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Assessment of Water Use Pattern among the Member Nations of Niger Basin Authority

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***Abstract**: This work investigated the water use pattern of the member nations of the Niger Basin Authority. The Niger basin authority has its member nations as Nigeria, Cameroon, CoteD'ivoire, Guinea, Chad, Niger, Burkina Faso, Mali and Benin. The method used in this research is the survey research design where questionnaires and interviews were employed in obtaining data. Documentations, relevant literature and statutory bodies were consulted for necessary information. The research discovered that the member nations have massive arable land and the greatest part of their water is used for agricultural purposes with little or no water used for industrial purposes. The research revealed that the greater percentages of the populace reside in rural areas and they have poor access to safe water.*
***Keywords**: Water use, basin, water demand, water stress*

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I. INTRODUCTION

Water use pattern has been associated with the ranking of the economic and health status of any nation. Developed countries have be adjudged to enjoy bountiful supply of water that meet world health organization standards while developing nations are still wallowing in the inadequacy of water requirements which fall far below the international standards.

The member nations of the Niger Basin Authority are all developing nations and there is obvious need to investigate and determine empirical data on their uses of water for various purposes. These data will guide the appropriate organs of government and international bodies on how the water use of these nations can be upgraded and improved. In this research, the uses of water for the various needs will be limited to industrial, domestic and agricultural purposes.

1.1 NIGER BASIN Authority

Niger Basin Authority is an organization of West African states through which the Niger River transverse and it is charged with the responsibility of the management and development of activities that concern the river Niger. When translated in French it is called De L'autorite Du Basin Du Niger.

1.1.1 Origin of NBA

The conception of the idea to set up an organization that would promote the development of Niger River basin was dated back to the colonial period in 1950 with the establishment of the NigerStudies and Development Mission in Bamako. In 1963,the riparian states adopted the Niamey Act on "Navigation and economic cooperation, among River Niger Nations" with the focus of exploitation of the River Niger, its tributaries and sub-tributaries. Further transformation replaced the Niamey Act and the organization was named River Niger Commission on 25th November, 1964. The River Niger commission was saddled with the responsibility of encouraging, promoting and co-coordinating the studies and programs for the development of the Niger River resources. At the Lagos summit in January 1979, a decision was taken to substitute the river Niger commission with another organization with added responsibilities. This idea was implemented on 21th November,1980 in FaranahGuinea Summit and this gave birth to the Niger Basin Authority.

1.1.2 Member States of NBA

The member states of Niger Basin Authority with their capitals are Benin Republic (Cotonou), Republic of Burkina Faso (Ouagadougou), Republic of Cameroon, (Yaounde), Cote D'Ivorie (Abidjan), Republic of Guinea (Conakry), Republic of Mali (Bamako), Republic of Chad (N'djamena), Republic of Niger (Niamey) and Nigeria (Abuja). The N.B.A promotes cooperation among the member countries to achieve an integral development of the River Niger basin. The focus of the authority is mainly on hydrology, hydraulics, agriculture, animal rearing, fisheries, farming, forest exploitation, and sylviculture, transport and communication. The actual issue that cemented these nine nations together is the River Niger.

1.1.3 Management and Development

The regulation of water in River Niger is done partly through dams. There are two diversion dams vizSotubadam (downstream of Bamako) and the Markala dam (downstream ofSegou). These two diversion dams are used to irrigate 54,000 hectavres. The Kianjiand Jebba dams of Nigeria are used majorly for hydropower electricity generation.

The objectives of the Niger Basin Authority in managing the water resources include;

(i) Harmonization and co-ordination of national policies with regards to water resources within the basin.
(ii) Participation in developmental planning through the development and implementation of integrated development plan within the basin.
(iii) Promotion and participation in the design and exploitation of common works and projects.
(iv) Achievement of control and regulation of any form of navigation on the river, its tributaries and sub-tributaries.
(v) Participation in the formulation of requests for assistance and in the mobilization of funds for studies and works needed for resources development within the basin.

1.1.4 Water Charter of Niger Basin:

The water of the Niger Basin is a legal framework for the enforcement of solidarity and reciprocity order supporting the sustainable, equitable and co-ordinated use of all water resources within the basin. The water charter was approved by the Niger Basin Authority in April, 2008. This charter facilitates closer relationships and cooperation among states and nations in the basin.

