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Inventory Of Existing Rural Water Supply Sources Using Model Nigerian Communities Vis a Vis Household Access to Improved Water

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Abstract: *A household is considered to have access to basic services required by a family unit in Nigeria if the household has water supply and sanitation facilities, which are used appropriately at all times. A comprehensive inventory of all water sources was conducted in 12 Local Government Areas (LGAs) of four States of Bauchi, Benue, Jigawa and Katsina States between 2011 and 2012; the data was used to relate access to basic services of the people to the population living within the communities studied. It was found that Katsina State had the largest number of solar powered water supply systems (40.3% of all motorized water sources in the State) followed by Bauchi with 36.4%. The most common improved rural water source in the LGAs was bore-holes with hand-pumps (82.28%). Functionality was also monitored. For hand-pumps, there was a relationship between community ownership and functionality (Dass-Bauchi 77.17%; Warji-Bauchi 75.15%; Oju-Benue 82.09%). Population data on each LGA used to analyse the percentage number of household using the improved water sources showed that all the four LGAs still fall short of the basic access of 30 litres per capita per day within 250 metres radius of the water source. It was recommended that roles of stakeholders on Operation and Maintenance should be established while Capacity building at various levels is ensured towards achieving sustainable water supply systems.*

Key words: *Functionality, Household, Improved Water Sources, Rural Water Supply, Sustainable*

I. Introduction:

Nigeria with a population of over 140 Million people [1] has a critical challenge of meeting basic needs of food/ water and shelter for the people which if met, will ultimately translate to a strong and healthy nation. Health which is not just the absence of diseases but also physical, mental and social well being of the people is achieved by the improvement of health and quality of life of community members.

The smallest unit of any community is the family of which primary focus is on the household within which the family dwells (shelter). A household is considered to have access to basic services required by a family unit if the household have water supply and sanitation facilities, which are used appropriately at all times [2].

Water has been a very important factor in settlement development in any country, it usually serves as a major factor to areas where houses are built and communities develop, it also serves as human settlement boundaries. The relationship between water and dwellings cannot be over-emphasized, in any settlement; access to improved water supply contributes to the well being of the dwellers. Access to improved water supply in rural areas is defined in this paper as the availability of at least 30 litres of improved, safe water per person per day within 250 metres of user's dwelling [3].

This paper focuses on the survey conducted in rural areas of 12 Local Government Areas (LGAs) with a complete inventory of water sources in the 12 LGAs of 4 of States – Katsina, Jigawa, Bauchi and Benue. The 4 States were selected States to participate in the UNICEF Nigeria supported 'Sanitation, Hygiene and Water in Nigeria (SHAWN)' project. The survey focused on the determination of the total number of improved water sources in the States, the functionality of the water facilities, determination of the status of Village Level Operation and Maintenance (VLOM) for all the water sources.

The information collected and analysis of data are to be used 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 developed to support increase of access to services by the timely use of information presented.

II. Literature Review:

The National Water Sanitation Policy [2] defined the following terms: Household, Access, Affordable and Sustainable as follows:

- Household- A family unit shall be 8 persons living together.

- Access- All households and public places have water supply and sanitation facilities, which are used appropriately at all times.
- Affordable- The ability of households to own, operate and maintain water and sanitation facilities, without a major disruption in their expenditure pattern.
- Sustainable- The ability of a water and sanitation delivery facility or system to continuously ensure user satisfaction at all times without jeopardizing the ability of future use.

The National Water Sanitation Policy [2] also defined Access to Water Supply as follows: Access to Water Supply**:** The availability of at least 30litres per person per day of improved water supply from a source within 250 metres of user's dwelling.

Improved Water Supply**:** Technologies including: Household Connections, Public standpipes, Borehole, Protected dug Well, Protected Spring, and Rainwater harvesting.

Not- Improved Water Supply**:** The following technologies are considered "not improved": Unprotected well, unprotected spring, Vendor-provided water, Bottled water, Tanker truck-provided water, Streams and ponds.

