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Challenges of Water Supply Sustainability in an Emerging Economy

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Abstract - *Water is a colourless, transparent, odourless, liquid which forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms. "All life is water", said Thales, the Greek philosopher, this paper examines the twin problems which is the access and availability of water resources in Africa especially in Nigeria, Its intricate relationship that exists between their exploitation, use and availability at once, and environmental sustainability. Access to water for different use categories is assessed to be relatively low in the country, even though there are indications of marginal improvement since the advent of a new democratic dispensation. The gap between water need and supply has widened steadily in African continent, despite continuous efforts made to develop the nation's vast surface and groundwater resources. Acute water shortages afflict the inhabitants of the towns and cities. The paper revealed factors affecting water management in the country include; Lack of effective compliance to policies, weak data base, fragmented responsibility, climate change, poor state of infrastructure, cost intensive, corruption, and low rate of costs recovery as the bulk of available water supply is unmetered and where metered, ridiculously low rates are charged. Thus; in order to ameliorate these challenges; recommendations were made in achieving sustainable water resources. There is need for total compliance to water management policies (both local and international), encourage stakeholder participation, enforcement of existing laws and regulatory responsibilities. There is also a great need for management policy that aims at financial viability and economic efficiency like increasing production and distribution costs.*

Keywords: *Water Resources, Environment, Water cycle, Water resources management, Indigenous technology.*

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I. Introduction

Water's unique and vital role in nature stems from its wide range of unusual physical properties that define ways in which water can be used and treated. Water is the only substance that exists naturally on Earth in all three physical states of matter gas, liquid, and solid and it is always on the move among them. The Earth has oceans of liquid water and Polar Regions covered by solid water. Energy from the sun is absorbed by liquid water in oceans, lakes, and rivers and gains enough energy for some of it to evaporate and enter the atmosphere as an invisible gas, water vapor. As the water vapor rises in the atmosphere it cools and condenses into tiny liquid droplets that scatter light and become visible as clouds. Under the proper conditions, these droplets further combine and become heavy enough to precipitate (fall out) as drops of liquid or, or if the air is cold enough, flakes of solid, thus returning to the surface of the Earth to continue this cycle of water between its condensed and vapor phases. The new emphasis on water resources management in Africa is coming with a shift in the principle and approach to the management of water resources. It is now recognized that water is a commodity of strategic importance because of increasing demands and rising costs, coupled with diminishing supplies (Sharma et. al., 1996). Furthermore, it is recognized that it is no longer feasible in a long-term, cost-effective and environment friendly manner, to increase water supply by building additional dams and conveyance systems, sinking new wells, constructing desalinization plants, etc. In addition, it is now recognized that solutions must be found at the user-end of the pipe, which is, improving water use productivity, reducing conveyance losses, reusing water and optimizing allocation (Sanstrom, 1997). The underlying principle is that water is a scarce good with dimensions of economic efficiency, social equity and environmental sustainability. Therefore, it has both public and private characteristics, and hence there is an important role for public and private participation in efficient management and development of water, particularly communities that use water (Sharma et al., 1996; Karikari, 1996). After almost sixty years of water supply development in Nigeria, it is regrettable that only 71% of the population has access to safe drinking water, and in rural areas less than 62% of the households have access to potable water (National Millennium Development Goals Report, 2005). Rural

people in the country still depend very much on rivers, streams, rainwater, and shallow wells for their water needs. During the dry season, some of these sources dry up and households have to invest a substantial amount of their resources to get water of doubtful quality. This has very serious implications for the economic development and social welfare of the people specifically and the country as a whole. First, there is the tremendous economic waste involved in people spending so much time and effort in search of water. Secondly, lack of water often means relatively low levels of personal hygiene and environmental sanitation. Thirdly, because water is needed for most productive activities, inadequate access to water limits the livelihood options of the people, particularly in rural areas (IDRC, 2002).

