WATER SUPPLY MANAGEMENT POLICY IN NIGERIA: CHALLENGES IN THE WETLAND AREA OF NIGER DELTA

Kevin Ejike Chukwu, PhD
Department Of Geography & Meteorology, Faculty Of Environmental Management, Enugu State University Of Science And Technology, Agbani, Enugu State, Nigeria

Abstract

The Niger Delta wetland is currently facing serious challenges of sustainable water supply management. Despite the availability of water, the region has been struggling with acute potable water shortage due to ineffective water supply management culture. To combat water shortage various governments within the region have set up water corporations to manage this important resource. This paper examines the widening gap between water need and supply in the wetland despite continuous efforts made to develop the regions' vast surface and groundwater resources. The study employed the review of literature on water supply management policy documents and other works so as to understand the challenges of water supply management in the wetland. The paper revealed that the challenges facing sustainable water supply management in the Niger delta wetland include lack of effective compliance to policies, fragmented responsibility, poor state of infrastructure, corruption, and low rate of costs recovery. In order to ameliorate these challenges, the researcher recommends the need to comply with water management policies that aim at economic efficiency, encourage stakeholder participation, and enforce existing laws and regulatory responsibilities**.**

Keywords: Challenges, Water Supply, Management policy Reform, Niger Delta, Wetlands

Introduction

Water is a finite resource that is very essential for human existence, agriculture and industry. Without doubt, inadequate quantity and quality of water supply have serious impact on water resources management and environmental sustainability. Problem of this nature have been increasing in scope, frequency, and severity because the demand for water continues to

increase while supply of renewable water remain fixed (Okoye, 2015). In Nigeria the primary responsibilities for water resources development are vested on government agencies including the Federal Ministry of Water Resources, State Water Agencies and non government agencies such as UNICEF. Other government agencies not directly concerned with water resources development but carry out water resources developments include the Federal and State Ministries of Agricultures and Environment. These agencies and private individuals carry out water resources development projects in an uncoordinated manner with each not taking into considerations the activities of the other. In most cases quality control and assurances were downplayed with emphasis on number of communities covered rather than water supply system efficiency. Water Schemes sustainability involving ownership, operation and maintenance structure are not properly addressed in planning. Consequently water supply projects benefits are short lived. Despite billions of dollar invested in water projects, supply is falling behind the demand of a growing population and development of new sources of water is increasingly becoming capital intensive. (Okoye, 2015)

Cities exhibit intensive water shortages since the oil boom of the 1970s. The situation in the cities of the Niger Delta wetland is like any other across the country, and sometimes worse because of heavy pollution of its water sources due to oil exploration. For example Niger Delta Environmental Survey (NDES) (2000) covering the region found out that most settlements depend on untreated surface water and wells, which result in health problems. In a related study of the NDES (2004), it was found that the available quantity of water to residents which was less than 10 litres per person per day in 1994 had reduced to 5.5 litres per person per day in 2000. This shows that as the population increases there is a dramatic reduction in the quality and quantity of water available to the residents. To increase safe water supply especially domestic in the country, the Federal government enacted a water policy in 2000 for the purpose of meeting the national economic target of improving from 40% in 2000 to 60% by the year 2003, expansion of service coverage to 80% of the population by 2007 and by 2011, 100% sustaining coverage. The supply was to ensure good quality, affordability, free access for all and to monitor the performance of the sector for sound policy adjustment and development of sustainable water supply and sanitation (NWSP 2000). Unfortunately, very few workers have directed research efforts towards assessing the obstacles to sustainable water supply need and management in the paradoxically difficult geographical wetland region of Niger Delta with acute shortage of potable water supply. This research problem informs the need for the present work

Aim and objectives

Based on this research problem the National water Supply policy (2000), this paper is aimed at analyzing the water supply management policy in Nigeria. Specifically, the objectives of the paper are designed to

i) Examine water supply management and reform in Nigeria

ii) Assess the challenges of sustainable water supply management in the Niger Delta wetland region of Nigeria

iii) Examine the appropriate strategies which should be directed to achieve truly sustainable supply management system in the Niger Delta wetland

The achievement of these objectives will enable us explore suitable recommendation to improve the situation

Literature review

There are various degrees of water shortage/scarcity and these could be absolute, life threatening, seasonal, temporary, and cyclical. Water shortage is a situation of absolute shortfall between available water and defined minimum requirements (Bhatia, 2009; Okoye, 2015). On the other hand water security is a condition where people have reliable and adequate access to good quality water to meet the full range of their needs and are able to take advantage of the opportunities that water resources present. They are protected from water related hazards and have fair recourse where conflicts over water arise. From a regional planning perspective, water shortage is often explained in terms of urban morphology. UN Habitat (2003) stressed that water is one of the ecological foot print of a city. Its production, distribution and management often affect and are affected by the settlement forms and structures, which are manifested in the illegality and informality of urban neighborhoods. Urban locations which are densely populated and inaccessible are definitely without water service networks and are mostly inhabited by the poor. This makes the urban slum dwellers to be mostly affected by water shortage. The importance of water and its effective management cannot be overemphasized. Inadequate water supply and poor water quality give rise to health and other societal issues, limit agricultural productivity and economic prosperity, and pose national security risk. In order to effectively harness and manage water, there is need to adopt sustainable measures and one of these measures is cost recovery (Adah and Abok, 2013). Treating water as an economic good enhances financial viability, by ensuring that tariffs cover the costs of investments and operation and maintenance. FRN (2000) observed that Universal and sustainable provision of water supply services is possible only if water is recognized as an economic good, subject to the relation of supply and demand. Thus people's demand for water is a function of the price of water. Their

willingness to pay for water is influenced by the level of service they desire and the quality of the service they receive. The management of water and other natural resources is too often subject to poor governance, which contributes to insufficient and polluted water and threatens the health and livelihood of millions of people. These problems are particularly acute in poorer countries, in which people are mostly dependent on their national resource base. Water management is highly complex and extremely political. Therefore, balancing competing interests over water allocation and managing water scarcity requires strong institutional approach.

