A Comprehensive Collation of River Basins in Nigeria: Benefits and River Basin Development Planning and Management

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ABSTRACT: River basin is defined as an area of land drained by a river and its tributaries. There are over eighty major rivers in Nigeria and the biggest among them are the river Niger and Benue. Significances of river basins include; provision of drinking water, food, habitat, fossil information, transportation, recreation, hydro-electric power, erosion control, flood control, oceanic recharge and pollution control. There are eleven River Basin Development Authorities in Nigeria and they are charged with functions such as water supply facility construction and control, basin management and pollution control and fishery and its control. River Basin Development Planning and Management is the process of identifying the best way in which a river and its tributaries may be used to meet competing demands while maintaining river health and could be single purpose, dual purpose, multipurpose, comprehensive or integrated. There are threats to river basin in Nigeria and the commonest include waste input, excessive water resources exploitation and invasive weeds. River systems in Nigeria should be properly and sustainably developed to enhance economic growth of the nation.

Key words: River basin, RBDPM, Tributaries, Drainage, Environment, Management

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1.1 INTRODUCTION

Sophocleous, (2002) defined river basin to be the area of land drained by river and its tributaries. River basins are the geographical areas within the watershed limits of a system of rivers and converging towards the same terminus. Such terminus could be a sea, lakes or sometimes an inland water body. Tributary, and basins more limited in size are often called watershed (in American English) while catchment area is used in British English as a synonym for river basins and watershed is being defined as the line separating two river basins (Molle *et al*. 2007). During much of the 20th century, the water needs of the grown population were met through the construction of infrastructure such as dams and reservoirs to increase water withdrawal from rivers and aquifers (Klare, 2001). Water was thought to be abundant and impact on the environment was incremental and little noticed at first. Today water resources in many rivers are fully committed to a variety of human uses, portable water quality is degraded, river-dependent ecosystem are threatened and the expanding demand for water is leading to competition and even to strife at times.

In agriculture the challenge for water management is to maximize agricultural production with less water from river basins that are already stressed while judicious assessment of new water infrastructures are needed in open water basin.

Except for a few inland or desert areas, all lands on the earth surface are part of one river basin or another and most of the world land surface apart from the most arid and cold area is divisible into river basins (Dasmann *et al.,* 1973). Thousands of years ago, efforts to control rivers were initiated and the concept of river basins as units for planning, developing and managing water emerged in the late 19th and early 20th centuries (Teclaff, 1996; molle, 2006). Multipurpose development of river basins

focused primarily on construction of large dams during the second halve of the 19th century which increased from 5000 in year 1950 to 45000 in year 2000. River systems are interconnected transfer and transport systems (Newson, 1997) carrying water, sediment, nutrients contaminants and biota across space and time.

In Nigeria, control of water, estimation of extreme events and management of animal variability posed many problems unanticipated by engineers Sneddon, (2002). Human activities and intervention in the water cycle placed many river basins under stress. Basin uses need to be well coordinated and it is a logical stem to use water resources development as an integrating social, economical and environmental condition throughout the basin (kraezel, 1957). In moving towards sustainable river basin management, there is a growing interest in institutional processes that can bring together fragmented water users into an integrated planning, allocation and management framework.

2. 1 RIVERS IN NIGERIA

There are over eighty major rivers in Nigeria and the biggest among these include; River Niger which has its sources from Equatorial Guinea and River Benue. River Benue drains to join rivers Niger at Lokoja popularly known as the conference town. These two rivers (as River Niger) drain together into the Atlantic Ocean. As they drain down the Atlantic Ocean, some other tributaries and rivulets join the river while at South South region of Nigeria, this River Niger forms a delta popularly known as Niger Delta. Geographically, three states of Nigeria are found in this Niger Delta region which include; Delta State, Bayelsa State and River State. Other major river in Nigeria to note include; River Gongola, Calaba river, Osun river, river sokoto, river Ogun, river Kaduna etc.