II. Literature Review

2.1. water resources

Water resources are sources of water that are useful or potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. We can also consider water as a unitary resource, since all water in the hydrological cycle forms part of one whole. Consequently, any intervention by man or nature, at or on one part of the cycle has a definite impact on another phase of the cycle. Excessive extraction of groundwater for instance has the potential of reducing base flows to rivers. The diversion of surface water may reduce the recharge ability of ground water, just as the discharge of wastewater affects water quality. And ultimately, water quality determines the dynamics of the ecology (Sharma et al., 1996), with its interrelated natural systems such as land and forests. Generally, as human interventions intensify through the effect of rapid population growth, poverty and poor land use practices, water ecosystems such as rivers can be fundamentally altered in terms of increased deforestation, soil erosion and runoff, as well as possible modification, in the long-run, of microclimates. The loss of vegetation for instance may contribute to loss of soil and water quality, impede river flows and increase sedimentation processes. It is within this context that the management of water resources should be ideally set within a broader framework of land use and the level of economic activities, with man and sustainable human development as the primary factors of concern. It turns out that the poorest segments of society are the ones who have the least access to water, and incidentally, they are the ones who pay the most for water services, from the economic point of view. In the typical African urban centre for instance, the poorest communities are usually the last to be served by municipal water utilities – a situation that usually forces them to gather their own water often from polluted sources, with their health threatened by contaminated water and improper sanitation. They are also the ones who purchase water from any available source.

III. Environmental Issues

Bearing in mind again that your body is about 75 percent water it is easy to understand that water must be the body's most essential daily ingredient. The body looses each day about 2-3 litters of water through elimination, urination, perspiration and respiration. It does appear that the degradation of all categories of environmental resources records intense deterioration during the initial stages of the development process but over time substantial economic growth should lead to better environmental quality. However, it can be argued that economic growth alone does not provide the sufficient condition for improvement of environmental quality on all fronts, thus justifying environmental policy intervention at all stages of the development process (Orubu, 2003; Orubu et al. 2002). Thus given the linkage between economic and environmental processes, the identification of the specific environmental issues incidental to the exploitation and utilisation of Nigeria's water resources is justified. This should provide an appropriate analytic anchor on the basis of which an integrated framework for the management of water resources could be developed.

Dredging activities on rivers and watercourses also have adverse consequences for the environment. Dredging activities are usually undertaken indiscriminately, thereby leading to unstable upper crust structure of adjoining human settlements. Indiscriminate sand mining in the country has in many instances led to stresses on road structures such as bridges. Although under the appropriate statutes, there is the requirement for the conduct of Environmental Impact Assessment (EIA) studies for dredging projects, the activities of sand miners are not usually checked. Indiscriminate sand mining activities also increase the risk of flooding in vulnerable topographies. Pollution, particularly by oil industry activities has continued to pose a serious threat to fragile aquatic ecosystems of the Niger Delta area, where the largest proportion of oil exploration and production activities takes place in the country. Major spills of crude petroleum into the Niger Delta ecosystem have been known to have adversely affected the mangrove ecology and fish population in the area, thereby negatively impacting the economic livelihood of the people (Ekuerhare and Orubu, 1996; Orubu et al., 2002) and the survival of non-timber forest products (Orubu, 1999).

IV. Water Cycle

The water cycle, also known as the hydrologic cycle, is the process by which water moves from place to place above, on, and below the Earth's surface. This is the process by which water moves around the Earth to different places. The total amount of water on the Earth is relatively unchanging, and it has remained about the same since our planet's formation. As the planet cooled, water vapor present at its formation condensed to fill the oceans and other places, like inland lakes and rivers.

The Earth's surface is 75% water and 25% land. Of the water, 97% is salt water, a surprisingly high percentage, leaving only 3% as fresh water. Most of that - two-thirds of the fresh water on Earth - is frozen in snow and ice in glaciers, ice caps, and the like. That leaves only about 1% of all the Earth's water as liquid and fresh, making it a very scarce natural resource. If that wasn't enough, most of the liquid fresh water is stored underground in aquifers. Groundwater is just what the word sounds like: water stored under the surface of the Earth. But like rocks or other types of matter, water on the Earth is not static. It constantly is moving around the hydrosphere, the layer of the Earth where water is present. It moves around by changing in three different processes that make up the water cycle. The components of the hydrologic cycle are: precipitation, evaporation, transpiration, infiltration, percolation and run-off see fig 1 below.