Based on the available evidence, a number of gaps exist in the area of water resource management and environmental sustainability in the Niger Delta wetlands of Nigeria from the regional planning perspective. With the exception of a few studies on the role of physical planning (Ekong, Jacob, Ebong 2012), there has been essentially no work on water governance in the region and the physical planning implications. The study employed various methodological approaches. Data on historical and traditional water management strategies were obtained from the national Archives and other water related public agencies. A household survey Questionnaire was structured to collect information on socio-economic characteristics of the respondents, availability and affordability of potable water. The research result showed that majority of the people (85.7%) do not have access to good drinking source as only 14.3% get their water from tap which is the only seemingly treated sources. This is consistent with the National Bureau of statistics that water in the majority of the Niger Delta States come from unsafe supply facilities, including streams, rivers, ponds, unprotected wells, boreholes and vendor trucks. Findings also showed a wide income disparity in the region; and households with higher income spend less daily on water. This is because that category of households lives in the government estates where pipe borne water is served at far cheaper rates. Water supply imbalances were observed in the study area and the challenge of meeting the shortfall is becoming endemic.

This paper specifically examines Nigeria's water management policies and reforms; the challenges in the Niger Delta wetland and strategies adopted over the years towards optimal exploitation and utilization. The environmental implications of water supply are also examined taking into specific account the link to sustainable development. Against this background, the problems militating against effective management of the wetland's water supply are highlighted. The ultimate objective is to identify a number of critical factors, which must be taken into account in physical planning and designing appropriate strategies for sustainable utilization of its water resources. It explores the holistic management approach to sustainable

water supply through the principles of Integrated Water Resources Management (IWRM).

Conceptual issues

The essence of a holistic approach to water supply management adopted in this study is to ensure that all the relevant components and factors are considered in the totality of their effect on the whole process in order to achieve the sustenance goal of the system. The concept of water supply system is made up of three main components that are one-way directional and serially complementary in significance and criticality (Bhatia, 2009; Okoye, 2015). They are intrinsically linked through design, function, and performance. These are the source, treatment and transmission/distribution.

There are two broad categories of water sources; surface and underground sources.

i). Surface Water: This is water that is abstracted directly from streams, rivers and lakes. These sources generally contain larger quantities of turbidity and bacteria than groundwater and often the surface waters of rivers and lakes are polluted by the influx of sewage or industrial wastes. In an article from Encyclopaedia of Earth, the Niger Delta Basin was identified as the principal surface water basin in the Delta region which covers an area of 584,193 km^2.

ii). Groundwater: Groundwater is water obtained from wells and springs that feed streams, rivers, and lakes. In its course, groundwater dissolves soluble mineral matter. The ultimate source of all natural potable water on earth is rainfall. Groundwater contains high concentrations of dissolved chemicals. Nigeria has extensive groundwater resources, located in various hydrogeological areas together with local groundwater in shallow alluvial (Fadama) aquifers adjacent to major rivers (Okoye,2015).