Major rivers that drain into river Niger include; river Sokoto, river Zamtara, river Ka, Malendo, river Kontagoa, river Kaduna, river Bakosi, river Oli, river Tesi, river Oshin, river Oyi, and Mim river. While the rivers that drain into river Benue include; river Yedseram, river Kilunga, river Ruhu, river Gongola, river Gaji, river Wase, river Sheman, river Guma, river Mada and Daudau river

Table 1: Main Rivers in Nigeria by geopolitical Zones

Rivers in North West	Rivers in North East	Rivers in North Central	Rivers in South West	Rivers in South East	Rivers in South South
Rima river	River Hadeja	River Belwa	River Ominta	River Anambra	River Ikan
River Sokoto	River D. Gaya	River Sanro	River Shasha	River Aloma	River Orashi
River Gurata	River Katagun	River Oli	River Tesi	River Abione	River Kwaibo
River Guma	River Chatawa	River Mim	River Oshin	River Manu	River Ase
River Karami	River	River Ram	River Ogun	River Imo	River Okwa
River Melendo	Jamare(Bunga)	River	River Kobo	River Aya	River Great
River Dinya	River Bajel	Menchum	River Otan	River Aba	Kwa
River	River Lere	River Bantaji	River Erinle	River Otamiri	River Atapko
Sarkinwaria	River Gongola	River Benue	River Yelwa	River Akwayafe	River Calabar
River Mariga	River K. gona	River Nurka	River Oshun	River Ekulu	Niger
River Galma	River Anuma	River Mayoyin	River Oueme	River Oyi	Distrubutories;
River Kaduna	River Ruhu	River Suntai	River Okpara		Escrovos river
River Tubo	River Hawal	Banta	River Oyan		Forcados river
River Kuntagoa	River Ngodoa	River Gashaka	River Ofiki		Chanomi creek
River Mashi	River Goma	River Donga	River Ona or		Nun river
River Teshi	River Yedseram	River Katsina	Awna		River Osiomo
River Kano	River Kilunga	River Niger	River Ogunpa		River Ikpoba
River Gaminda	River Watari	River Gamana	River Oba		River Ogbese
River Goulbide	River MIssau	River Mada	River Osse		River Ethiope

de Maradi River Gagere River Bunsuru	River Komadugu Gnana River Pai River Faro River Gururu	River Dauda River sheman River Wase River wuru			River Owena Ramos river

Source: (Adapted from Army Map Service, 1967; World Atlas, 1985)

