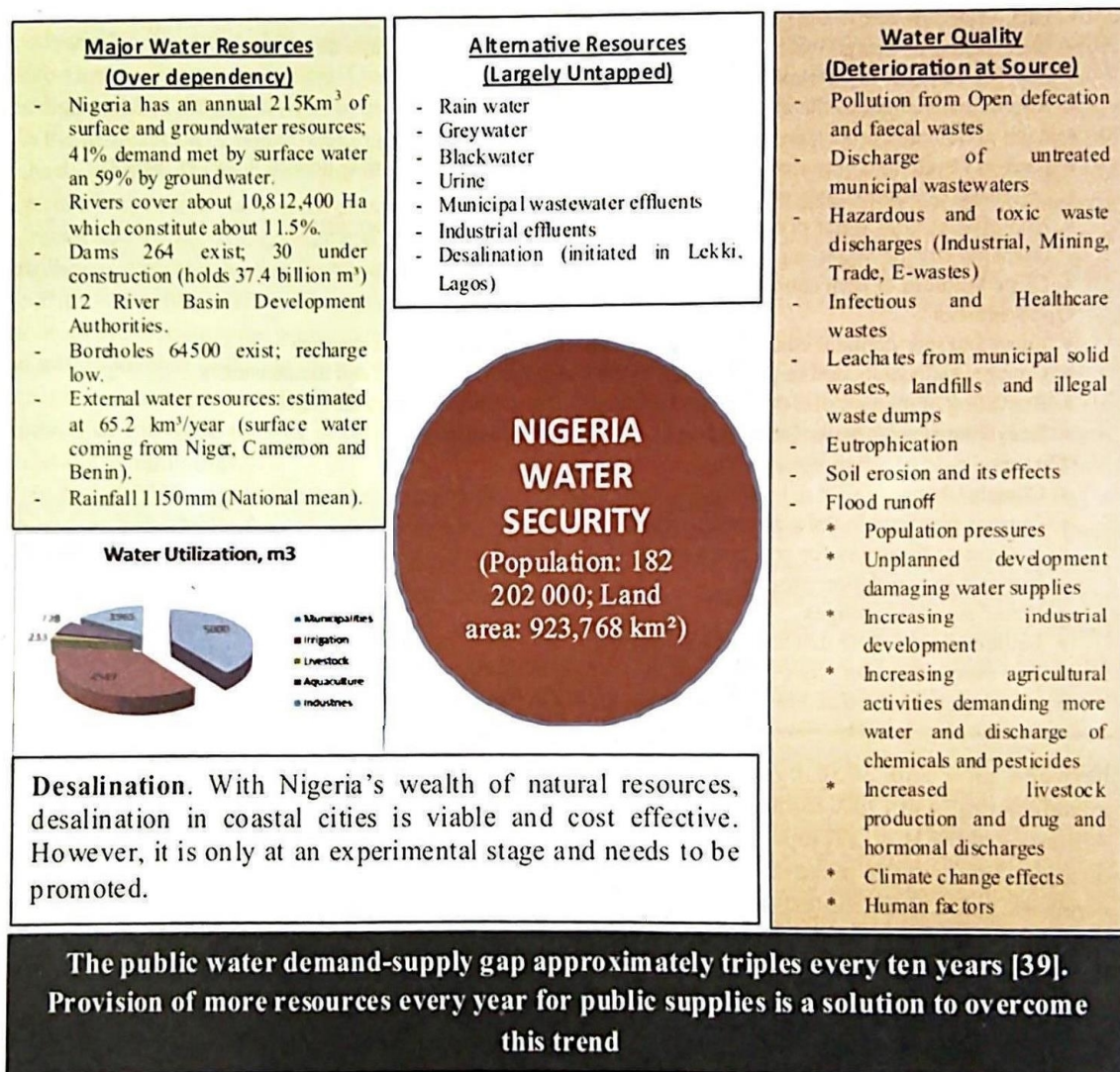


Fig. 2: Factors that threaten water security in Nigeria
Source: Sridhar (Unpublished conceptual diagram)

Strategies for improving water security

Improving water security entails collective responsibility of all stakeholders and targeting resources to mitigate identified water risks to provide water users tangible benefits. The water security improvement (WSI) process is based on eight

- Expansion of water storage capacity and improvement of groundwater management through the allocation of financial support for water storage projects, improved and sustainable groundwater management, cleanup of the state's contaminated groundwater reservoirs, and

improved conjunctive management of surface and groundwater storage strategies.

