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INTEGRATED WATER RESOURCES AND WASTE MANAGEMENT: WATER, SANITATION, FLOOD AND STORM WATER MANAGEMENT.

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Abstract: At the world summit on sustainable development (WSSD) held in Johannesburg in 2002, the International Community took an important step towards realization of sustainable pattern of water management by including in WSSD plan of implementation with a call for all countries especially the developing countries to develop Integrated Water Resources Management (IWRM) and Water Efficiency plans by year 2005. Many countries have taken the WSSD target very seriously and have embarked on the accelerated process of IWRM. Suffice to state that African countries are part of this driven plan. Nigeria as a country is in the centre of this approved plan and the time is ripe for the proper implementation of IWRM by the Federal, State and Local Governments as well as by corporate bodies and other stakeholders. The challenge before Nigeria in terms of IWRM is that her water is “Unsafe” and it is a “War risk zone”. A survey carried out by project supervisor of Global Initiative for Women and Children equally revealed that “about 69 Million Nigerians lack safe drinking water”. This report canvasses for a strong policy on IWRM to ensure safe water supplies in Nigeria.

INTRODUCTION

The pride of any nation that is abundantly blessed with natural resources is the ability to put into use and utilize her resources effectively. Nigeria as a country, is one that bathed in all ramifications with resources (i.e. water) available for the development of other sectors of human’s lives in the area of domestic water needs, institutional demands, industrial needs, commercial development, agriculture, hydropower and fishing demands. The Government of Nigeria has for long now recognized that the economic progress of the Country depends principally and mainly on the development of her integrated water resources. However, suffice to state here that the country has not made significant progress in the field of water resources and waste management over the past four decades.

Nigeria is a country with a large Green and Blue water resources, and also with subsequent long period of the year suitable to produce biomass (i.e over 50% of the arable land with six months growing seasons, and with annual rainfall from 1.100 to 2. 700mm (Table 1). The country is also rich in both surface and groundwater resources. The total water resources available in the country is estimated to be 286,200km³/yr. This implies that the country has abundant water resources that is available for use when compared to the total water withdrawal of 800km³/yr. The country is also blessed with a vast expanse of inland freshwater and brackish ecosystem. However, their full extent has never been accurately measured due seasonal variations in rainfall pattern and the total surface area of water bodies in Nigeria, excluding deltas, estuaries and miscellaneous wetlands that are suitable for rice cultivation is estimated to be about 148, 869km³. Despite this, the water resources in the country are unevenly distributed across the different region of the country with surplus in some regions and scarcity in some other regions. This provides challenges for efficiency in the use and productivity improvement in the water scarce regions, especially dry land areas of the north where human habitation relies heavily on ground water resources that usually recharge from fresh water percolation and run

off during the rainy season. Anything that upsets this balance threatens the livelihoods and economy of the people who reside there.

Past Government efforts have been focusing on water resources development on a sub-sectoral basis, but neglecting to manage it strategically as national resources. Water resources presently worldwide are under extreme pressure. The resulting problems have given rise to many activities which reflect the growing concern, and the important accorded to their sustainable management. Following the above objectives, the United Nations declared the period 2005 to 2015, the International decade for Action as “Water for life”. In Nigeria irrigated Agriculture accounts for 69% of the annual blue water withdrawals (Table 1&3) from the inland water resources. However, in the Northern region of the country, irrigation systems, tapping shallow ground water is low lands and freshwater local wetlands are still common with a covering of 30% of the traditional (FAO, 1987, Scoones; 1991). This report is a review on water resources management in Nigeria with focus on the development of a strong IWRM policy in Nigeria.