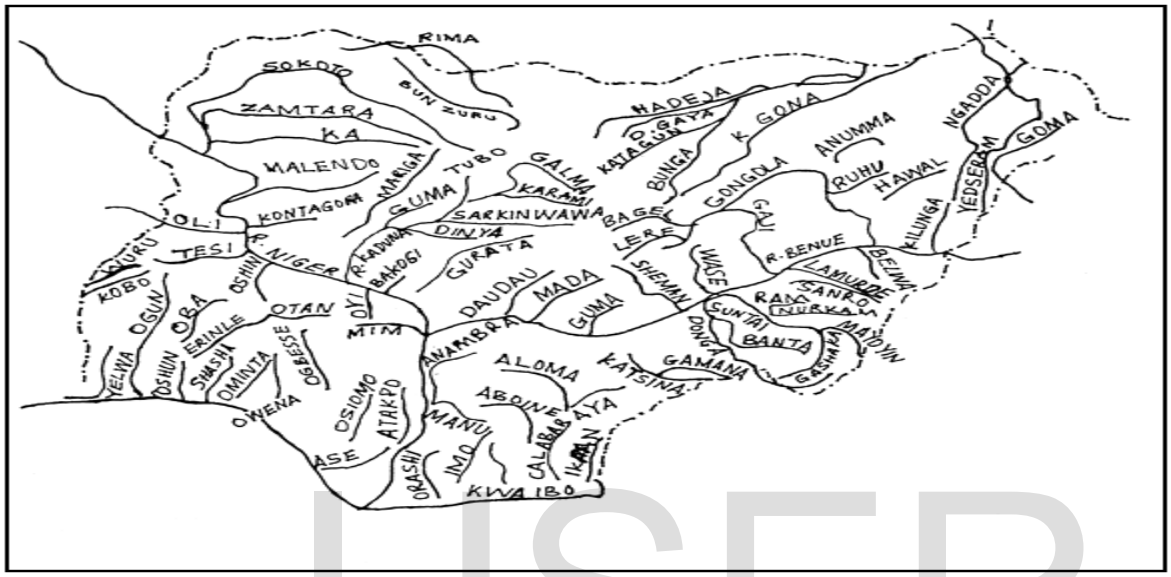

Figure 1: Map of Nigeria showing major rivers Source: (Army Map Service, 1967)

2.2 SIGNIFICANT OF RIVER BASIN IN NIGERIA

Nigeria is blessed with numerous river basins and they often provide numerous benefits to mankind. The significances of these river basins in Nigeria include;

Drinking water provision

River basins in Nigeria serve as a source of portable water to many rural areas of the country. These river systems also play a role in ground water recharge through seepage in.

Food

River basins are major source of fish food production in Nigeria. The fishes gotten from river basins serve as food. Aquatic organisms such as macrophytes and algae can be a good source of nutrition for man. Water hyacinth is native to Brazil and it has been used fresh for feeds to pigs in southwest Columbia. It was substituted for 20 percent of commercial feed without toxicology problem. Silage composed of water hyacinths can be used for ruminant diets with excellent result for acceptability palatability. Water hyacinth is high in protein, potassium, calcium. Phytoplankton such as *chlorella* and *spirulina* are both super food and food supplements made from *chlorella* and *spirulina* can be found in different super markets in Nigeria. Larger zooplanktons (meso planktons) such as copepeda and cladosera can be used as feed. Other resources in river basin that can be used as food include crayfish, snails, different animals and palatable plants etc.

Habitat

River basins serve as a habitat for organisms that live in the river system. Such include; fishes, crayfish, macrophyte, microalgae, zooplanktons, aquatic birds and other animals.

Accumulation of fossil information

The river system can serve as a good fossil reserve to ascertain past events and inhabitation. This aids chronological measurement.

Transportation

River basins in Nigeria serve as a means of transportation and navigation. People can travel from one place to another through the river system.

Recreation

Water contained in the river basins in many occasions has served for recreational purposes. For example, in the construction of beaches and resorts.

Hydro-electric power provision

This involves construction of dam along a water fall in a river system for generation of electricity such as kaiji dam in river Niger.

Building and Construction

The soil (white sand) found in and around a river basins is very useful in building and construction in Nigeria and such is exploited at Onitsha, along river Niger.

Erosion control

By the virtue of the ability of river basins to serve as an end point to water run-off in cities and towns, they help to control erosion.

Flood control

As river collects and store inland water run-off as a result of rainfall, they help to manage and control flooding.

Oceanic recharge

Rivers flow into oceans and help recharge the system. In Nigeria, more than three quarter of the river basins drain into Atlantic Ocean.

Pollution control

Vast number of companies and industries in Nigeria use river basins as end-point for their waste discharge.

3.1 RIVER BASIN DEVELOPMENT AUTHORITIES IN NIGERIA

In 1961, eleven river basin development authorities were established to ensure effective exploitation of inland water resources in the Nigeria. There are eleven authorities in Nigeria. They have similar function and are evenly distributed along river basins of Nigeria. In Nigeria, river basin authorities are charged with functions which include;

- Irrigation
- Water supply facilities (construction and management) e.g reservoir, dams, borehole etc Fishery and its control
- Basin management and pollution control
- Hydro- electric power generation and control and management
- Recreational facilities
- Fishing regulations

Table 2: River Basin Development Authorities in Nigeria

Name of authority	Area of operation	Headquarter
Anambra-Imo river basin authority	The whole of Anambra and Imo State.	Oweri