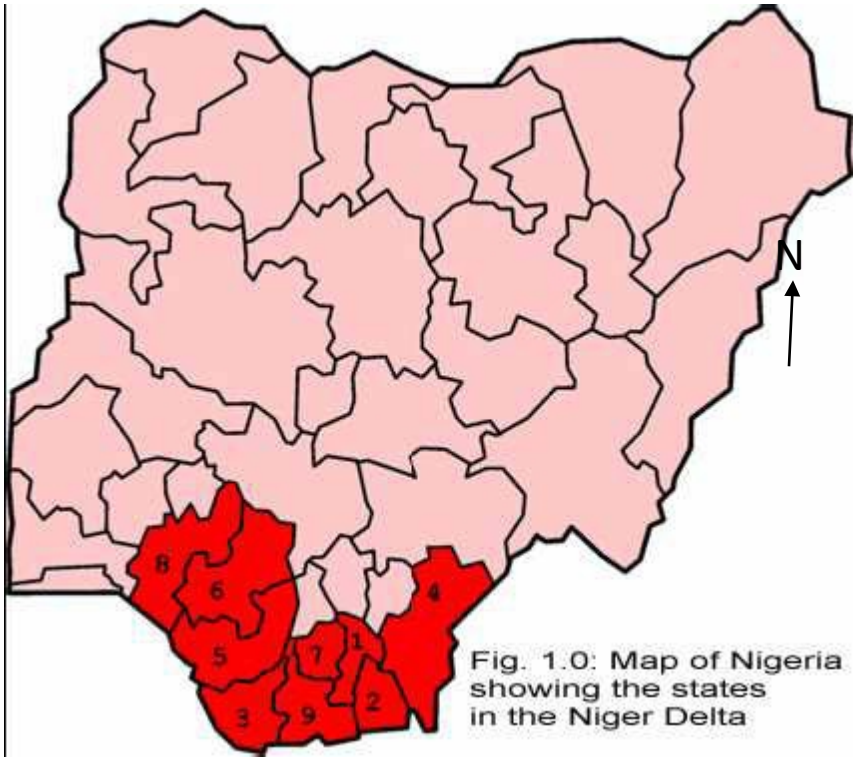
Research area and methodology

The study area

The study is conducted in the Niger Delta Region (NDR), Nigeria. Located on the Atlantic coast of southern Nigeria, the Niger Delta lies within the lower reaches of the Niger River, extending between latitudes 4^0 and 7^0N and longitudes 3^0 and 9^0E within the semi-equatorial region of the tropics. The average monthly temperature of the region is 27°C, and an annual rainfall ranging from 3000 to 4500 mm. There are two distinct seasons with the wet season occurring from July to September and the short dry season from December to February (World Bank, 1995). The Niger Delta is made up of nine states, having 185 local government areas and home to some 30 million people, approximately 22% of the country's population (2006 census). It is mostly rural (difficult terrain) with an urbanization index of

6.28%, the least in the country. The Delta is among the 10 largest in the world, with a coastline of about 450 km which ends at Imo river entrance. The region encompasses an area of 20,000 km2 and is the largest delta in Africa and the world's third largest (Uluocha and Okeke, 2004). Over the decades, water discharges, sediment deposits and other loads across Southern Nigeria and beyond into the Atlantic Ocean has resulted in the formation of a complex and fragile Delta, abundant in biodiversity. About 2,370 km^2 of the Niger Delta area consists of rivers, creeks, estuaries and stagnant swamps. Approximately 50% of the Delta is covered with water accounting for 55% of all freshwater swamps in Nigeria (Ikelegbe, 2006). The Delta mangrove swamp spans about 1900 km^2 as the largest mangrove swamp in Africa and about one third of the Delta consists of wetlands. This system of wetlands was formed by the accumulation of sedimentary deposits, transported by rivers Benue and Niger (World Bank,1995) and is considered one of the 10 most important wetlands and marine ecosystems in the world (Uluocha *et al*, 2004). This region contains an array of characteristic ecological zones comprising seasonal rainforests, sandy coastal ridge, fresh water swamp forests and saline mangroves. It is considered the richest wetland in the world in terms of biodiversity (Ebeku, 2004). Since this region is very wide to cover effectively especially with limited time and resources, the present study covers Bayelsa, Rivers, Akwa Ibom and Cross River states.

The region is virtually surrounded by water with the Atlantic Ocean flanking the South, Cameroun River to the east and Benin River to the west. As coastal states, they are characterized by many streams and creeks which are heavily polluted (Ekong, 2005). This scenario has created an illusion of abundance of water for domestic uses and thus eclipsed the reality that adequate fresh water is an increasingly scarce commodity in the region. Investigation has shown that rivers/streams, the major source of domestic water supply in the rural areas are drying up. In the urban areas, potable water scarcity has led to desperate and indiscriminate underground water extraction through borehole drilling. Beside long queues at commercial borehole points and trekking of long distances, water from this boreholes are not safe as most of them are not treated. This, as reported by Bassey (2003), leads to increased wave of waterborne diseases in the region. Consequently, the government of the various states in the region in their effort to rescue the situation has invested heavily on their water corporations since early 1990s.



Nigeria numerically showing Niger Delta States, (1) Abia; (2) Akwa Ibom; (3) Bayelsa; (4) Cross River; (5) Delta; (6) Edo; (7) Imo; (8) Ondo ; (9) Rivers.

Table 1: Projected Population of the Region

States	Land Area	Male	Female	2006	2010	2015	2020
Abia	4,877	1,434,193	1,399,806	2,838,999	2,839,262	2,842,475	2,845,688
Akwa Ibom	6,806	2,044,510	1,875,698	3,920,208	3,920,417	3,925,684	3,928,897
Bayelsa	11,007	902,648	800,710	1,703,358	1,703,621	1,706,834	1,710,047
Cross River	21,930	1,492,465	1,396,501	2,888,966	2,889,229	2,892,442	2,895,655
Delta	17,163	2,074, 306	2,024,085	4,098,397	4,098,660	4,101,873	4,105,086
Edo	19,698	1,640,461	1,577,871	3,218,595	3,218,595	3,221,808	3,225,021
Imo	5,165	2,032,286	1,902,613	3,934,899	3,935,162	3,935,162	3,941,588
Rivers	10,378	2,710,665	2,474,735	5,185,400	5,185,663	5,188,876	5,192,089
Ondo	15,086	1,761,263	1,679,761	3,441,024	3,441,287	3,441,287	3,444,500

Source: Projected from NPC, 2006

Sources of data and materials

In achieving the set target for this paper, secondary sources of data were used. These include the use of library and review of literature on water resources management policy documents and other theoretical works so as to

understand the challenges of water supply management in the Niger Delta areas of Nigeria. Some of the relevant data were sourced from Federal Ministry of Agriculture and Water Resources (FMAWR), Niger Delta Development Commission (NDDC), Federal Ministry of Niger Delta (FMND), Niger Delta Basin Development Authority (NDBDA), UN-Habitat publications, and Water Aid. Data on historical and traditional water management strategies were obtained from the national Archives and other water related public agencies. Information on water shortage and other water crisis issues were obtained from literature. The statistics from these sources formed core sources of statistical information.