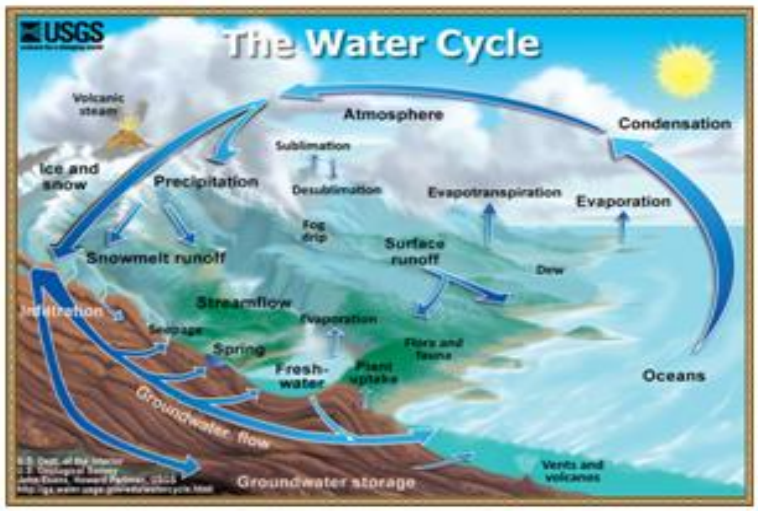

Fig 1: Water Cycle

4.1. The Importance of Water

With two thirds of the earth's surface covered by water and the human body consisting of 75 percent of it, it is evidently clear that water is one of the prime elements responsible for life on earth. Water circulates through the land just as it does through the human body, transporting, dissolving, replenishing nutrients and organic matter, while carrying away waste material. Further in the body, it regulates the activities of fluids, tissues, cells, lymph, blood and glandular secretions. An average adult body contains 42 liters of water and with just a small loss of 2.7 liters he or she can suffer from dehydration, displaying symptoms of irritability, fatigue, nervousness, dizziness, weakness, headaches and consequently reach a state of pathology. Dr F. Batmanghelidj, in his book 'your body's many cries for water', gives a wonderful essay on water and its vital role in the health of a water 'starved' society. He writes: "Since the 'water' we drink provides for cell function and its volume requirements, the decrease in our daily water intake affects the efficiency of cell activity.....as a result chronic dehydration causes symptoms that equal disease...

4.2. The History of Water

Water is a colourless, transparent, odourless, liquid which forms the seas, lakes, rivers, and rain and is the basis of the fluids of living organisms. "All life is water", said Thales, the Greek philosopher, water has been used since antiquity as a symbol by which to express devotion and purity. Some cultures, like the ancient Greeks, went as far as to worship gods who were thought to live in and command the waters. Whole cities have been build by considering the location and availability of pure drinking water. The place of gathering was around the wells, which is perhaps the following trend in building fountains in the middle of piazzas. Traditional and modern medicines have been making use of the psychological and physiological diverse properties of water, in all forms of hydrotherapy (composite Greek word: hydro, of water and therapy. We all know of the simple, yet effective, calming qualities of a warm bath or the invigorating qualities of a cold shower. For

centuries, numerous healing springs located all around the world have been recognized for their benefits. The famous Belgium spas in the Ardennes is a fine example. Historical records of these cold springs claim 'cures' since the fourteenth century. The hot Californian spas, the healing spas of Loutraki in Greece, the Dalhousie hot springs in the border of South Australia and Northern Territory, Moree in NSW, Hepburn mineral spas in Victoria are just a few examples.

V. The Trends in Water Resource Management In Nigeria

Water resources management includes, but not necessarily limited to: data collection and analysis including modeling; the preparation and implementation of draft river basin management plans and other planning activities relating to water resources; the implementation and enforcement of the permit regime for the use of water resources including the determination of permit applications; activities relating to floods, droughts & emergency response; capacity building and education for communities; and inspection of activities involving the use of water resources and the enforcement of the laws and regulations in force. Man has always tried to tap the hydrologic cycle for a tone or more points in order to utilize the water for a variety of purposes. The attempts to take advantage of certain aspects of the hydrologic cycle gave rise to water resources projects of a wide range of sophistication. Nigeria developed a number of programmes since the early sixties to provide water for people in general. The first National Development Plan Period of 1962-1968 contained the first attempt of the Federal Government at water resources development. Lake Chad and River Niger Basin Commissions were set up with neigbouring countries and within the country, the sokoto Rima and the Chad Basin Development Authorities were established in 1976. The number of River Basin Development Authorities, after several modifications, stands at 24 as at today. Their major assignments, expectedly, are to ensure the development of water resource potentials in their respective areas of operation. In recent times, other Agencies set up to enhance water resource development and management, include: National Water Resources Institute, Agricultural Development Projects (ADPs), National Council on Water Resources, the defunct Directorate of Foods, Roads and Rural Infrastructure (DFRRI) and the Petroleum Trust Fund (PTF), International organizations are involved in the race to develop Nigeria's water resources. Notable ones are: UNICEF, FAO, UNDP, WHO, and USAID. Between 1980 and 1990, several international loans were taken to address the issue of water scarcity, all yielding little dividend. For example in 1992, the Federal Government launched the National Water Rehabilitation Scheme with a USD 1.12 Billion foreign loan, taken on behalf of the 30 existing State. This was in addition to other loans of unspecified amounts taken from World Bank, African Development Bank, the Paris Club, etc. for water projects that were mostly poorly executed. Yet, the Federal Government in 2001 plans the construction of 23 000 boreholes in the all the Local Government Areas of the country.