Benin-Owena river basin authority	The whole of Benin, Delta, Ondo State excluding those parts of Bendel State drained by the Benin, Escravos, Forcados and Ramos river creek system.	Benin
Chad river basin athority	The whole of Borno State excluding those parts drained by the Jama'are and Misau river system but including those parts of Gongola (Adamawa and Taraba) State drianes by Yedseram and Goma river systems.	Maiduguri
Cross river basin authority	The whole of Cross river State.	Calabar
Hadejia-Jama'are river basin	The whole of Kano State and those parts of Bauchi and Borno State drained by the Jama'are and Misau river system.	Kano
Lower Benue river basin	The whole of Benue and Plateau State.	Markurdi
Niger Delta river basin authority	The whole of River State and those parts of Delta State drained by Benin, Escravos, Forcados, and Ramos river creek system.	Portharcourt
Niger river basin authority	The whole of Kwara and Niger State, the federal capital territory. Whole of Kaduna Sate excluding Kastina State	Minna
Ogun-Osun river basin authority	The whole of Oyo, Ogun, Osun and Lagos State	Abeokuta
Upper Benue river basin authority	Those parts of Bauchi State drained by the Gongola River system. The whole of Gongola State excluding those parts drained by the Yedseram river system.	Yola
Sokoto-Rima river basin	The whole of Sokoto State and Kastina State.	Sokoto

Source: (RBDAA, 1986)

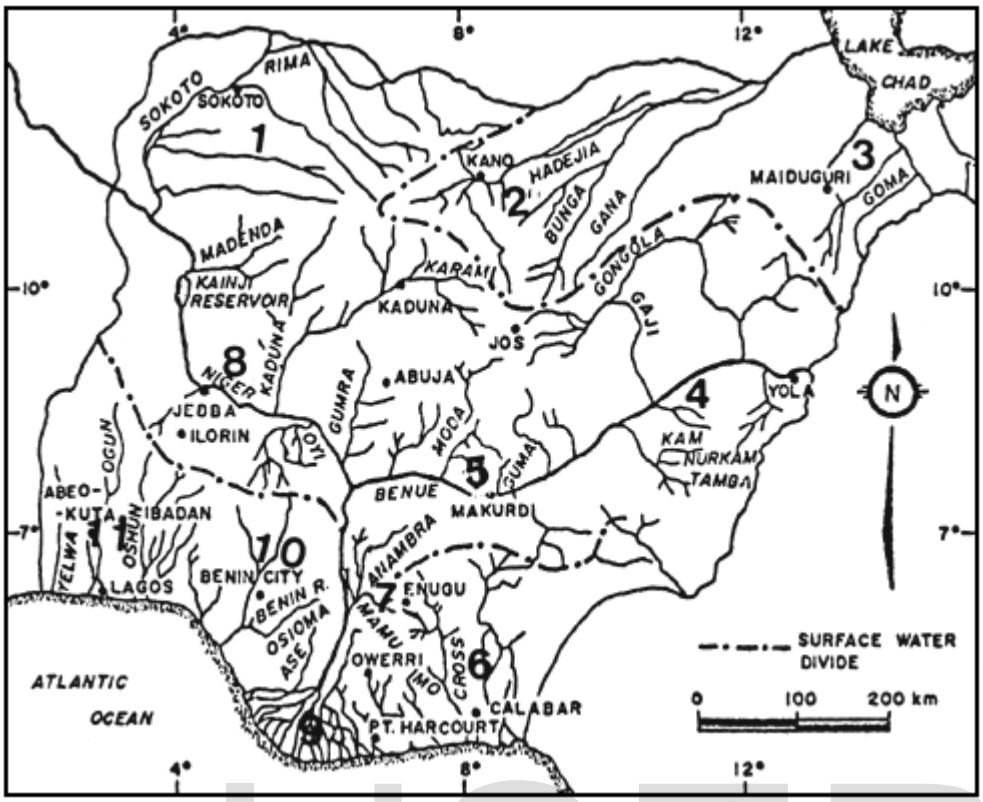

Figure 2: River Systems of Nigeria and their organization into 11 River Basins Development Authority (RBDAs)

Source: (Amusu, 2015)