Discussion of research findings

Water supply management policies in nigeria

The Federal Ministry of Water Resources (FMWR) is the main national coordinating body in the water sector. Water resource management is a complex function which includes regulatory, support and operational activities. The responsibilities for water resources development in Nigeria are vested on government agencies including the Federal Ministry of Water Resources, State Water Agencies and non-governmental or donor agencies such as CBO, NGO, UNDP, UNEP, Water AID, EU, World Bank and UNICEF (Emoabino and Alayande, 2007). Other government agencies not directly concerned with water resource development but carry out water resource developments include the Federal and State Ministries of Agricultures and Environment.

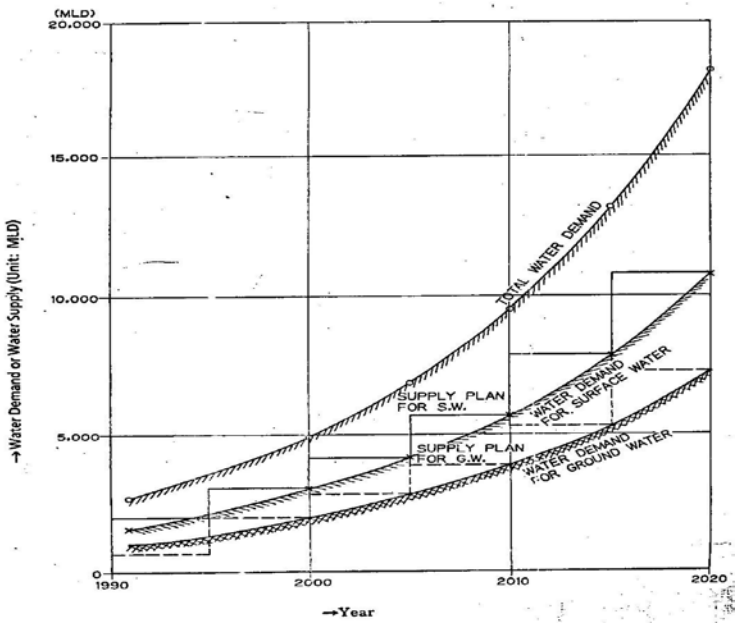


Fig 2 Demand-Supply plan for urban water supply (Source: Okoye, 2015)

Table 2: Share of Federal Capital budget allocated to water supply (1991 – 2002)

Year	***Allocation to water supply(N million)***	***As percentage of annual federal budget***
1991	83.8	0.02
1992	71.7	0.01
1993	63.6	0.12
1994	197.5	0.6
1995	2,579.4	2.1
1996	2,195.1	14.9
1997	2,786.2	1.5
1998	3,843.4	1.5
1999	N.A	N.A
2000	14,318	2.2
2001	64,761	7.2
2002	30,200	3.3

Source: Central Bank of Nigeria, *Annual Report and Statement of Accounts*, Several Issues.

The traditional institutional separation of surface water from groundwater has created fundamental communication barriers that extend from technical expertise to policy developers, operational managers and water users. These barriers impede the understanding of the processes and consequences of groundwater-surface water interaction. Considering the nation's River Basins and their associated Groundwater Basins, the disproportionate management of surface water resources without the groundwater counterpart has contributed significantly to unsustainable and inadequate water supply.

Water Policy Reform in Nigeria

The World Bank has been providing assistance to Nigeria in the water supply sector since 1979. The first generation of assistance was directed at investments and strengthening institutions at the state level, especially since urban water supply is constitutionally a responsibility under Nigeria's constitution. Amengo-Etego and Grusky (2005) (in Emoabino and Alayande 2007) pointed out that the States that benefited from the World Bank Water projects are 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 and 2005 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).

National Water Supply and Sanitation Policy of 2000

This policy spelt out the Institutional Framework for Water Supply and Development thus;

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.

The River Basin Development Authorities (RBDAs): This came into existence following the promulgation of Decree 25 of 1976. The current law on RBDAs is the RBDA Act; cap 396 Laws of the Federation of Nigeria, 1990. The authorities are charged with the development, operation and management of reservoirs for the supply of bulk water for water supply amongst other uses in their areas of jurisdiction.

The National Water Resources Institute: It is be responsible for manpower training, research, development and studies under the National Water Supply Training Network in the water supply sector.

The State Water Agencies: These agencies are responsible mainly for urban, semi urban and rural water supplies. In some States separate agencies exist for rural water supplies and urban and semi-urban water supplies.

The Local Government Authorities: Are responsible for the provision of potable water to rural communities.

The National Water Policy (NWP) Document of 2004

Water abstraction for public water supply is guided by the National Water Policy. In other to meet Nigeria's water supply demand, the policy objectives had been drawn and the guiding principles for implementation. The formulation of the water resources policy was guided by; The Millennium Development Goals (MDGs), NEPAD Objectives and the resolutions of various conferences, conventions and meetings based on the International trends and agreements in water Policy. The International trends and agreements in water policy highlighted the fact that water management

and development should be conducted on a participatory basis with decision making occurring at the lowest appropriate level.

The challenges of sustainable water supply management in the niger delta wetland

Water Supply Status in the wetland

There is an acute shortfall supply of water to a significant number of people in the region inspite of the general recognition of the importance of water. Table 4 shows water supply imbalances in the area of study and the challenge of meeting this shortfall which is becoming endemic. For example, the available quantity of water to household in the region dropped from 119,846 in 2002 to 94,435.8 in 2006 (Table 9). Daily water consumption per household is less than 100 litres of water per day. If this is divided by the National average household size of 5 persons, it shows daily intake of 20 litres per capita. This is extremely low when compared with the WHO standard of 120 litres per capita per day. This is consistent with the NDES reports in 2004 that more than half of the urban population in the region does not have access to enough potable water (Ekong et al 2012).