The States that benefited from the World Bank Water projects were Kaduna (in 1979), Anambra (in 1980), and Bornu (in 1985) and Lagos (in 1989). The second generation of assistance was in the form of a loan of US$256 million for the National Water Rehabilitation Project (1991-2001), which targeted the entire country. Concurrently also, the World Bank supported the First Multi-State Water Supply Project (1992-2000) with a loan of US$101 million, which was targeted at Kaduna and Katsina States. The third generation of assistance (2000-2004) was the provision of US$5 Million under the Small Towns Water and Sanitation Pilot Project aimed at satisfying the needs of 16 towns. However it is sad to note that the Independent Evaluation Group (IEG) of the World Bank considers its intervention between 1979-2005 to have failed because the seven selected case studies were 'rated as unsatisfactory' with unlikely sustainability and with negligible or modest institutional development impact' (World Bank 2006:vii).

5.1. The Federal Ministry of Water Resources:

It is charged with the responsibilities of policy advice and formulation, data collection, monitoring and co-ordination of water resources development (of which water supply is a component) at the National level. Despite the existence of this Ministry, the challenges of the urban, semi-urban/rural water management in an emerging economy like Nigeria continues unabated.

5.2 THE CHALLENGES OF URBAN WATER MANAGEMENT IN NIGERIA

The challenges in urban water management are ample and are threatening the sustainability of the urban water system as a significant fraction of the urban population has no access to proper (good) water supply. Some of the challenges include the following;

i. Lack of Effective Compliance to Water Management Policies: The inability for the stakeholders in water management to comply with the existing policies on water management and development constitute a great challenge in the system hence retards its efficiency.
ii. Weak Data Base: Gold face – Irokalibe (2008) observed that water management cannot be done with poor data management. In the past ten years, no single pan Nigerian hydrological yearbook has been published. Without water assessment there cannot be decision support system (DSS) models

necessary for understanding the impact of abstraction and groundwater aquifers. There is currently no effective water resources data management system for the nation. Therefore, Nigeria does not only need to set up nationwide networks for these data collection but also an institute to use the data and make models.

iii. Fragmented Responsibility: Fragmented sectoral practices according to Gold face – Irokalibe (2008) have also led to disjointed development and have critically led to a situation where there is presently nothing in place to significantly ensure the quality of water. There are no clear responsibilities, no mandated water quality standards, no effective water monitoring, no enforcement, no sanctions for polluters, and no remediation.

iv. Climate Change Mitigation: climate change and water scarcity go hand-in -hand to cause some of the biggest contemporary challenges to the human race. These issues have a reciprocal relationship, identified by the Intergovernmental Panel on Climate Change (IPCC), in which, "water management policies and measures can have an influence on greenhouse gas (GHG) emissions." As renewable energy options are pursued, the water consumption of these mitigation tactics must be considered in producing alternatives ranging from bio-energy crops to hydropower and solar power plants.

v. Poor State of Infrastructure (In adequate supply of energy for water works and service stations): The poor state of power supply from the Power Holding Company of Nigeria, Plc. (PHCN), limited distribution system that was put at 40%, ageing plants, vehicles, machineries and limited service coverage due to limited reticulation pose a serious problem to many water supply projects in the Country.

vi. Cost Intensive (High production and maintenance cost): Producing potable water for the public involves finance in the purchase of materials/equipment and paying of bills-(chemicals, power, maintenance and overhead costs).

