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THE USE OF COMPOSITE WATER POVERTY INDEX IN ASSESSING WATER SCARCITY IN THE RURAL AREAS OF OYO STATE, NIGERIA

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Abstract

Physical availability of water resources is beneficial to man when it is readily accessible. Oyo State is noted for abundant surface water and appreciable groundwater resources in its pockets of regolith aquifers; as it has about eight months of rainy season and a relatively deep weathered regolith. In spite of this, cases of water associated diseases *and deaths have been reported in the rural areas of the state. This study attempts to conduct an investigation into accessibility to potable water in the rural areas of Oyo State, Nigeria via the component approach of water poverty index (WPI). Multistage method of sampling was applied to select 5 rural communities from 25 rural LGAs out of the 33 LGAs in the State. Data were collected through the administration of 1,250 copies of questionnaire across 125 rural communities. Component Index method as developed by Sullivan, et al (2003) was modified and used in this study. The results show that values of WPI were generally low, ranging from 11.29% in Itesiwaju LGA to 47.89% in Atisbo LGA out of 100% maximum obtainable; indicating that these rural areas are water stressed. The paper recommends aggressive human development efforts and the need for massive improvement in water infrastructure in the state.*

Key words: Water Poverty Index (WPI), Water accessibility, Rural Areas.

Introduction

Accessibility to water is a condition of uninterrupted contact and use of water for different purposes and it can be in terms of quality and cost of getting water for various uses. Access to water on the other hand entails varying types of quality and cost of getting water for use both spatially and temporally. Cost here is in terms of water price and time spent both vertically and horizontally to get water. Unequal distribution and access to natural resources may be due to resource scarcity, poverty and deprivation. Access to water has been an important issue, for example, scarcity of water is recently becoming an important phenomenon in view of its consequences on the lives and livelihood of people, water scarcity and water poverty are serious issues which have given rise to absolute poverty in many parts of developing countries.

Water use can be categorized into 5: drinking water, domestic water, food security needs, economic production and environmental needs. Water scarcity on the other hand can also be of 5 types: physical

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security, economic security, managerial security, institutional security and political security. Water Poverty describes a situation where a people cannot afford the cost of sustainable clean water to its citizens at the right quantity and time. It encapsulates the relationship between availability and access to water and the socio-economic status of an individual or group of people. People can be water poor in the sense of not having sufficient water for their needs either because it is not available; or due to walking a long distance to get to the nearest water point. Just like people are income poor, one may also be water poor, especially when water is available but people lack affordability (Lawrence, et al., 2002). According to Sullivan (2002) and Sullivan and Meigh (2003) a close association exist between income poverty and water poverty. Indeed, without adequate and efficient water supply, any measure to reduce income poverty may be unsuccessful.

Several indicators have been employed to quantify water accessibility and water scarcity, some of which are: Falkenmark indicator, human development index, social water stress index, water scarcity index, water resource vulnerability index, index of local relative water use and reuse, watershed sustainability index, water supply stress index, population growth impacts of water resource availability, water stress indicators, life cycle assessment, etc. Indeed, about 34 agri-environmental and 50 economic and social indicators have been documented (Gleick, 2002; Falkenmark, 1989; Anderson, 1991; Gleick, 1996; Salameh, 2000; Vidal, 2002; Molle and Mollinga, 2003; Asheesh, 2004), etc. According to Heidecke (2006) indicators do not provide sufficient details especially when working on water resource assessment on a smaller scale, despite the fact that a high level of detail is required for such an exercise (Feitelson and Chenoweth, 2002; Moll and Mollinga, 2003). However, out of the indices above Water Poverty Index has been fingered to be the most efficient tool. It is easy to calculate, easy to implement, it is based mostly on existing data, and it assist in priotizing water needs.

There are 5 approaches for computing WPI these are: composite index approach, time-analysis approach, a gap approach, Jarman