- Provide education and training to water sectors' staff on water quality monitoring, data analysis, pollution control mechanisms, and on the application of existing water quality regulatory instrument.
- Develop educational module to address public education and information dissemination gaps on water pollution management and control
- Identify the most critical gaps in knowledge that limits the ability of policymakers, water resources planners and managers to plan, allocate and enforce appropriate water use practices

Medium-term plans

- Water distribution system infrastructure in the form of pipes, pumps, valves, storage tanks, reservoirs, meters, fittings, and other hydraulic appurtenances that connect treatment plants or well supplies to consumers' taps should be made available.
- Final passage of the National Water Resources Bill into law should be pursued, and its implementation by all stakeholders ensured along with all other approved policies in the sector to engender best practice in Nigeria water sector.
- Develop national capacity (human and institutional) to develop laws, regulations, standards and procedures that facilitate an appropriate decision on water allocation and use
- Provide equipment and facilities that enhance the water quality monitoring and regulating the capacity of relevant institutions.
- Private sector participation in WASH projects

Long term plans

- The aging condition of the water infrastructure of the country needs to be addressed. This can be done through rehabilitation, reactivation and complete overhauling of outdated waterworks to pave the way for newly constructed and improved water facilities.
- Putting in place infrastructures for both mini-water schemes, and large waterworks for collection, treatment, storage, and distribution of water between water sources and consumers.
- Setting up wastewater treatment plants using appropriate technologies (e.g. condominial sewerage system for collection from septic tanks and subsequent treatment in non-conventional facilities) for treatment of grey and black wastewater.

- Put in-place practical legislative framework that supports efficient investment in water development, conservation and use

Sources of funding

The possible sources of funding to promote water security shall include mobilisation of fund from the Federal, State and Local government through their budgetary processes. Other sources of funding shall consist of the African Development Bank, national and state development/infrastructure banks, micro-credit banks/organisations, philanthropists, NGOs with both international and local scope, as well as multilateral agencies European Union, Japanese JICA, UNICEF, UKAid, USAID, WaterAid and the World Bank.

Monitoring and evaluation

Monitoring is tracking the performance of all WASH sector players, through sector-related activities towards the sustainability of project outcomes. Monitoring entails the "routine collection and analysis of data about a project or programme, undertaken while ongoing to track performance and percentage funds utilisation to achieve project-specific objectives, while evaluation is the periodic, retrospective assessment of a project or programme that might be conducted internally or by external independent evaluators" [31]. Successful M&E requires that a "meaningful water security indicators be integrated with other relevant tools to gauge the cause-effect relationships.

The FMWR has a national 'monitoring and evaluation framework' with a call on all states to domesticate and implement in phases the national M&E agenda. However, the few states (donor assisted) that domesticated the national M&E framework did not have the human resources capacity, finance and political will to implement its components. The development and operations of the water, sanitation and hygiene information management system (WASHIMS) at the FMWR was developed to track rural water supply, with the intention of either upgrading to the national database for WASH, or linked with another site, to host the national WASH database. Development on having a national database for WASH is stalled and therefore, lacking a national picture of the water supply and household water security situation in Nigeria

Conclusion

Nigeria, through the FMWR, the academic and development partners have made efforts towards

increasing water coverage and access as a fulcrum to achieving household water security in Nigeria. This review identified the strengths, weaknesses, opportunities and threats against household water security and considered the enactment of appropriate legislation, with enforcement arms, and the activation of the national M&E framework with monitoring and evaluation systems and indicators towards significant progress towards achieving household water security in Nigeria.

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