The terms Rural Areas, Small Towns and Urban Areas are defined as in table 1:

Table 1: Description of Areas in Terms of Population

Classification	Description
Rural Areas	Settlements with a population of less than 5,000 people.
Small Towns	Settlements with populations between 5,000 and 20,000 people.
Urban Areas	Towns with a population more than 20,000 people in a settlement.

Per capita consumption of domestic water for Rural, Small Towns and Urban Areas are given as follows:

- Rural Areas = 30 litres/capital/day,
- Small Towns = 60 litres/capital/day,
- Urban Areas = 120 litres/capital/day.

Basic service means a protected, year-round supply of 30 litres per capita per day basic minimum preferably within 250 metres of the community and not exceeding 500 metres, serving about 250 persons per outlet. Higher levels of service are encouraged.

A rural water supply scheme is defined as a simple scheme serving a population of less than 5,000 people.

A semi-urban water supply scheme is defined as a scheme providing water to population between 5,000 to 20,000 people.

An urban water supply scheme is defined as that providing water to a population larger than 20,000 people.

The Water and Sanitation Programme [4] promotes the Self Supply Concept especially for the rural areas. Self supply schemes build on the desire of individuals to invest in solutions that benefit households directly, rather than as members of larger groups with less direct control. The components include traditional sources and rainwater harvesting, improved water quality (through source protection, improved water collection and storage practices, and household water treatment); improved water lifting for productive use. Self supply offers choice of technology, progressive upgrading, and replicability with little dependence on outside funds, enabling rapid and significant improvements to the lives of millions of people.

Self Supply Concepts:

These are simple concepts with the technologies as far as possible replicable with minimum dependence on outside resources, encouraging local investment in systems over which investors have direct control.

• The application of minimum design standards can form the basis for phased and affordable improvements in supply, especially in areas of low population density.

• Local artisans and contractors provide safe water supplies, easier water- lifting devices and promote low-cost options.

• Where possible, linkage is made to economic benefits as well as health benefits, increasing the perceived value (and therefore sustainability) of water supply.

• Management is maintained within naturally developed groups, usually the household or existing source user group, and has access to adequate, unbiased information, empowering them to make choices and solve problems.

Access to improved water supply in rural areas has been relatively low compared to access in other areas in Nigeria. The WHO/ UNICEF Joint Monitoring Programme report [5],shows that Nigeria recorded an increase in the use of improved drinking water sources in rural areas from 30% to 43% between 1990 and 2010, while the total improved national figures for country increased from 47% to 58% between 1990 and 2010. The national total percentage of household population using improved drinking water sources in Nigeria stands at 55% as at 2011 [6].

III. Materials and Method:

A comprehensive inventory of all water sources was conducted in 12 LGAs of four States of Bauchi, Benue, Jigawa and Katsina States between 2011 and 2012. A data collection tool that can then be incorporated into routine data collection was developed in the form of a questionnaire. This tool was administered and raw data collected from the field was cleaned and analyzed. The survey questionnaire was designed to capture information on various issues such as inventory of all water sources, ascertain the functionality of the improved water sources in these 12 LGAs, ascertain the status of Village Level Operation and Maintenance (VLOM) of these sources [7].

The study areas of 12 LGAs in four States are rural areas in Nigeria. Housing type in these areas are bungalow, Mud houses with thatched roofs, Mud houses with Corrugated Roofing sheets and Sandcrete block houses with corrugated roofing sheets as peculiar to rural areas. Figure 1 shows the map of Nigeria with the four selected States highlighted. The participating Local Government Areas (LGAs) for each State is as follows:

Bauchi State: Dass, Gamawa and Warji LGAs
Benue State: Konshisha, Ogbadibo and Oju LGAs
Jigawa State: Birnin Kudu, Birniwa and Roni LGAs
Katsina State: Bakori, Kaita and Maiadua LGAs