Table 1: Water resources in Nigeria

Water resources	Year	Amount	Unit
Average precipitation	2005	115c	Mm/yr
Total precipitation	2005	1062,336	Km ³ / yr
Internal renewable water resources Total	2005	221,000	Km ³ / yr
External renewable water resources-total	2005	65,200	Km ³ / yr
Total water resources	2005	286,200	Km ³ / yr
Irrigation water requirement	2000	1650	Km ³ / yr
Water withdrawal			
Agriculture	2000	5507	Km ³ / yr
Domestic	2000	1687	Km ³ / yr
Industrial	2000	810	Km ³ / yr
Total	2000	8000	Km ³ / yr

Source : Aquasat, 2005

Water Resources Sector in Nigeria and her Attended Multi-Facet Problems

i. Lack of unsafe water and poor sanitation

Nigeria has adequate surface and groundwater resources to meet the current challenges and demands for water within the country (Tables 1 & 2). Adverse health outcomes, which are associated with ingestion of unsafe water, lack of access to water (linked to inadequate hygiene), contact with unsafe water, and inadequate management of water resources and systems, infections with different forms of diseases are common in the country. Poor sanitation conditions and inadequate health education programs, and access to safe water in the country are low, while the population of the country is on the increase. The poor sanitation prevailing in the country with inadequate proper health education programs has resulted to the increase of various diseases such as dysentery, gastroenteritis, infectious hepatitis, hookworm, guinea worm and other parasite infections.

ii. Flood Disaster

Regardless of the fact that the rain may have subsided, no fewer than 25million Nigerians living along coastal communities of Rivers, Niger, Benue, Sokoto, Katsina, Lagos, Ondo, Delta, Akwa Ibom, Bayelsa, and Cross Rivers state in Nigeria may be threatened by displacement and devastation before the end of the year. Investigation revealed that the failure of the Government to explore proactive measures in tackling perennial flood in some disaster prone northern states, blocked drains and water channels and the harrowing effects of erosion in the South-East and some states in the Niger Delta region may spell doom for the nation.

Table 2: Major inland water resources (including brackish & freshwater floodplains) of Nigeria

Water Body	Surface Area, (ha)
Major rivers:	
Anambra River	1,401,000
Benue Rivers	129,000
Cross River	3,900,000
Imo River	910,000
Kwa Iboe River	500,200
Niger River (less Kainji & Jebba lakes)	169,800
Ogun River	2,237,000
Oshun River	1,565,400
Subtotal	10,812,400
Major lakes and reservoirs:	
Lake Chad	127,000
Kainji Lake (man-made)	35,000
Shiroro Lake (man-made)	31,200
Goronyo Lake (man-made)	20,000
8 others (man-made)	90,400
Subtotal	853,000
Floodplains	3,221,500
Total, major freshwater resources	14,886,900
Other freshwater bodies:	
Delta and estuaries, brackish	858,000
Other (minor reservoirs, fishponds)	104,400
Miscellaneous wetlands suitable for rice	4,108,100
Total, all inland water bodies	19,958,000

Table 3: Sample of water use patterns by available water sources in Nigeria, (FGN, 2000)

Spring / stream	32%
Hand dug well (w/apron)	30%
Hand dug well (w/out/apron)	27%
Rain	20%
River	16%
Pipe borne	14%
Borehole	14%
Vendors	6%

Table 4: Ten top diseases from sample hospital records in Ibadan, Nigeria

Rank	Type of Disease	Recorded Cases	% of Total
1	Diarrhea	1530	25.0
2	Malaria	1130	18.5
3	Pneumonia	713	11.7
4	Tuberculosis	686	11.2
5	Eye Disease	459	7.5
6	Measles	421	6.9
7	Malnutrition	330	5.4
8	Anaemia	318	5.2
9	Hypertension	314	5.1
10	Hernia	219	3.5
	Total	6120	100

Reasons for the above Multi – facet Problems

There are reasons for Nigerian multi-facet water resources problems. A few of these are:-

(ii) Poor investment planning

Poor planning and ineffective co-ordination of rural water supply programs. Schemes handled by various agencies of Government involved in the provision of water supply Schemes have not yielded good and sufficient results.