vii. Corruption: The situation where projects are not adequately monitored by coordinating agencies is detrimental to economic progress and against social benefits for the government to carry out such projects. Huge capital investment without corresponding financial discipline and accountability for performance, along with political interference in decisions about allocations and pricing are reflected in the inefficient operations, inadequate maintenance, financial losses and unreliable service delivery as witnessed.

viii. Challenges of Cost Recovery: The sustainability of a project is tied to continuous maintenance which involves continuous flow of funds. Cost recovery measures are not adequately put in place in our water management approach because water supply has always been considered as a social good. There is no appropriate metering system, and where they do exist utility officer do not make use of them for proper pricing system.

ix. Urbanization Challenge: The accelerating growth in urban population could see a supply-demand gap in water resources. Currently, due to urbanization process more than one billion people don't have access to clean water on the global scale, (Jeff 2010). This is a great challenge to the water management sector of the economy. More strategic and proactive approach need to be adopted to handle this situation.

5.3 WATER ZONING

Economic development and activities including agricultural, industrial and urban development, should be planned with due regards to the constraints imposed by the configuration of water availability. There should be water zoning of the country and the economic activities should be guided and regulated in accordance with such zoning.

The water sharing and distribution amongst states should be guided by a national perspective with due regard to water resources availability and needs within the river Basin. Necessary guidelines, including for water short states even outside the Basin, need to be envoled for facilitating future agreements amongst the Basin state.

5.4 Water resources in Nigeria

Nigeria has been divided into eight hydrological areas or provinces. The total and percentage areas covered by each hydrological area is shown in the table 5.3.

Table 5.1 Hydrological Areas/Surface Water Provinces in Nigeria

Area Code	Designation	No. Of Principal Sub0Basins	Percentage Of Total Areas
1	Niger North	15	13.6
2	Niger Central	23	16.9
3	Upper Benue	17	16.9
4	Lower Benue	16	8.0
5	Niger South	12	5.9
6	Western Littoral	16	11.1

7	Eastern Littoral	17	6.5
8	Lake Chad	21	21.1
			(100)
	Total	**153**	**92.4 Million Ha**

The Niger River, the prinicipal river system in Nigeria, belongs to a regime that is typical of tropical rivers which have the complex regime of the second degree and characteristic of most of the world's large rivers such as the Nile and the Zambezi. The torrential regime is exemplified by some of the headwater of the Hadeija and Rima Rivers. The flows are intermittent occurring mainly during the short rainy season. The regime characteristics discussed above are important determinants of the usefulness of the rivers for navigation, hydro-electric power generation or any other purpose which requires a certain minimum stage or flow over a given period of time.

The Chad Basin area with more than 21 percent has the largest percentage total area, while the Niger South has the smallest area. The decreases in the density of the drainage network from south to north is easily noticed; it is due to the combined effect of hydroclimatic and geological factors.

The river regime also influence the cost and efficiency of developing water resources for human survival where the volume of flow is adequate and sufficiently stable under natural conditions, it becomes cheaper to harness the river for development e.g. for hydropower production, without having to incur large expenses on complex regulating structure. In general, the more favourable the river regime is, the less storage capacity is needed to be provided in order to maximize available yield or runoff.

The specific yield is the discharge per unit area of the Basin. The specific yield gives clear indication of the humidity or aridity of the Basin in question. A Basin which receives high rainfall over all or much of its area normally bestows high specific yield to rivers draining it. On the other hand, rivers draining dry or semi-arid basins have low specific yields. For example the Benue drains much more humid area than the Niger and contributes some 60 percent of the Niger-Benue system flow, even though it accounts for less than 35 percent of the basin area.

The rivers carry their sediment load as bed load (5 – 6 percent), suspended and siltation solution load. The latter load is responsible for the building up of the alluvial valley and an important factor of reservoir sedimentation. The implication of excessive sediment transport include aspects of impaired water quality, basin degradation, soil loss and deterioration, valley aggravation and reservoir sedimentation.

Nigeria is situated entirely in the tropics where the climate is semi-arid in the North and humid in the south. Annual rainfall varies from over 4, 000mm in the South-East to below 250mm in the extreme North-East. It is also highly seasonal with the wet season of July-September. Geographically, in the far south are low-lying swamp forests followed in a northerly direction by generally flat dense rain forests, hilly shrub lands in the middle belt, relatively flat Savannah grasslands and semi-arid areas in the far north. The central part of the country is marked by crystalline rock outcroppings and gently rolling hills.