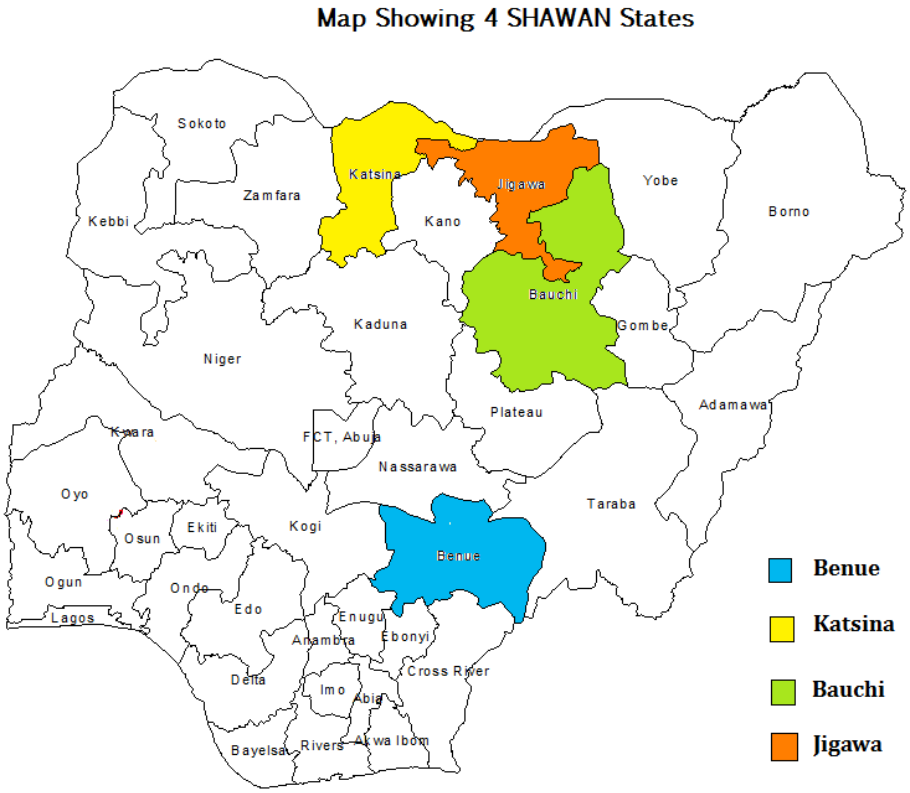

Fig. 1: Map of Nigeria showing 4 selected States for inventory

IV. Results:

Tables 2 to 9 give the results on the inventory of the improved water sources.

Table 2: Total Number of Improved Water Sources In 12 LGAs

State Name	Total	Handpump/ Borehole		Handpump/ Dug Well		Motorized Borehole		Piped water		Rain Water Harvesting		Details not Captured	
Bauchi	733	608	82.95%	13	1.77%	110	15.01%	-	-	-	-	2	0.27%
Benue	444	341	76.80%	1	0.23%	34	7.66%	3	0.68%	65	14.6%	-	-
Jigawa	1,329	1174	88.34%	41	3.09%	111	8.35%	1	0.08%	-	-	2	0.15%
Katsina	558	340	60.93%	3	0.54%	206	36.92%	2	0.36%	-	-	7	1.25%
Total	**3,064**	2463	80.39%	58	1.89%	461	15.05%	6	0.20%	65	2.12%	11	0.36%

Table 3: Source of Energy for Motorized Boreholes							
		Generator Powered		Electricity Powered		Solar Powered	
State Name	Total No. of MBHs	No.	%	No.	%	No.	%
Bauchi	110	64	58.18	6	5.45	40	36.4
Benue	34	30	88.24	1	2.94	3	8.8
Jigawa	111	88	79.28	3	2.70	20	18.0
Katsina	206	119	57.77	4	1.94	83	40.3
Total	**461**	**301**	65.29	**14**	3.04	**146**	31.7