In accordance to the charter the Niger River is an international water course including all its tributaries. The objectives of the charter include:

(i) Promotion and facilitation of dialogue and consultation among the nations in the design and implementation of programs and projects affecting or likely to affect the water resources in the basin.
(ii) Definition of conditions and modalities for the review and approval of new projects that are making use of water resources or likely to affect water quality.
(iii) To provide guidance for the principles and modalities of water resources allocation among the various use sectors, as well as sharing the benefits.
(iv) Definition of principles and rules governing the prevention and resolution of conflict associated with the use of water resources within the basin.
(v) Definition of modalities of participation of water users in the decision making process involved in the management of water resources.

1.2 WATER DEMAND

This is the quantity of water needed by the inhabitants of a particular community, country or region. It is an important datum required in the design of water supply systems. Whenever an engineer has a duty to design a water supply scheme for any society, it becomes a necessity for him to evaluate the amount of water required by the community. The engineer determines the quantity of available water in the community both surface and groundwater. This also involves population projection and the level of sophistication of the community under consideration. The purposes of water use are considered and this ranges from domestic, industrial, agricultural, fire, commercial, recreational, and aesthetic purposes.

1.2.1 Domestic Demand

This is water needed to address adequately all domestic purposes such as drinking, cooking, bathing, lawn sprinkling, gardening, sanitary, laundry etc. It is water required in a household and residential set up. The amount of domestic water consumption varies according to the class of the inhabitants, their level of technology, and other general living conditions. In a developed and affluent country more water is consumed in their rich living in air cooling, bathing in bath-tubs, dish washing of utensils, car washing, home laundries and garbage grinders. The total domestic water consumption usually amounts to 50 – 60% of the total water consumption.

1.2.2 Industrial Water Demand

This is water required by industries in both their ancillary and main operational processes to enable them turn out their products. For a community, the industrial demand is obtained by identifying the various industries and their water demands and determine the sum. The demand explains the necessity of planning cities and mapping out a certain area for industries. This arrangement makes it easier for the project future industrial water demands.

1.2.3 Agricultural Water Demand

This entails water necessary for the production of crops and rearing of animals. In advanced and well improved agriculture, irrigation systems are used to abstract water for the use of crops. The water demand is calculated by determining the water requirements of the crops and the acreage of the land to be irrigated.

1.2.4 Commercial Water Demand

This covers the water required by institutions, hospitals, hotels, restaurants, schools, colleges, universties, railway stations, offices and factories. This quantity of commercial water demand varies from city to city depending on its commercial status.

1.2.5 Fire Demand

Fire demand is the water required to put off fire resulting from any form of conflagration. In thickly populated cities, fire demand is a sin-aqua-non for the design of the water system and included in the reticulation of water. Mega cities maintain full-fledged fire fighting squads. A provision is made in public water supply schemes for fighting fire. The quantity of water needed for fighting fire should be readily available and stored in reservoirs for any emergency. Fire hydrants are control points on the main distribution water line through which water can be readily assessed for extinguishing fire. The fire hydrants are fitted on the mains at a distance of 100 to 150 apart. Fire fightingpumps are connected to the fire hydrants by fire brigade staff to enhance the pressure of the water so that the water can easily be extinguished.

1.4 WATER STRESS

It is an understatement to say that water resources in the Niger Basin is under stress due to increasing abstraction resulting from uncontrollable population rise. The issue of overwhelming climatic change is impacting negatively on the water resource availability within the basin.

1.5WATER USE IN NIGER BASIN AUTHORITY (NBA)

With regards to water uses, the Authority does not set any priority use. However, in an occasion of water use conflict special consideration is given to basic human needs. The withdrawals from the River Niger were mainly used for agriculture. It is the aim of NBA to create a situation where every citizen of the member nation will have access to safe and potable water.

In pursuance of this primary concern, the N.B.A has its primary objectives as:

(a) Harmonization and co-ordination of national policies for the development of resources.
(b) Participation in the planning, development and execution of an Integrated Development Plan for the Basin.
(c) Designing, achieving and maintaining common infrastructure and projects.
(d) Enforcing regulation of any form of navigation on the river, its tributaries and in conformity with Niamey Act.
(e) Participation in the formulation of requests for assistance and in the mobilization of funds.

1.5.1 Factors Affecting Patterns of Water Use

It is not easy to predict, water use because apart from related economic activity, population growth and other variables of water use, there are many unknown and poorly defined variables and the people's disposal to change. However, there are known factors that affect use of water namely, population number and distribution, technology, economics, environmental conditions, in stream and withdrawal uses.