The Niger Delta wetland like most areas in Nigeria is faced with numerous water management challenges. These challenges in urban and rural water management are ample and are threatening the sustainability of the water system as a significant fraction of the population has no access to proper (good) water supply. These include among others the following:

a. 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.

b. Challenges of Cost Recovery and Social Equity: Cost recovery for water has been a major challenge in water management in the Niger Delta. More than half of the regions' growing population does not have access to water and sanitation services. Inequitable access often means that poorer people pay more for water. Bulk of available water supply is unmetered while ridiculous rates are charged for the unmetered users. For instance about N400 is charged for a compound or tenement house while about N600 is charged for a flat. Twenty litres of water costs as much as 19.23cents per litre in urban centres. 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. This is a common scenario across the nation thereby imposing extra cost burden on government that continually invest more funds in water supply projects principally to satisfy political allegiance rather than developing the people's capacity for proper management systems.

c. Lack of Community Participation: Community participation in water management in the region is barely absent except in the areas of the provision of private alternative sources such as wells and boreholes. The resulting effect of this practice leads the poor paying more for water as they have to depend upon water vendors who sell water at higher prices.

d. Rapid Rate of Urbanization and Environmental Sustainability: Niger Delta urban centres (which includes Port Harcourt and Warri) are among the most populated cities in the Country with its present estimated population put at about 9,283,791 (Wikipedia, the free encyclopaedia, 2010). The population is currently on the increase due to the demand for the rich natural resources of the wetland. The sustainability of its water resources is threatened both in terms of quantity and quality. Rivers are the major transporters of domestic and industrial wastes generated which are discharged into them untreated. Also there are problems of saltwater encroachment and oil spillage during exploitation and transportation of crude oil; which pollute most surface and underground water bodies. Such pollutants are increasingly accumulating in reservoirs created downstream for water supply. Unless the current patterns are changed, future per capita investment on water treatment will significantly continue to be on the increase thereby outweighing investment in other productive sectors of its economy. Less pollution and effective wastewater treatment will reduce the environmental impacts on the functionality of the wetland's ecosystem.

e. Lack of Maintenance Culture and End Use Inefficiency: It not uncommon to see broken water pipes without any efforts made by the residents or the authority concern; to repair or replaces such pipes. This phenomenon leads to water wastage as well as water contamination hence detrimental to health and economy as well. For instance more than 60% of water supply to high density areas is wasted through badly maintained service pipes and plumbing facilities in homes. More importantly, because over 90% of supplies are currently not metered, people developed very poor attitude to the use of water, and tend to waste more with no conservational attitude. A lot more water can be saved through end use efficiency through application of smart technologies and metering. Water saving strategies and technologies can be adopted in all economic sectors to achieve end use efficiency.

f. 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.

g. 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.

h. 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.

i. Climate Change Mitigation: In circle of blue.org news (2010), it was reported that 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.

j. 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).

k. 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.

Way forward for sustainable water supply management (wsm)

Having understood that water supply management in Niger Delta wetland is facing serious challenges due to numerous factors, it is therefore important to develop good approaches, so that policy development and planning are directed towards addressing these global change pressures, and to achieving truly sustainable water supply systems. The following are therefore some of the strategies considered to achieve this.

i). **Sensitization Campaign/Effective Data and Information Management:** Creating awareness and improving people's understanding of Water Resource Management (WRM) is the first step towards implementation of WSM in Niger Delta wetland. The collection and analysis of data and the circulation of information is needed for different kinds of assessment, preparation of plans, construction and operation of projects. In addition, data are required for decision making and for taking appropriate interventional measures regarding management, allocation and development of water resources. An effective integrated water resource management system must be able to provide timely and correct information on the quantity, quality and resource use. All stakeholders should be made to see themselves as working towards the same goals and be ready to share information.

ii). **Manpower Development and Capacity Building:**

The roles of the institutions and their capacities to effectively promote and implement WSM needs to be urgently understood. The technical and management skills required at the different levels of stakeholders must also be identified, and their capacities developed in a more integrated manner to cope with the challenges. Thus for integrated water resources management to be successful and to implement sustainable and participatory water management strategies, capacity will have to be built in user groups as well as at a technical level. Women and youths should also be well represented in professional and managerial positions.

iii). **Development of Institutional and Legal Regulatory Framework:**

The Water Decree 101 of 1993 is the principal legislation governing the utilization and pollution control of the water resources. This legislation does not adequately meet present and emerging water resources management challenges and the requirement emerging from this water policy. A central issue is definition of access to water resources through permits, the establishment of water protection zones and the fees related to raw water abstraction and fines for water misuse and pollution. This is to respect the "user–pays" principle. Access and the application of royalties for water abstraction will not be applied in a general manner but limited to the commercial use of water resources only. The conservative capability of existing end-use technologies for water services does not conform to the

principles of best practices. Prepaid water meters should be a precondition for prequalification for water service to consumers and punitive measures should be in place to deal with illegal water connections and vandalisation of water installations. The regulatory framework will require the regulator to apply a wide variety of tools and employ a degree of selectivity in jurisdiction and responsibilities. How the regulator meets the above responsibilities is through the application of various tools, best illustrated as regulatory inputs and outputs as in figure 3.