(i) Inadequate and unstable fiscal policies and poor funding

This has been noticeable among all tiers of Government. Water projects are capital intensive. Most of the equipment are imported with foreign funds and loans attached. Due to low allocations of funds for water resources projects, many of such projects are abandoned in the country

(ii) **Inadequate manpower**

Insufficient relevant manpower poor remuneration, inadequate training and high turnover of skilled personnel has actually diflected the performance of water supply Scheme in the Nigeria

(iii) **Poor maintenance policy**

Lack of formal maintenance policy which institutionalizes prevent maintenance and also incorporates annual budgetary provisions for maintenance is the reason for failure of sustainable water supply in the Country. In most cases, early decay and breakdown of the equipment and water shortage are the results.

(iv) **Poor concept of water project**

Adequate engineering practice requires that engineering works should be preceded by thorough investigation and later should be properly designed for optimum performance and efficiency. The construction work should be carried out in a workable manner for such water facilities. This is what is lacking in many water projects in the country.

INTEGRATED WATER RESOURCES MANAGEMENT (IWMM)

IWRM may be defined as a process which promotes the co-coordinator development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM is a comprehensive approach to the development and management of water, addressing its management both as a resources and the framework for provision of water services.

A few considerations on the why of Integrated Water Resources and Waste Management should be adopted include:

(1) **Some Countries Experiences on Water Resources Issues**

Water scarcity and deteriorating water quality have become critical factor in many countries thereby limiting National Economic Development, expansion of food production and provision of basic health and hygiene services for the population. The recognition of the need to redress these weaknesses in their water governance structures has convinced many countries that a new water management frame work is needed.

Other common critical issues include; awareness and priority i.e Political level of water issues is limited and less attention is given to it, lack capacity to manageme pressures on water resources, in appropriate pricing structures and limited cost recovery and maintenance of water system, and as well in miss-allocation and loss of water, low investment in the water sector, and insufficient attention in the national budgeting procedures and lack of information and data to support sound management of water.

(ii) **Pressures and Competition for Improved Water Management**

This results in lack of safe and affordable drinking water and basic sanitation and pressure from National Economic Sectors like energy (Hydropowre) and Agriculture, due to lack of water for, development and management.

(iii) **IWRM Relationship to Economy**

Poor management of water resources causes ill-health environment and economic losses on a scale that impedes development, and also frustrates poverty reduction efforts. Examples of this are water degradation health and global loss of productive population of people without access to clean. Lack of water and improper sanitation are among the prime causes of water-borne diseases in developing countries.

(iv) **Soil Degradation and Loss of Productive Land**

The way water is managed in relation to land use has significant effects on agricultural production. Deficient management always results in erosion and destruction of soil structures.

(v) Risk Management, Floods and Droughts

Economic losses from floods, drought and climate variability are usually experienced at a very large scale globally.

(vi) Major Diseases

Water borne diseases are among the worst killers in different developing countries, and the poorest segments of the population are always the most affected.

(vii) Environmental Sustainability

IWRM addresses natural resources and degradation as a result of unsustainable exploitation and that Environmental Laws needs to be maintained, so that ecosystem and planning of allocation and recycling can function properly.

Integrated Water Resources Management Implementation Approach

(i) Critical Focus of IWRM on Countries

The role of IWRM varies depending on the development stage of any country. Developing countries in transition will all have different ways of implementing the IWRM process and derive different benefits. Developing countries will in particular see sound water resources management as a factor in addressing poverty, hunger, health and environmental sustainability.

(ii) The Three Pillars of IWRM

Implementing an IWRM is a question of getting the “three pillar” right moving toward an enabling environment of appropriate policies, strategies for sustainable water resource development and management putting in place the institutional framework through which the policies, strategies can be implemented and setting up the management instrument required to do the job.