River Systems of Nigeria and their organization into 11 River Basins Development Authority (RBDs) as displayed in Figure 2;

(1) Sokoto-Rima Basin

(2) Hadejia-Jema' are Basin

(3) Lake Chad Basin

(4) Upper Benue Basin

(5) Lower Benue Basin

(6) Cross River Basin

(7) Anambra-Imo Basin

(8) Niger Basin

(9) Niger Delta Basin

(10) Benin-Owena Basin

(11) Ogun-Oshun Basin

4.1 RIVER BASIN DEVELOPMENT PLANNING AND MANAGEMENT

Barrow, (1998) stated that River Basin Development Planning and Management is the process of identifying the best way in which a river and its tributaries may be used to meet competing demands while maintaining river health. It includes the allocation of scarce water resources between different users and purposes, choosing between environmental objectives and competing human needs and choosing between environmental objectives and competing human needs and choosing between competing flood risk

management requirements (Molle, 2006). However, increasing development and population pressure, the complexity of many of the river basins have increased and many serious crises related to floods, degradation of water quality, acute water shortage and degradation of ecological health have been experienced. Approaches to basin planning have evolved over time and a basin planning is ultimately playing significant roles to the adaptation of these local circumstances.

4.2 GOALS OF RIVER BASIN DEVELOPMENT PLANNING AND MANAGEMENT

- To avoid environmental degradation
- To coordinate the uses of shared basin (multiusers, inter state and international).
- To promote sustainable development of the basin.
- To integrate land and water management
- To promote sustainable provision of water through irrigation for agriculture
- To promote the excessive use of water and water resources that can lead to environmental fragility and deterioration.
- To promote integrated, optimal development of natural resources, agriculture, infrastructure, social services etc.
- To promote rural development.
- Development into a basin remote area will counter the pull of large cities in favoured area.
- To decentralize planning and management and make it adaptive.
- To integrate environmental dimensions with other aspects of planning and management.

4.3 TYPES OF RBDPM

- Single purpose
- Dual purpose
- Multipurpose
- Comprehensive
- Integrated

Single purpose

Early efforts were mainly single purpose for example flood control. Such approaches that involve just one purpose is said to be single purpose.

Dual purpose

This involves combining two development goals using a single methods. For example, a reservoir can be utilized for water supply and flood control.

Multipurpose

This seeks to pursue a number of goals. For example, a dam can be used for water supply, irrigation supply, flood control, electricity generation (UN, 1955).

Comprehensive

UN, (1967) defined this as a planned, complex, continuous and interdisciplinary process which is controlled on a system analysis bases. It considers both land and water resources development and how they inter-relate the goal being “optimal development of resources” (Theorp, 1986). Comprehensive RBDPM puts less emphasis on promoting human welfare than integrated RBDPM.

Integrated

This is sometimes regarded as comprehensive in some text. Integrated and comprehensive approach share;

- Adoption of a basin-wide program
- Comprehensive regional development
- Multipurpose development

Integrated approach is used for approach that goes further than comprehensive RBDPM in this ways;

- To actively use water as a tool for social and economic development (Falkenmank, 1981) or engine of development.
- To deal with relationships between basin activities, demands, needs e.t.c for example, construction of beaches as a resort and source of social and economic development.

4.4 PROBLEMS OF RBDPM

- Inability to control the whole basin
- Lack of baseline data and inadequate monitoring hinders RBDPM.
- Politics is another problem. It can determine who is to be employed, what is on the agenda and how RBDPM proceeds (Klare, 2001).

5.1 THREATS TO RIVER BASINS IN NIGERIA

Waste disposal (solid): This can form obstruction to water flow, causes sediment deposition and change physical, chemical and biological water characteristics.

Industrial effluent discharge: This can lead to water pollution and eutrophication.

Agricultural land inflow: This is the inflow of agricultural wastes and used chemicals by irrigation water back into the water system or by rain flooding into the water system.

Deforestation of riparian vegetation: This can make excess light energy reach the water surface and consequently cause over heating as a result of increased temperature and can cause photo-inhibition of biological growth.