The average rainfall is about 500mm/year in the north, occurring between April and September, and increasing to about 3,000mm/year in the south from March through October. Many rivers in the north are intermittent having water in them only in the rainy season but the majority of the rivers in the South are perennial, flowing all year round, and are important sources of drinking and irrigation water.

Many people take it for granted that the river basin is the natural geographical unit for the planning and management of water resources. However, the river basin is not a natural political basis for planning. Policy is an outcome of political processes not hydrological processes, although it is obviously heavily influenced by them. Other systems and decisions from outside the basin tend to influence solutions to water problems (Akanmu et. Al. 2006).

The range of functions laid down for the River Basin Development Authorities (RBDAS) in 1976 was extraordinarily wide. They encompassed:

- Irrigation
- Watershed management
- Pollution control
- Fisheries and Navigation

Other include activities remote from water resources
such as:

Seed multiplication, livestock breeding and food processing. Their remit also covered a number of activities to be shared by state agencies such as provision of agricultural services and rural electrification. However, in practice these hopes were not realized. The RBDAS have tended to concentrate on large scale single purpose projects, particularly irrigation schemes.

The issues here became one of competition between the RBDAS and the various state authorities. The interface was not managed properly, the roles, functions and coordinating mechanism not defined clearly, and quite

obviously far too much was attempted. As a result the
original goals and objectives were not attained and the erroneous notion developed that the river basin approach was a disaster.

VI. River Basin Management In Nigeria

Before August 1993 when the water Resources Decree 101 was enacted and promulgated, there was virtually no single agency who is responsible for an integrated river management on use and conservation of the water resources and river systems. The defunct Ministry of Water Resources created in 1975 was not given the responsibility of administering the nations rivers neither was the Federal inland Water Department which managed the inland navigation of Niger and Benue rivers.

Currently in Nigeria, the following river basin development authorities (RBDAS) are in existence:

1.) Anambra – Imo River Basin Development Authority
2.) Benin – Owena River Basin Development Authority
3.) Chad River Basin Development Authority
4.) Cross River Basin Development Authority
5.) Hadeji Jama' are River Basin Development Authority
6.) Lower Benue River Basin Development Authority
7.) Lower Niger River Basin Development
8.) Niger Delta Basin Authority
9.) Ogun-Osun River Basin Development Authority
10.) Upper Benue River Basin Development Authority
11.) Upper Niger River Basin Development Authority
12.) Sokoto-Rima River Basin Development Authority

River runoff over Nigeria is definitely seasonal with the wet season occurring between July and September in general, accordingly, the dam and reservoir are basically required to utilize the surface water throughout the year for irrigated agriculture, domestic and municipal water supply and hydropower generation. As of 1991, the number of dams as completed or under construction has reached 160 sites with a total effective storage of 30.7 x 10^6 cubic meters.

No. of Dams	**NW**	**NE**	**CW**	**CE**	**SW**	**SE**	**TOTAL (%)**
Irrigation	10	17	12	11	11	10	**71 (44)**
Water Supply	9	6	18	21	21	8	**83 (52)**
Hydropower	1	0	2	3	0	0	**6 (4)**
TOTAL	**20**	**23**	**32**	**35**	**32**	**18**	**160 (100)**

Active Reservoir Capacity (10^6 CUM)							
Irrigation	1,175	5.885	489	2.225	840	0	**11,164 (36)**
Water Supply	44	66	441	139	213	2	**905 (4)**
Hydropower	11,500	0	7,050	49	0	0	**18, 599 (60)**
TOTAL	**13,269**	**5,951**	**7,980**	**2,413**	**1,053**	**2**	**30,668(100)**

(Source: Federal Ministry of Agriculture and Water Resources)

Table 5.2: No of Dams and Reservoirs in River Basins
(Source: Federal Ministry of Agriculture and Water Resources)

For the hydropower, the large scale dams and reservoirs at Kainji and Jebba along the Niger and at Shiroro were constructed by PHCN (formal NEPA) while the NASCO is operating the local mini-hydropower in

the Jos Highland with the construction of nine small-scale water storages. General observation indicates that the hydropower generation as mentioned above is well-functioning inspite of the obsolescence of equipment.
The water storage dams for irrigation and water supply have been constructed throughout the country. In the Northern Region, there are many large-scale dams constructed since the onset of sahelian drought which occupy their active reservoir capacity of 7.7×10^9 cu.m or 63 percent of the nations total for these objectives. The central and South West Regions have in general many medium and small scale dams with some large scale ones, while there are only small-scale dams with the function close to diversion dams in the South East Region. It may be noted that the current water use rate of these existing reservoirs is quite low at 10 to 20 percent in general because the downstream facilities for conveyance and distribution have been in slow progress for construction mainly due to the lack of reservoir water operations rule (Akanmu et al, 2006).