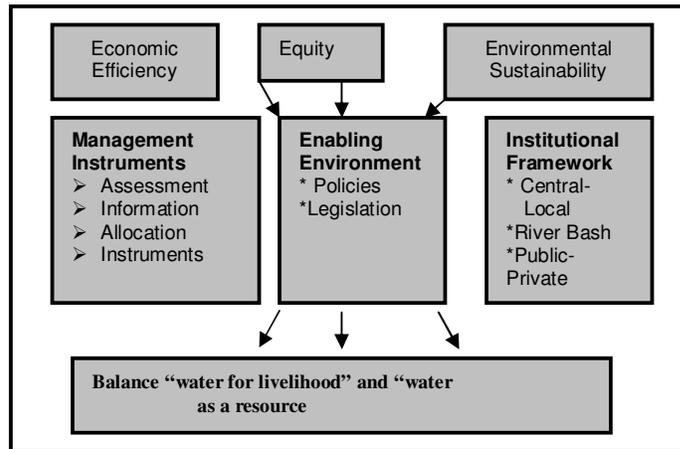


Figure 1: Pillars of IWRM

(iii) The Roles of the Actors

Government plays a key role in the implementation of IWRM framework. They should be the main regulators and controllers in the water sector with its associated infrastructure. In addition, governments should promote improvement in the public sector, regulate private sector involvement, and decide on market mechanisms. But “water is everybody’s business” as generally said, therefore, it is a resource to be managed at the lowest appropriate level. It is government working with civil society that would raise awareness of the importance of improved water resources management among policies and the general public. Dialogue with stakeholders, including government civil society and the private sector is necessary. Governments can only exercise their responsibilities of “good water government” if they

involve all relevant national (and if appropriate, also regional trans-boundary) stakeholders in the dialogue to develop and implement the framework to avoid frustration.

(vi). Cyclical Process of IWRM

The cycle starts with planning processes and continues into implementation of the frameworks and action plans and monitoring of process. At this stage – or indeed at any point in time, it can be decided whether new reform needs to appear or whether the reform process has led to the expected improvements. If the later is not the case, then the cycle must be repeated. IWRM “plans” as seen is just one step in the process of improved water resources management (Fig.2)

(v) Contribution of Poverty Reduction to IWRM

Poverty Reduction Strategy (PRS) describes a country’s macroeconomic, structural and social policies and programmes to promote growth and reduce poverty, as well as external financing need. PRS are usually prepared by the government through a participatory process involving civil society and development partners. PRS are the basis for lending by the World Bank and International Monetary Fund (IMF) and influence international donors choice on which sector to support. It is important that governments realize the significance of water and the management of water resources of poverty reduction and gender equality and also priorities water sector interventions in PRS where relevant.