Population and its distribution is directly related to water use. Quantity of water used by people is the product of population and per capita usage. People living in urban areas tend to have different patterns of water use and they tend to use greater quantities of water than people in the rural areas. Technology and changes in technology affect the quantity of water used, its availability and demand for it. Technological developments that permit users to economize water such as efficient indoor plumbing fixtures, close conduit irrigation systems, like drip and microsplinker system and computerized irrigation management techniques results in water use reduction. Economic conditions that are extraneous to a community can affect their use of water. Recent declines in the world price for cotton have caused sharp declines in the potential profits from irrigated cotton production and this in turn has prompted both political and economic impetus to reduce cotton plantations in Israel and substituted the plantations with dry land agriculture. Environmental conditions in the form of

increased rainfall or decreased evapotranspiration are likelyto compliment water supplies and reduced water required for irrigated agriculture. Also, it should be noted that global change is likely to have significant effects on regional watersupplies and demands. This concept on factors affecting the use of water cannot be complete without distinguishing in stream and withdrawal uses of water. Certain uses of water do not affect its availability for future use meaningfully, and do not affect the properties or quality of water to serve subsequent. Typical instances of instream uses of water include recreational uses (swimming) support of aquatic life, and other environmental uses such as navigation and generation hydroelectric power.

II. METHODOLOGY

2.1 DESIGN OF STUDY

The research method employed in this work is the survey research design. This method gave room for obtaining information from people considered to be the representative of the entirepopulation. Interviews and questionnaires were also used to solicit for information. Research assistances were used to obtain relevant information from some of the countries. Documentations on relevant information and data were obtained from existing literature and statutory bodies, including embassies.

2.2 AREA OF STUDY

The area of study comprised the nine member nations of Niger Basin Authority which included Benin Republic, Republic of Burkina-Faso, Republic of Cameroon, Cote D'Ivoire, Republic of Mali, Chad Republic, Niger Republic, and Nigeria. The map of the study area is shown in fig. 2.1

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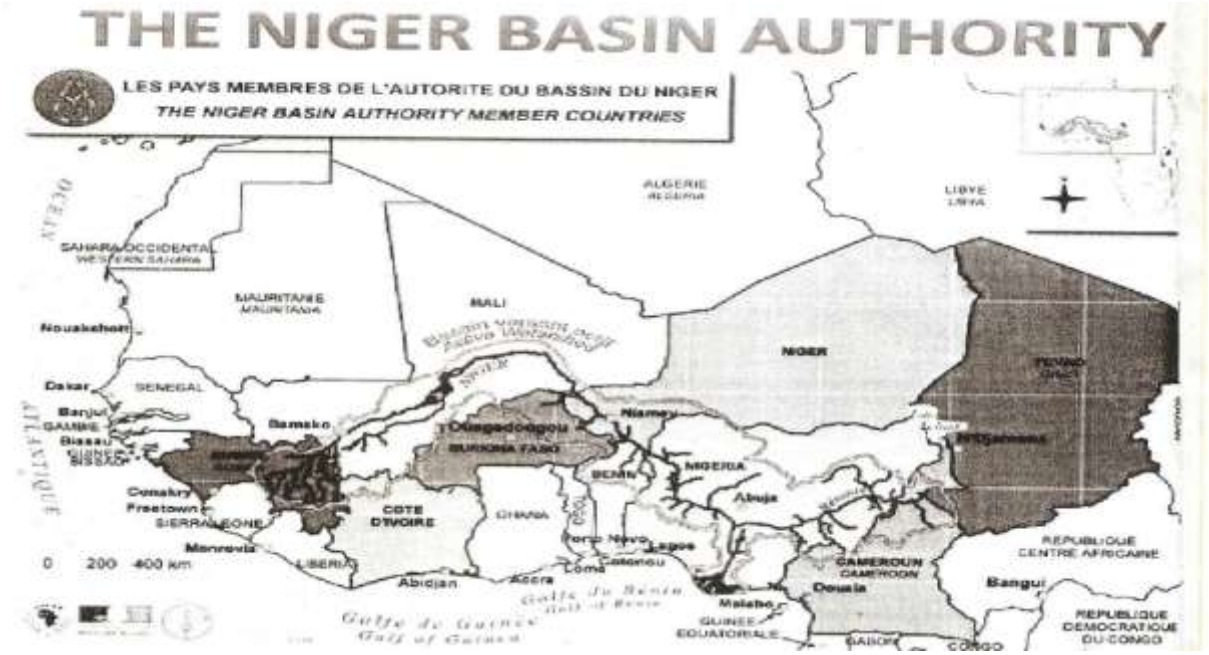

Fig. 2.1 Map showing the Study Area

2.3 NATURE OF DATA OBTAINED

The data obtained were the population of each country, land are and density, estimate of each country's withdrawal from River Niger, population of each country that has access to safe water in terms of urban and rural dwellers, the use of water in each country for agricultural activities, domestic and industrial purposes.