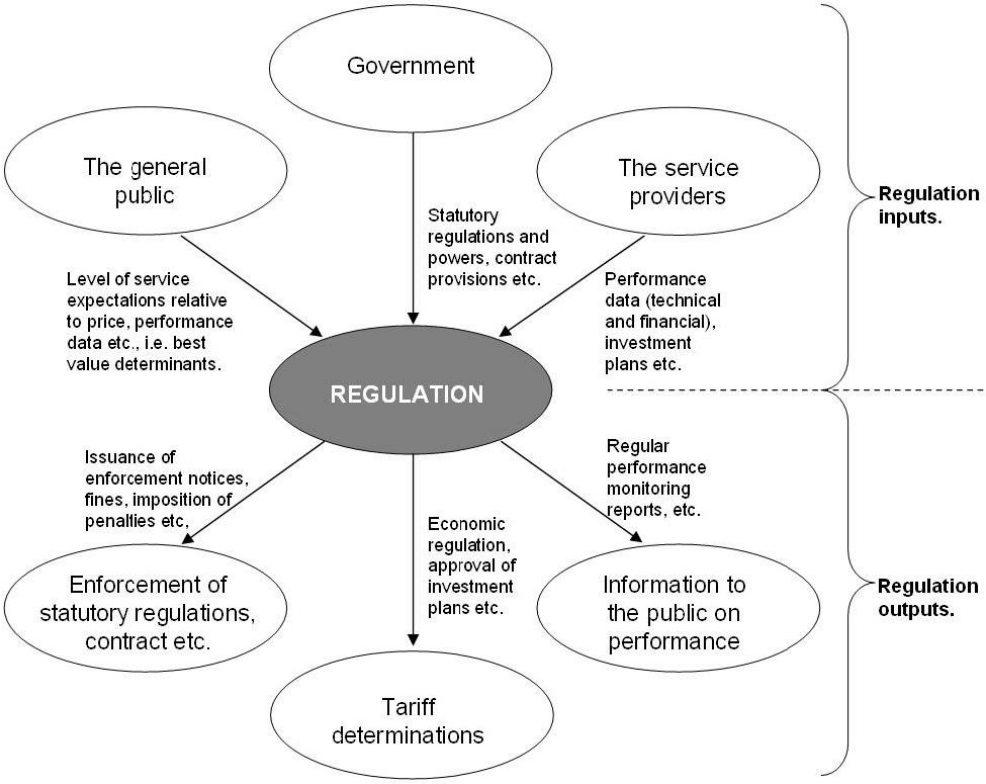


Fig. 3 Regulation inputs and outputs
Source: Adapted from FGN, FMWR National Urban Water Sector Reform Project (2006)

iv). **System Surveillance/ Monitoring and Evaluation of Water Projects:**

Water agencies should adequately be funded to automate their network surveillance for rapid response to system failures. The Geographic Information System technologies will enhance the capacity of the agencies to cope with these challenges and should be pursued with vigor. Monitoring is necessary for the protection of the quality of raw water sources as well as the output conformity with drinking water quality standards. Improvement of water service delivery requires that activities are continuously monitored and evaluated to guarantee a timely execution of projects and to ensure their

sustainability. Also Continuous monitoring and testing of the water before it reaches the tap is required. This is to improve on the envisaged impact of the project. Where feasible; participatory monitoring and evaluation will be carried out with support from the government levels, NGOs, and the Private Sector.

v). **Political Will and Holistically Managed Ecosystems:**

The government should demonstrate as a matter of urgency the political will to declassify water supply as a "free service" in their political manifestoes but as a "user pay service". The public should realize that qualitative water service is capital intensive and cannot be rendered as a free service. Simply put, holistic management applies to a practical, common-sense approach to overseeing natural resources that take into account economic, cultural, and ecological goals. In essence, the whole is greater than the sum of its parts, and each facet is related to and influences the others.

vi). **Current International Approaches in Water Management should be adopted:**

The `Dublin Statement' (International Conference on Water and the Environment, 1992) and the `Agenda 21' (UN Department for Sustainable Development, 1992) unfold a vision about how water resources are best managed, to serve the people, without damaging the environment. The `Dublin Statement' principle addresses the issue of water management from a river basin perspective. The principles of the `Dublin Statement' are: Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. Management of water resources requires linking social and economic development with environmental protection, within the river basin or catchment area. Water development and management should be based on a participatory approach, involving users, planners and policymakers at all levels. Decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in planning and implementation. Institutional arrangements should reflect the role of women in water provision and protection.

vii). **Urban Water Project Finance and Cost Sharing/Recovering Measures:**

Water services can be delivered through public, private or community based institutions. Water pricing for these services is a substantial aspect underpinning the understanding of water as an economic good. Cost recovery of these services is necessary to ensure their long-term utilization. All consumers should be appropriately metered for effective cost recovery starting with Industrial and commercial consumers to communal outlets down to domestic consumers. However a careful application of cross-subsidies among users and cost-sharing between users and government shall

be applied to protect the poor. It is, however, of imperative importance to know the total costs of each service in order to allow the application of these tools and to find out the most cost-effective investments.