Table 4: Primary Use of Improved Water Sources by Households					
State Name	Total WS	Drinking	Domestic	Gardening	Building Blocks
Bauchi	733	96.59%	96.32%	26.33%	43.66%
Benue	444	92.12%	91.44%	16.22%	34.46%
Jigawa	1329	98.50%	94.43%	20.32%	55.68%
Katsina	558	91.22%	72.94%	19.00%	46.59%
Total	3064	95.79%	90.54%	20.92%	48.07%

Table 5: State Wide Water Source Functionality For Improved Water Sources					
State	Total	Functional Water Sources		Non-Functional Water Sources	
		No.	%	No.	%
Bauchi	733	513	69.99	220	30.01
Benue	444	327	73.65	117	26.35
Jigawa	1,329	1,116	83.97	213	16.03
Katsina	558	277	49.64	281	50.36
Total	**3,064**	**2,233**	**72.88**	**831**	**27.12**

Table 6: State Wide Handpump Water Source Functionality							
State	Total No. of HP and HP with DW	Functional HP/HP with DW		Non-Functional HP/HP with DW		Not available Data	
		No.	%	No.	%	No.	%
Bauchi	621	440	70.85	180	28.99	1	0.16
Benue	342	253	73.98	89	26.02	-	-
Jigawa	1,215	1,024	84.28	191	15.72	-	-
Katsina	343	158	46.06	184	53.64	1	0.29
Total	**2,521**	**1,875**	**74.38**	**644**	**25.55**	**2**	**0.08**

Table 7: State Wide Motorized Borehole Functionality							
		Functional		Non-Functional		Not Available	
State	Total No. of MBH/PWS	No.	%	No.	%	No.	%
Bauchi	110	71	64.55	39	35.45	-	-
Benue	34	12	35.29	22	64.71	-	-
Jigawa	111	89	80.18	21	18.92	1	0.9
Katsina	206	119	57.77	83	40.29	4	2.88
Total	**461**	**291**	63.12	**165**	35.79	**5**	**1.89**

Table 8: Management/ Ownership of the Water Source						
State Name	Total No. of Water Sources	Institution involved in Water Source Management (%)				
		Community	Individual	Government	NGO_INGO	Details not captured
Bauchi	733	73.12	6.96	10.15	0.14	9.63
Benue	444	70.68	14.41	6.53	0.45	7.93
Jigawa	1329	73.47	6.05	17.99	0.38	2.11
Katsina	558	67.20	7.17	25.27	0.36	-
Total	3064	71.11	8.65	14.99	0.33	-

Table 9: LGAs with High Number Of Functional Handpumps			
Bauchi -LGA	% Functionality	Benue - LGA	% Functionality
Dass	77.17	Konshisha	70.42
Gamawa	65.23	Ogbadibo	68.50
Warji	75.15	Oju	82.09

V. Discussion:

The improved water supply facilities that exist in the States are boreholes with motorized pumps, hand pump boreholes/well, protected hand dug wells, pipe connection and rainwater harvester, a total of 3064

mechanised water facilities were found in the twelve LGAs covered in the four states of Bauchi, Benue, Jigawa and Katsina as presented in table 2.

Also, table 2 shows that in Benue State, rain water harvesting (RWH) accounted for 14.6% of all improved water sources in the State. All other States had no rain water harvesting structure in existence. Most common improved water source was bore-holes with hand-pumps (82.28%) followed by motorized systems (15.05%).

The majority of the MBHs were generator powered (65.29%), while 31.7% were solar powered. Katsina had the largest number of solar powered systems(40.3% of all motorized sources in the State), followed by Bauchi (36.4%) as presented in table 3.

Communities that depended on improved water sources as the main source for drinking and other essential household needs are more likely to succeed in Village Level Operation and Maintenance (VLOM). It was found that more than 90% of the water facilities are the main source of drinking water for the communities as presented in table 4. Table 8 shows that most of these communities manage these water sources which increase the sense of ownership for the water sources.