Dredging: This is to make canals. It can result to deposition of sediments which form spoil banks. This obstructs the traditional water hydrology and water flow obstruction.

Invasive weeds: This includes water hyacinth, water lettuce, Typha etc. They block the water ways and obstruct hydrology. They increase sediment deposition in the rivers and can lead to formation spits over time. Invasion of river by invasive plants can also lead to dirt and migration aquatic animals.

Plate 3: River infected by invasive plant Source: (Achenyo, 2015)

Pipeline vandalism, rupture and consequent oil spillage. This leads to dirt of river basin organisms and reduces its utility to man. Oil coats the surface of the river body and reduces the ability of air to diffuse into the system.

Excessive water resources exploitation. Excess exploitation of river water such as use of river water for irrigation without a equal source of replenishment.

CONCLUSION

Nigeria is enriched with numerous river basin systems and the river basin resources in Nigeria should be properly and sustainably harnessed to enhance economic growth of the nation. Government must ensure effective policies and make implementations to ensure adequate planning, development and management of the basin areas for socio-economic and other benefits that can enhance the livelihood and growth of the nation.

REFERENCES

Achenyo, I., "The challenges for women entrepreneurs in Africa". *The Pride of Africa's women Entrepreneur*. p 1, 2015

Amusu, I. "Fisheries development and management in the river basins of Nigeria". *FAO Document Repositor* pp 1, 20-25, 1980.

Army Map Service, "Nigeria river map". *Updated in 2013.,* 1967.

Barrow, C. J. 1998. Development Planning and Management. *World development* 26(1): 1721-186.

Dasmann, R. F., Milton, J. P. and Freeman, P. H. "Ecological Principles for Economic Development". *London Academic press.* pp. 46-51, 1973.

Falkenmark, M. "Integrated view of land and water". *Geografisker Annaler,* vol 63A**,** pp. 261-271, 1981.

Klare, M.T., "The New Geography of Conflict". *Foreign Affairs,* vol 80, no. 4, pp. 49–61, 2001

Kraenzel, C. F., "The social consequences of river basin development". *Law and Contempory Problems,* vol 22, pp. 1-236, 1957.

Molle, F., "Development Trajectories of River Basins: A Conceptual Framework". *Water International,* vol 29, no. 1, pp. 70–80, 2006.

Molle, F., Philippus, W and Phil, H., "River Basin Development and Management". *Development and change,* vol 32 no. 4, pp. 40 52, 2007.

Newson, M., Land, "Water, and Development: Sustainable Management of River Basin Systems". *Scottish Geographical Magazine,* vol 104, pp. 56-66 , 1997.

Olawale, A., "Law, Water and Sustainable Development: Framework of Nigerian Law". *Law, Environment and Development Journal,* vol 89, pp 1-8, 2012.

River Basin Development Authority Act., "An Act to repeal the River Basins Development Authorities Act 1979 and establish the River Basins Development Authorities listed under the First Schedule to the Act". pp. 3, 1986.

Sneddon, C., "Water Conflicts and River Basins: The Contradictions of Comanagement and Scale in Northeast Thailand". *Society and Natural Resources,* vol 15 no. 8, 725–41, 2002.

Sophocleous, M., Interactions between Groundwater and Surface Water: The State of the Science. *Hydrogeology Journal,* vol 10, no 2, 52–67, 2002.

Teclaff, L.A., "Evolution of the River Basin Concept in National and International Water Law." *Natural Resources Journal,* vol 36 no. 2, pp. 359–91, 1996.

Thorpe, B. R, "Comprehensive basin management in England and Wales". *Water Supply,* vol 4, pp 9-13, 1986.

United Nations "Multiple Purpose River Basin Development. Part 1". Manual of River Basin Planning. ESCAFE Series, United Nations, New York. p. 6, 1955.

United Nations, "River Basin Development: Policies and Planning, Vol. I." *Proc. of a UN Interregional Seminar on River Basin and Interbasin*. UNDP/National Water Authority of Hungary, Washington, DC. pp. 16-26, 1976.