viii). **Private Sector Participation (PSP) in Urban Water Management:**

The private sector (operators, commercial banks, and consultants), communities, as well as NGOs have a critical role to play in the planning, design, financing, implementation and operation of water management system. Their potential for additional finance and technical expertise should be tapped. Other benefits inherent in participation are greater transparency, efficiency, accountability to the consumer, and self-sufficiency. This is also in line with good governance principles that decision-making should involve participation of all stakeholders, especially the consumers and providers of services. Furthermore the local community needs to fully participate; this is because conventional wisdom is that without community participation; there is little likelihood of sustainability being realized. This is in part a pragmatic recognition of Governments' inability to deliver services, but in part an ideological proposition which values concepts such as 'empowerment', and 'capacity building' for their own sake. Even from a strictly practical approach, a number of the issues mentioned earlier illustrate the need for capacity building at the community level as well as at the level of Government or NGO. (Ademiluyi, and Odugbesan, 2009).

ix). **Optimization of Water Resource/Improvement of Management and Maintenance Practices:**

The use of the storage, transport and treatment capacity of existing urban infrastructure for water resource management can be optimized in many cases. Optimization of urban water systems aims at finding the technical, environmental and financial best solution, considering and balancing measures in the sewage system, the wastewater treatment plant and the surface water system at the same time. Financial management, operation and maintenance, abstraction and treatment techniques and control of water sources pollution should be taken seriously.

x). **Economic/End Use Efficiency:**

Economic efficiency is a key objective of water demand management and needs to be viewed from the broader perspectives of the society. End use efficiency means doing more in economic terms with less water. Water saving strategies and technologies can be adopted in all economic sectors to achieve end use efficiency. A lot more water can be saved through end use efficiency through application of smart technologies and metering.

xi). **Environmental Sustainability and Improvement of Catchment Area:**

The sustainability of the nation's water resources is threatened both in terms of quantity and quality. Rivers are the major transporters of domestic and industrial wastes generated which are discharged into them

untreated. Such wastes are increasingly accumulated in reservoirs created downstream for water supply. Improving the water catchment systems is essential for areas with no other reliable water sources. This is already been practiced in Pakistan and India; two countries that contend with some of the worst effects of climate change are overhauling rainwater harvesting systems.

Conclusion

The importance of water and its effective management cannot be overemphasized.Well-designed and operated rural and urban water systems are critically important for maintaining public health as well as for controlling the quality of the water. In order to effectively harness and manage water, there is need to adopt sustainable measures and one of these measures is cost recovery. FRN (2000) observed that Universal and sustainable provision of water supply services is possible only if water is recognized as an economic good, subject to the relation of supply and demand. Water has been considered a social good (Agbola, 2003) but not as an economic commodity thus the fully centralization of water governance. If water allocations are optimized by benefit and cost recovery, the corporations will break even and will be able to expand their services. The case whereby, for the almost 20 years of their existence, the Water Corporations have not been able to supply water to half of the urban population should not be overlooked. The role of the physical planning authority is therefore to provide distribution network plan for all the corporations in line with the urban plan. The major argument advanced by the author is that because of the intricate linkage between water resources and environmental sustainability which is crucial to enhancing the quality of life of the poor in particular, there is need to frame water resources management strategies within the context of sustainable development principles. Essentially, the management of water resources in the country has been almost an exclusive responsibility of government. Water governance in the region as in other part of the country is central. There is a common agreement that fully centralized governance systems are mostly inefficient because of high transaction costs, financial constraints and lack of human development. The different intervention institutions depend on the states to function and cannot define their own policies and procedures having no financial autonomy from the state budget. By and large, the proportion of the wetland population with access to safe water and sanitation is relatively low, while the area of land under irrigation since the 1990s has remained virtually constant. The time has therefore come to seek the co-operation of all the relevant stakeholders, including NGOs, the private sector and community-based organizations (CBOs) in a co-ordinated manner towards sustainable

exploitation of the wetland's water resources. The present governance structure should be decentralized and good governance introduced as a vital component of actions to improve environmental sustainability.

Recommendations

As underground and surface water are physically interlinked; the author calls for holistic management approach to sustainable water supply in which groundwater component would be substantial. Ground water deserves serious attention in the Niger Delta. This is because there are no alternative sources of water supply in many parts of the wetland. This is particularly the case in those areas where estuaries penetrate very far inland, leaving many places surrounded by saline creeks and inlets. There is still greater opportunity that the integrated development of groundwater and surface water resource would exploit the many positive attributes which include greater water conservation, smaller surface storage, smaller surface distribution system, and increased reliability of water supply. Therefore the duplication and fragmentation of several policies and legal frameworks will fail to utilize the huge and sustainable groundwater resources for healthcare delivery, environmental harmony and socio-economic progress of the country. The paper suggests paradigm shift toward long term sustainable strategies through the principles of Integrated Water Resources Management (IWRM) to be implemented at River Basin Development Authorities (RBDAs) levels. The panacea to challenges in sustainable water supply lie entirely in ensuring that the groundwater component of IWRM is boldly spelt out within legislative framework to address sustainable approaches, encapsulate professionalism, data bank management, quality control monitoring, benchmarking, and regulation. Therefore, the nation's 3-tier government, intergovernmental organization and NGOs should focus on long term sustainability strategies of water supply through conjunctive water usage and regular operational assessment within the context of the nation's IWRM.