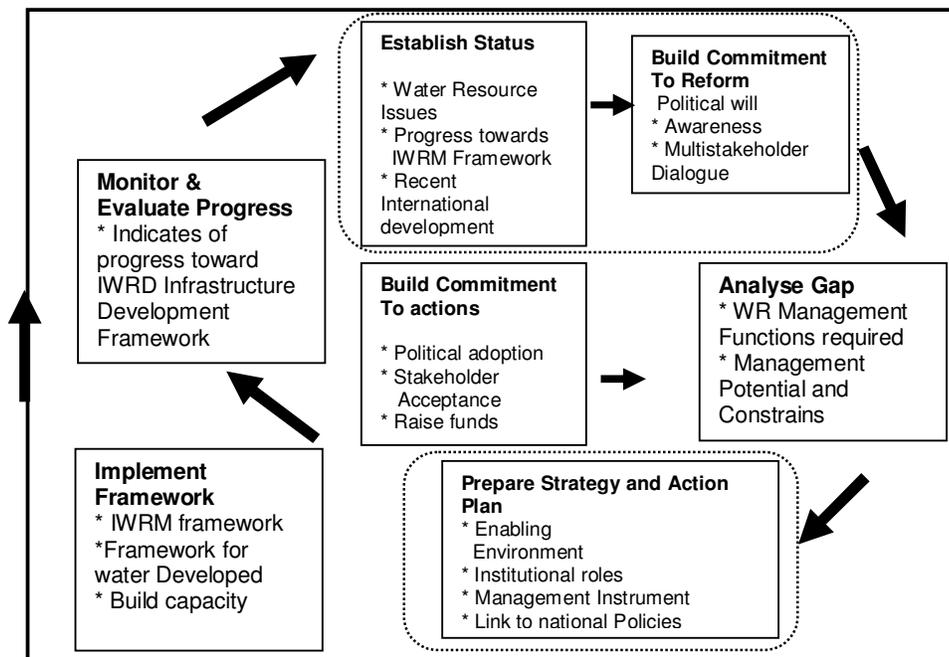


Figure 2: IWRM implementation process

The generalized process towards IWRM is envisaged to comprise the steps of the process cycle in Figure 2. The number of the steps and depth of the work will depend fully on the individual present stage of progress towards IWRM and the goal set.

Strategies for Achieving Integrated Water Resources Management

A few strategies for achieving Integrated water resources management both at National and International standards are discussed below:-

(i) Identification of Watershed Problems

Problems such as flood occurrences, drought, erosion and sediment damages, conservation, development, utilization, disposal of water originating in the watershed should be addressed. Major problems such as flood damaged and entered, with information on amount and value of land exposed to the flood hazard in the watershed, frequency of flood occurrence,

significance of small frequent flood or large infrequent flood in total, with limitations coupled with other pertinent problems should be given adequate attention and consideration.

(ii) Suggested Steps towards Watershed Solutions

Suggested steps for different objectives and problems identified should be based on the following:-

(a) Recognition phase:

The recognition of watershed problems (their probable causes and development) should be carried out by conducting several surveys as soil survey, land survey, agronomic survey, forest land under permanent vegetation surveys, engineering survey and socio – economic survey.

(b) Restoration phase

This phase follows the recognition phase in which treatment measures should be apply to the critical areas of the problems for restoration.

(c) Protection Phase

The protection phase covers the treated areas which have been restored earlier.

(d) Improvement Phase

The improvement phase covers all areas.

(e) Evaluation

Evaluation should be conducted to accomplished the set objectives, such as flood control, sediment control, water supply and financial returns.

(iii) Engineering Strategies Aspects

(a) Storage, diversion or lifting of water

This is the first phase of irrigation Engineering. With the construction of a dam across the river, a suitable reservoir can be created and water can be stored. Alternatively, if a river is perennial and carries sufficient discharges, a suitable diversion works such as weir, barrages can be constructed across the river and water can be diverted to create a canal. In places where groundwater table is high, suitable well can be dug and water can be lifted and fed into small channels.

(b) Conveyance of water to the agricultural fields

The stored or diverted water can be conveyed to the agricultural fields through suitable distribution system. If a proposed project is big, the distribution system will consists of two or more main canals and a number of distributaries and minors from the canal water can be led to the field through “water course” or “field channel” These field channels takes off from the distributaries or minors through modular or non – modular outlets, so that water supply can be regulated.

The second phase includes the design and construction of suitable canal system, along with various regulatory works such as head regulators, cross regulators, falls, etc. for the efficient working of the canal. In addition to these, suitable cross drainage works such as aqueducts, supper passages, level crossings, bridges, etc. will have to be designed and constructed at place where the canal crosses a natural drain road or a road.

(c) Drainage and relieving water-logging

Proper disposition of excess water by suitable drainage methods is very important. For conveyance losses and excess application of water to farm crops, which usually result into raising the sub-soil water level, the design of surface and sub-surface drainage system will be of vital importance in maintaining the high productivity of irrigated lands.

(d) Development of water power

In rural areas, most of the irrigation projects should be associated with the generation of hydro-electric power either at the dam site or at canal falls. If implemented, this will provide more revenue for the country.

(e) Agricultural aspect

The agricultural aspect deals with the thorough knowledge of the following points before implementation. These are; proper depths of the water necessary in single application of water

for various crops, distribution of water uniformly and periodically, capacities of different soils for irrigation water and the flow of water in soils and reclamation of waste and alkaline land, where this can be carried out through the agency of water.