Table 5 shows that more than of 70% of the mechanized water facilities were functional across the four States with Jigawa having the highest functionality of 83.97% and Katsina having less than 50% of its water sources functional.

Handpump/Hand dug well water source functionality was found to be more than 70% with Jigawa state having the highest of about 84% and Katsina at lowest at 46% as presented in table 6. Table 9 shows LGAs with high percentage functionality of handpumps. It can be seen from tables 8 and 9 that there is also a relationship between community ownership and functionality (Dass-Bauchi 77.17%; Warji-Bauchi 75.15%; Oju-Benue 82.09%).

63.12% of motorized schemes were found functional. Jigawa State functionality for motorized schemes was highest at about 80%. Benue state which had the lowest number of motorized schemes as compared to the other states, also had the lowest functionality of 35% as presented in table 7.

In relating the number of improved water sources in communities to the population served, population figures from the National Population Commission [1] for Local Government Areas in States are presented in Tables 10 to 13.

Table 10: Population in 3 LGAs of Bauchi State

LGAs	Population of LGA
Dass	72,153
Gamawa	260,051
Warji	84,450
Total	416,654

Bauchi State has a total of 733 improved water sources in the 3 selected LGAs (Table 2) with at total population of 416,654 people, this gives an average figure of 568 people to an improved water source.

Table 11: Population in 3 LGAs of Benue State

LGAs	Population of LGA
Konshisha	227,573
Ogbadibo	139,870
Oju	160,781
Total	528,224

Benue State has a total of 444 improved water sources in the 3 selected LGAs (Table 2) with at total population of 528,224 people; this gives an average figure of 1,190 people to an improved water source.

Table 12: Population in 3 LGAs of Jigawa State

LGAs	Population of LGA
Birnin Kudu	313,373
Birniwa	142,329
Roni	77,819
Total	533,521

Table 12 shows that the 3 selected LGAs in Jigawa State have a population of 533,521 people with 1,329 water sources; this gives an average figure of 400 people to an improved water source.

Table 13: Population in 3 LGAs of Katsina State

LGAs	Population of LGA
Bakori	198,985
Kaita	149,852
Maiadua	207,442
Total	556,279

Katsina State has a total of 558 improved water sources in the 3 selected LGAs (Table 2) with at total population of 556,279 people; nearly 1,000 people depend on an improved water source.

VI. Conclusion:

Results show that based on the definition of Basic service in rural areas which means a protected, year-round supply of 30 litres per capita per day basic minimum preferably within 250 metres of the community and not exceeding 500 metres, serving about 250 persons per outlet, access has to be improved in all the 4 States studies as non of the LGAs had results of outlets serving an average of 250 persons per outlet.

Considering the definition of access and affordability, which requires all households and public places have water supply and sanitation facilities, which are used appropriately at all times and the ability of households to own, operate and maintain water and sanitation facilities, without a major disruption in their expenditure pattern, Nigeria has to increase intervention programmes to meet targets of all household having water supply and sanitation facilities.

It is therefore recommended that roles of stakeholders at different levels are identified and enabling environment created for roles to be played. In establishing a Village Level Operation and Maintenance (VLOM) of rural water sources, responsibilities, accountability and ownership at different levels must be established.
Capacity building at various levels to ensure continuous functionality of the systems should be provided to support increase to access of improved water sources which contributes to access in households.

VII. Recommendation:

Stepping up Community awareness in the study areas will provide the Community members the knowledge to demand for services the Government has put in Policies.
Creating awareness on different technology options best suited to LGAs will also enhance the ability of the Community members to demand for appropriate services.
Data presented in this paper should be used by the Government to plan for services in increasing access to improved water supply.
Roles of stakeholders on Operation and Maintenance should be established in Communities to help Community members own and maintain the water sources towards increasing functionality of the water systems.
Capacity building at various levels among the stakeholders must be ensured to bridge existing gaps in achieving sustainable water supply systems.