6.1 Water supply

Water supply schemes in major cities were started in 1911 by the colonial administration with key role that the improved water supply could play in the elimination and control of common diseases and in the raising of health level and general welfare of people. By 1970, there were 261 (two hundred and sixty-one) urban water supply undertakings. Since early 1970s, the governments have invested heavily in urban water supply schemes including the reservoir construction and borehole sinking for state capitals. At this stage, it may be understood that inadequate water supply remains one of the major problems in urban centers in fact, the supply of improved water can be said to be adequate in none of them. (Akanmu et al, 2006).

Until recently, virtually all the states gave a relatively low priority to water in their rural development efforts, and in many areas, the rural people regards water more in terms of convenience than of health benefits. Many tubewells were sunk in the Northern region in the 1940's to early 1960's without active involvement of the local people thus, the people were not made to accept to take care of them. With the establishment of the RBDAs in 1976 and DFRRI in 1986, a new era opened in the provision of rural water supply, and a great number of boreholes have been sunk in various parts of the country, because of inadequate supply, technical problems and people ignorance, many of the rural communities served in this way have not derived the maximum benefits.

Currently separate water supply considerations have been made for three socio-economic profiles of the population – Urban (more than 20,000), semi-urban (5,000 to 20,000) and rural (less than 5,000) according to the access and extent of such amenities as electricity, water pipes and paved road. Urban systems typically use surface water and groundwater source with the piped system, house connection and yard taps, in which the surface sources require treatment plants. Semi-urban supply is mainly based on the use of mechanized deep well schemes with piping to yard taps and public standpipes. Rural water supply generally includes the use of hand-pump equipped boreholes and wells.

VII. Conclusions and Recommendation

Securing safe, reliable, reasonably priced water and sanitation services for all is one of the leading challenges facing sustainable development. There is widespread concern that poor water management will be one of the major factors limiting sustainable development during the next few decades. The centerpiece of Nigeria's water supply and sanitation policy shall be the provision of sufficient potable water to all Nigerians in an affordable and sustainable way through participatory investment by the three tiers of government, the private sector and the beneficiary.

7.1. Target

i) The initial target is to meet the national economic target of improving service coverage from 50% to 80% by the year 2019.
ii) Extension of service coverage to 100% of the population in the year 2020
iii) Sustain 100% full coverage of water supply services for the growing population beyond the year 2020.

7.2. Consumption Standard

Separate water supply and sanitation considerations are made to match the three socioeconomic profiles of the population as follows:

Rural water supply guaranteed minimum level of service of 30 liters per capita per day within 250 meters of the community of 150 to 5,000 people serving about 250-500 persons per water point.

Semi-urban (small towns) water supply represent settlements with population of between 5,000-20,000 with a fair measure of social infrastructure and some level of economic activity with minimum supply standard of 60

liters per capital per day with reticulation and limited of full house connections as determined by the beneficiaries/government.

Urban water supply120 liters per capital per day for urban areas with populations greater than 20,000 inhabitants to be served by full reticulation and consumer premises connection.

7.3. Components of the Policy Objectives

The elements of the policy objectives include but are not limited to the following.

i. Increase service coverage for water supply nationwide to meet the level of socio-economic demand of the nation in the sector.
ii. Ensure good water quality standards are maintained by water supply undertakings.
iii. Ensure affordability of water supply services for the citizens.
iv. Guarantee affordable access for the poor or basic human need level of water supply and services.
v. Enhance national capacity in the operation and management of water supply undertaking.
vi. Privatize water supply and services (where feasible) with adequate protection for the poor.
vii. Monitor the performance of the sector for sound policy adjustment and development for water supply through good legislations, regulation and standard enforcements.
viii. Reform of the water supply sector to attain and maintain internationally acceptable standards.

Lastly, it is also recommended that the new integrated approach requires greater knowledge and understanding of the Indigenous technology, social, economic and ecological dimensions of water resource management and how they are inter-related.

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