WASTE MANAGEMENT

Waste management is a serious environmental problem that has been the subject of several studies, conference, strategic meetings and debates. It's importance lies in its visibility and clear intrusion into the daily lives of the people, as well as the numerous secondary effects. This accounts for the global and National attempts to improve the managing of waste. The issue of waste management especially in the residential areas can not be handled with levity for some important reasons. These include the fact that: (i) the residential areas constitute the others, (ii) it is also the most troublesome to manage since it consists of diverse range of materials (glass metal, paper, food, nylon, etc) totally mixed together with relatively small amounts of each, (iii) it accumulates easily near communities, where it may pose health hazards as well as becoming offensive to sight and smell, (iv) the urban residential environment is not only the home of man, but also the Engine of economic growth and centre for employment and opportunities. They are also areas of enormous political, social, economic, and cultural importance to the countries and towns where they are found.

Therefore, any problem that threatens all well being of man in the urban areas, also threatens all other spheres of life. In other words, residential districts of cities and towns should be considered as very imperative, and means of evolving a sustainable urban waste management developed at all cost.

Disposal of Solid Wastes or Refuse

All solid and semi solid wastes of the community, except human excreta and sillage is classified under the general term refuse, refuse thus represents the dry wastes or solid wastes of the society and it includes :-

- (i) Garbage V12 food wastes from kitchens, hotels, restaurants, dry leaves, vegetable wood chips, etc.
- (ii) Ashes i.e incombustible waste products from hearths and furnaces and houses and Industries.
- (iii) Rubbish like rags, piece of papers, broken pieces of glass and furniture card, broken crockery, etc.

The practice of open burning of tree leaves and grasses, clippings as prevailing in many parts of the country should be stopped.

MANAGEMENT STRATEGY ASPECTS

In order for Nigeria to achieve the full status of integrated water resources level, management and leadership principles must be operational. A few examples of such are highlighted below:-

(i) Visionary leadership

Nigeria at present needs leaders who would put the economy of the country and other sectors as number one, and follow it up to a logical conclusion. Such leaders would take giant steps to diversify the economy and stop depending on other countries for support. Nigeria has what it takes to become a great Nation in terms of integrated water resources that would eliminate menace in the area of poor sanitation, flood and storm disaster apparent in the country.

(i) Reduction in the level of corruption

With the right kind of leaders, water will flow through all parts of the country without shortage. Flood disaster will equally be the story of the past.

(ii) Development of achievable goals for integrated water resources

Goals can be used to begin the actual in depth integrated assessment. Such goals are designed to (a) provide safe and equal access to water supplies needed for domestic, municipal, industrial, agricultural, and hydropower uses, (b) encourage a water shed based approach in evaluating all water resources issues that is participatory, equitable and socio-economically

sensitive, (c) develop appropriate water resources policies, institutional arrangements and structures, financial systems, and legal regulatory authorities in order to achieve Integrated Water Resources Management, (d) prevent human health risks due to the spread of waterborne diseases, (e) reduce discharges of pollutants into surface waters and also eliminate contamination of groundwater and (f) encourage research that would form a feed back for social learning and adaptive management.

A properly organized IWRM will ensure:

- (i) A sound environmental education and community awareness on water quality
- (ii) Improved public and private managed irrigation system
- (iii) Efficient watershed management
- (iv) Regulated water supplies
- (v) Create employment opportunities
- (vi) Effective and safe water harvesting
- (vii) Purposeful networking and collaboration

CONCLUSION AND RECOMMENDATION

The prosperity of a nation depend primary upon the exploitation of its natural resources. Water is one of the most important commodities which man has exploited than any other resource for sustenance of his life. The normal functioning of man's body depends entirely upon an adequate quantity of water. About 70% of man's body weight is water. In order to maintain this level, a healthy man will require an average of 2 liters per day. In addition, most of the foods that man eats contain water. Water is more than a public utility. It differs from other in this respect that its shortage or impurity endangers the life of a community. Easy flows and distribution of diseases are through water, as a result of non provision of sanitary facilities. This is the more reason why all forms of Governments should be involved in proper Integrated Water Resources and Waste Management.

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