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APPENDIX – SAMPLE OF SURVEY QUESTIONNAIRE

Status (Tick for completed forms)		**Village / Town Code:**								
		Summary sheet form number				**Date**				

	General Information

State:	Code			LGA:	Code			Ward:	Code		
Community / Kindred Name:				GPS Location	Longitude					
Village / Town Name:					Latitude					
Location Name:					Altitude					

SrNo	Name of the interviewee	Sex	Age (in yrs)	Identity / status
1.		M / F		
2.		M / F		
3.		M / F		
	Contact Persons Details			
Name:		M / F		

Name of the enumerator:		**Code (A/B/C…)**	
Designation:	Enumerator 1	Enumerator	2
Signature		**Date:**	

MODULE – 1	Inventory of Water Sources in 4 States

Q NO.	QUESTION	CODING	SKIP TO
1.	Topography of area (Not to be asked. Observe and record.)	Hilly 1 Low Land / Leveled Land 2 Fadama 3 Any other (Specify)..... 4	
2.	Type of water source (Not to be asked. Observe and record.)	Handpump 1 Dug well with HP 2 Motorized Borehole 3 Piped Water Source 4 Rain water harvesting 6 Any other (Specify) 7	

Q NO.	QUESTION	CODING	SKIP TO
2-a	Who owns the water source?	Community 1 Individual / Private 2 Health Unit 3 Educational Institution 4 Religious Institution 5 LGA / State 6 Others (specify) 7	
3.	Year of installation (HP / boreholes)	☐☐☐☐ Not Available 9999	
4.	Whether water source is -	Seasonal 1 Perennial 2	
5.	Is the water source in use? (If currently, non-functional – ask whether water source was in use when functional?)	Yes 1 No 2	➔ QN 07
6.	If no, specify reason -		
7.	Distance of the water source from nearest house?	☐☐☐ Meters ☐☐☐ Ft	
8.	Is this the main source of drinking water for the people using it?	Yes 1 No 2	
9.	Population covered (estimated) –	☐☐☐☐☐ Persons	

Q NO.	QUESTION	CODING	SKIP TO
	Population using water source	☐☐☐ Households	
10.	Which are the other sources of drinking water available in your village? (Multiple options possible)	Hand-Pump 1 Motorized Borehole 2 Dug Well 3 Stream 4 River 5 Any other (Specify) 6	

MODULE – 2	Water Source Functionality

Q NO.	QUESTION	CODING	SKIP TO
1.	Type of water source	Handpump / Dug well with HP 1 Motorized Borehole / Piped water source 2 Rain water collection & storage 7 Any other (Specify) 8	 ➔ QN 03 ➔ QN 03
2.	Is the hand-pump functional? (Check the functionality of handpump)	Functional 1 Non-functional 2	➔ QN 06 ➔ QN 04
3.	Is the water source (motorized borehole / piped water / rain water harvesting system) functional?	Functional 1 Non-functional 2	➔ QN 06
4.	For how long has the water source system broken down? *(How many years / months / days long?)*		

Q NO.	QUESTION	CODING	SKIP TO
5.	Can non-functional water source system *(handpump / motorized borehole / piped water / rain water harvesting system)* be repaired?	Yes 1 No 2	Go to QN 15
6.	When last did the water source break down? *(How many years / months / days ago?)*	 Never broke down till now 8	 ➔ QN 10
7.	At that break down, how long did it take for water source to be repaired? *(Number of years / months / days)*		
8.	How often does it break down?	Weekly 1 Every month 2 Once in 03 months 3 Half-yearly 4 Once in a year 5 Any other (specify) ..... 6 Not sure / not specific timeframe 9	
9.	What are the common causes of breakdowns?	1. 2.	
10.	Last repair / maintenance done within – (Have you done any repairs till now – when was it?)	0-3 months 1 3-6 months 2 6M-1 year 3 > 1 year 4 Never repaired till now 5	 ➔ QN 13