III. RESULTS PRESENTATION ANALYSIS

3.1 RESULTS PRESENTATION

The results presented include the population of each member nation with access to safe water, distribution of each member nation in terms of urban and rural population and the water use for agricultural, industrial and domestic purposes. The population of eachmember nation, the land area, urban and rural population are presented in table 3.1.

Table 3.1: Population, Land Area and Population Density of Member Nations of NBA.

S/N	Country	Population (P) (2017)	Urban Population (%)	Rural Population (5)	Yearly Change (%)	Land Area (Km^2)	Density (P/Km^2)
1.	Nigeria	191,835,936	47.8	52.2	2.59	910,902	211
2.	Cameroon	24,513,689	53.7	46.3	2.46	472,325	52
3.	Cote D'Ivoire	23,815,886	50.2	49.8	2.42	317,969	75
4.	Niger	21,563,607	17.7	82.3	4.10	1,268,447	17
5.	Burkina Faso	19,173,322	29.5	70.5	2.90	273,514	70
6.	Mali	18,689,966	36.5	63.5	3.06	1,221,566	15
7.	Chad	14,965,482	21.2	78.8	3.23	1,257,604	12
8.	Guinea	13,290,659	35.9	64.1	2.65	245,668	54
9.	Benin	11,458,611	43.3	56.7	2.61	112,782	102

Source:Worldometers, 2017

The water use status of the member nations with respect to the rural and urban populations was investigated and the results are presented in table 3.2.

Table 3.2: Member Nations Accessibility Status to Safe Water

S/N	**Nation**	Accessibility to Safe Water in Percentage	
		Rural Population (%)	**Urban Population (%)**
1.	Nigeria	35	65
2.	Cameroon	25	85
3.	Cote D'Ivoire	5	95
4.	Niger	30	70
5.	Burkina Faso	10	90
6.	Mali	22	78
7.	Chad	55	45
8.	Guinea	30	70
9.	Benin	26	74

Source: Field Works.

The water withdrawals from the Niger River with respect to the various uses of agriculture, industries and domestic utilization were assessed and the results are presented in table 3.3.

Table 3.3: Water use Patten among West African Nations

S/N	**Country**	**Water Use Pattern (%)**		
		Domestic (%)	**Industry (%)**	**Agricultural (%)**
1.	Nigeria	22	8	70
2.	Cameroon	21	6	73
3.	Cote D'Ivoire	22	15	63
4.	Niger	7	0	93
5.	Burkina Faso	12	2	86
6.	Mali	10	2	88
7.	Chad	19	0	81
8.	Guinea	9	3	8
9.	Benin	30	24	46

3.2 DISCUSSION AND ANALYSIS

Population and land mass have much influence on water use. When a nation has a comparable large area, it means that there is the possibility of using good portion of the land for agriculture and also a high population, demands much water for domestic purposes. For instance in table 3.1, it would be observed that Niger Republic which has a large land area of 1,268,447km^2 needs much water for agricultural purposes than it may need to take care of its population. Nigerian on the other hand needs much water to carter for its high population 191,835,936, more than it would need for het land area.

In table 3.2, it can be observed that the urban areas of the members nations except Chad have more access to safe water than the rural areas. This is due to the concentration of water infrastructure and increased potable water to these urban cities. Conversely, it is observed that accessibility to safe water is very poor in the rural areas where the majority of the citizens reside. From table 3.1, it can be deduced that greater percentage of the citizens live in the rural areas than in the urban citizens. It is very significant to note that in Niger Republic, 82.3% of citizens live in the rural areas. A histogram has been applied to enhance the understanding of accessibility to safe water among the urban and rural areas in the Niger Basin Area of authority. This is shown in fig. 3.1.