References:

Adah, P.D. and Abok G. (2013). Challenges of Urban Water Management in Nigeria: The Way Forward, *J. of Environmental Sciences and Resource Management, Vol.5, No.1; 111-121.*

Ademiluyi and Odugbesan (2009). Sustainability and Impact of Community Water Supply and Sanitation Programmes in Nigeria: An Overview. *African Journal of Agricultural Research* Vol. 3 (12).

Agbola, T (2003). Water supply and protection of urban watershed, *A Paper Presented at the 20th WEDC International Conference towards the*

Millennium Development Goals, Action for Water and Environmental Sanitation, Abuja, October 4,

Amengo-Etego, R. and S. Grusky (2005). 'The New Face of Conditionalities: The World Bank and Water Privatization in Ghana' in D. McDonald and G. Ruiters (eds.) *The Age of Commodity: Water Privatization in Southern Africa*, London & Sterling, VA: Earth Scan; 275-290.

Bassey S.A, (2003) The politics of safe water delivery in Nigeria, *A Paper Presented at the Environmental Parliament Programme held in Uyo*, Nigeria, (2003).

Bhatia S.C. (2009). *Environmental pollution and control in chemical process industries* Khanna Pub. Delhi

Ebeku KSA (2004). Biodiversity conservation in Nigeria: An appraisal of the legal regime in relation to the Niger Delta area of the country. *Journal of Environmental Law*. 16:361-375.

Ekong, F. (2005). Planning and Management of the coastal areas of South Eastern Nigeria, *Unpublished Ph.D Thesis submitted to the Department of Urban and Regional Planning*, Enugu State University of Science and Technology, Nigeria.

Ekong, F., Jacob, A. and Ebong, S. (2012). Water Resource Management in the Niger Delta Region of Nigeria: The Role of Physical Planning, *J. of International Review of Social Sciences and Humanities, .3, (1); 56-61.*

Emoabino .I.U. & Alayande A. W. (2007). Water Demand Management, Problems and Prospects of Implementations in Nigeria Being Paper Presented at National Water Resources Institute, Kaduna, and Nigeria. Retrieved on 27 May, 2010 from *Encyclopaedia Dictionaries & Glossaries* (n.d), Definition of Water Management.

Federal Government of Nigeria (FGN) (1993). *Water Resources Act 101* Government Press, Lagos.

Feitelson, E and Chenoweth, J (2002). Water poverty: towards a meaningful indicator. *Water Policy*. 4; 263 – 281

FGN (2000). *National Water Supply Draft National Policy on Water Supply and Sanitation (First Edition)*, (2000), Federal Government of Nigeria.

FGN (2000). *National Water Supply and Sanitation Policy*, 1ST Edition January,

FMWRRD (1995). The Study on the National Water Resources Master Plan. *Japan International Cooperation (JICA) and Federal Ministry of Water Resources and Rural Development, Federal Republic of Nigeria, Abuja.*

Irokalibe, I.J. (2008). Water Management in Federal and Federal Type Countries: Nigerian Perspective. *Forum of Federations*, Zaria, 2; 49-60.

Ikelegbe, A.I. (2007). "Socio-economic environmental challenges and the quest for sustainable development in Nigeria's oil rich Niger Delta: A

commentary, www.ucd.ei/dipcon/docs/theme02, (accessed on the 15th of April 2007).
Lawford, R.G., Landwehr, J.M., Sorooshian, S and Whitaker, M.P.L (2003). International Hydrologic Science Programs and Global Water Resources Monograph 16. American Geophysical Union 10.1029/016wm14 Moore, W.J., and Moore, E.A. (1976). *Environmental Chemistry, Academics Press,* Inc. London, pp. 360-368.
National Population Commission (NPC), *Government Notice of No.21 on 2006 Census*, (2007), Federal Government Printer, Lagos, Nigeria.
NDDC (2004). Niger Delta Environmental Survey, NDES
Nwankwoala, H.O. (2012), Case Studies on Coastal Wetlands and Water Resources in Nigeria, *European Journal of Sustainable Development* (2012), 1, **2**, 113-126
Nwankwoala, H.O. and Ngah, S.A. (2014), Groundwater resources of the Niger Delta: Quality implications and management considerations, *J. of International Review of Water Resources and Environmental Engineering,* Vol.6 (5), Pp. 155-163.
Nwidu, L.L., Oveh, B., Okoriye, T and Vaikosen, N.A (2008). Assessment of the water quality and prevalence of water borne diseases in Amassoma, Niger Delta, Nigeria. *African Journal of Biotechnology* Vol.7 (17), pp. 2993-2997.
Okoye, C. J. (2015). The Challenges of Water supply management in the Niger Delta wetland. *Seminar on Tropical Environment*. Enugu State University of Science and Technology Business school, Enugu 18th July, 2014
Orubu, C.O (2006), Water Resources, Environment and Sustainable Development in Nigeria, *J. Hum. Ecol.,* 19(3): 169-181
UNDP, (2000). *Niger Delta Environmental Survey Human Development Reports*, UNDP
UN–Habitat (2003). *Water and Sanitation in the World's Cities*: *Local Action for Global Goals*, London, Earth Scan.
Uluocha, N.O and Okeke, I.C (2004). Implications of wetlands degradation for water resources management: Lessons from Nigeria. *Geojournal*, 16:151 – 154
World Bank (1995). *Defining an Environmental Development Strategy for the Niger Delta*, Vol. II, Industry and Energy Operations Division, *World Development Indicators.* World Bank, Washington D.C
World Health Organization (1994). *Operation and maintenance of urban water supply and sanitation systems.* , *WHO,* Geneva