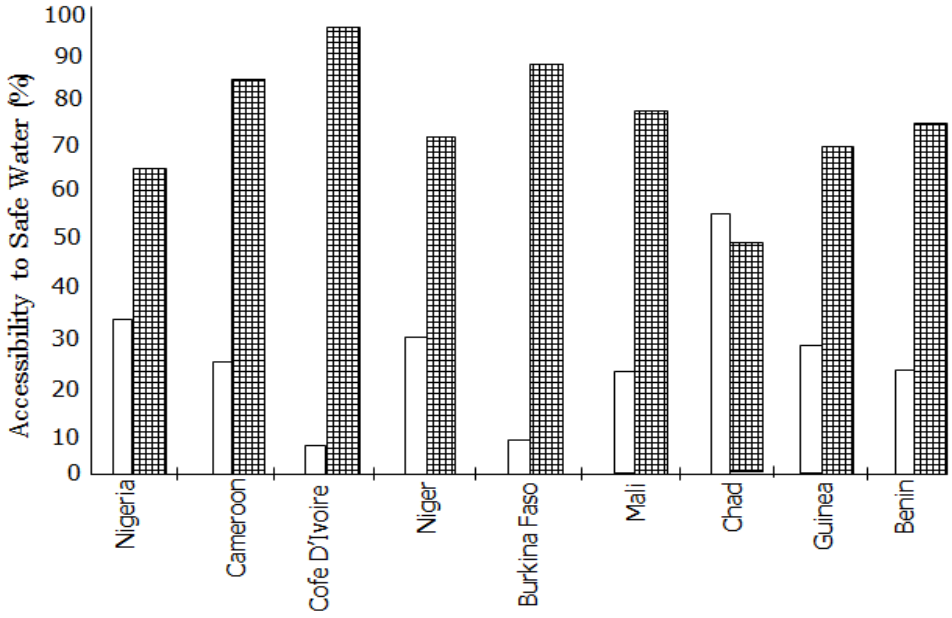

Fig. 3.1: Accessibility to Safe Water Among Rural and Urban of NBA Member Nations.

From table 3.3, it can be deduced that the water usage pattern of member nations is such that the greatest water is used for agricultural purposes. Niger, Mali and Guinea use the greatest percentage of their water for agriculture to the tune of 93%, 88% and 88% respectively. The usage is concentrated on withdrawals made from the Niger River. This is also suggestive that the River Niger is playing significant roles in the agricultural development of the member nations. More water is used for domestic purposes while the least water used is for industrial purposes. Apart from Cote D'Ivoire and Benin Republic which uses 15% and 24% of their withdrawals for industrial purposes, all other member nations use less than 10% of the withdrawals for industrial purpose. For a clear picture of the relationship of the usage of water among member nations, a histogram is provided in fig 3.2.

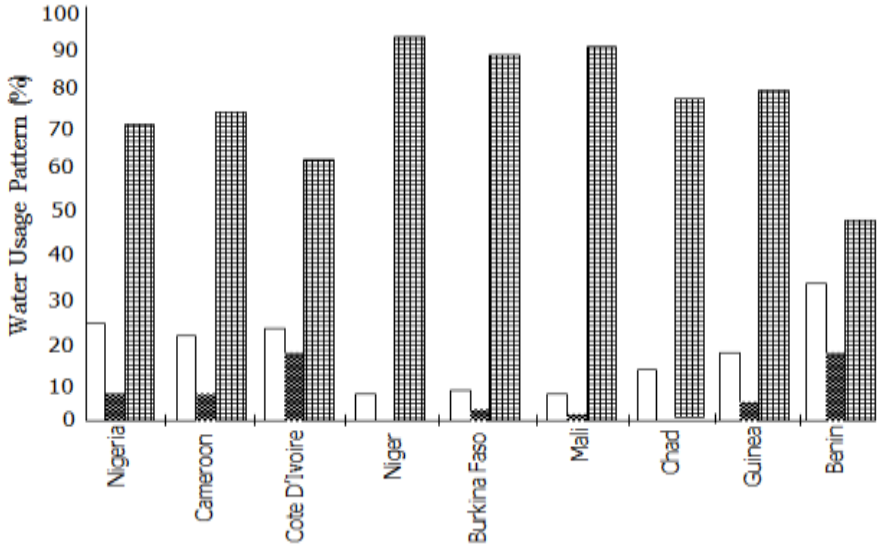

Fig. 3.2: Water Uses Pattern Among Member Nations

IV. CONCLUSION AND RECOMMENDATIONS

Water usage pattern among the member nations of the Niger Basin Authoritycan be said to lopsided as it is only in the areas of agriculture and domestic utilization that the water is mostly applied. The industrial application of water is still lagging behind among the member nations. It can also be understood from the research that the accessibility of safe water by the rural areas is highly inadequate and it needs great improvement.From the work, it was revealed that more than 90% of water withdrawals from the Niger Riveris used for agriculture. From the results of this research, the following recommendations are made:

1. Application of water for industrial purposes among the member nations should be upgraded and enhanced.
2. Water infrastructure and the supply of potable water should extended to the rural areas where the majority of the citizens of the member nations reside.
3. Drift to urban cities in these member nations should be discouraged as the scenario imposes much pressure on the water infrastructure in these urban cities.This can be done by improving the living conditions in the rural areas.

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