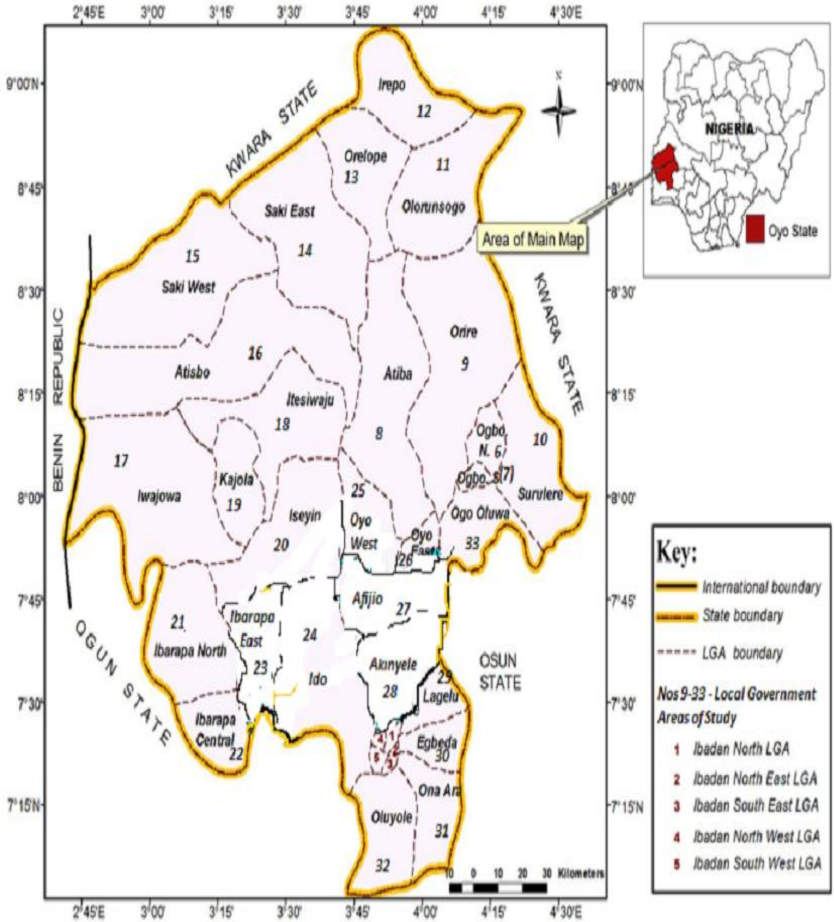
Index, pentagram and econometric (logit/probit) approach. The component method has often been criticized for incommensurability of some subcomponent data, however, in spite of this it has been adjudged to be comprehensive and it takes into account those factors that explain the situation of water poverty in a particular country or region (Yahaya et al., 2009). This present study will attempt the usage of water component method in estimating access to water in the rural area of Oyo state Nigeria.

Study area

Oyo state is located on latitude 07^{o} N to 09^{o} N and longitude 02.80^{o}E and 4.50^{o}E (Figure 1). The total population as at 2006 census was 5,591,589 (NPC, 2006). It has thirty-three (33) Local Government Areas (LGAs) out of which 25 are rural in nature.

Oyo State covers approximately an area of 28,454km^2 and it is ranked fourteenth by size in the country. The climate of Oyo State exhibits the tropical climate of averagely high temperature, high relative humidity and generally low rainfall maxima regimes during the rainfall period. Dry season lasts from November to March while wet season starts from March and ends in October. Rainfall amount varies from an average of 1200mm around Igbeti in the northern part of the State to 1800mm in Igbo-Ora and Ibarapa zone in the southern part. However, wet season is usually characterised by high f surface runoff with high humidity especially in the southern part of the State.

The landscape is largely undulating; the Yoruba and Kukuruku highland is quite prominent in the state. The rocks consist of old hard rocks and dome shaped inselberg hills, which rise gently from about 500metres in the southern part and reaching a height of about 1,219metres above sea level in the northern part around Igbeti.



It is underlain by metamorphic rocks of the basement complex, which outcrop over many parts. According to Asseez (1972), aquifers are of restricted vertical and lateral extent, but since the tropical climate affords the necessary conditions for deep and rapid chemical decay, thick, sandy clayey, lateritic overburdens serve as potential aquifers.

Oyo state is drained by rivers such as Ogun, Ofiki, Otin, Oba, Oyan, Sasa, Oni, Erinle and Osun , etc which all take their sources from the Yoruba highland.

Water supply situation in Oyo state according to Kehinde and Longe (2003) is below any acceptable standard. The records from the Water Corporation indicated that 233,485m^3 is generated daily by all water supply schemes in the state out of which about 55,080m^3 is actually supplied daily. The record further revealed that only 17.45% of households have piped water supply, but in Ibadan municipality 55% of households are linked to piped water supply. Thus over 56% of households in Oyo State have to obtain their water from unreliable sources. Existing total reservoir capacity in Oyo State is 630millionm^3, of which Ikere Gorge multi-purpose Dam alone contributes 565millionm^3.

A report by National Bureau of Statistics (NBS, 2009) showed that preventable diseases are common. For example, schistosomiasis increased from 25 reported cases in 2003 to 1107 reported cases in 2005, cholera increased from 157 in 2004 to 2768 in 2005 and typhoid from 484 in 2003 to 10,432 in 2005.

Methodology

Multistage sampling method was adapted in this study Sample Size was determined after Cochran's (1977) and Bartlett et al.'s (2001). Ten questionnaires were administered per village randomly selected households in each of the five rural communities selected from each local government area. The administration of the questionnaire was carried out during either early in the morning or late in the evening since rural dwellers spends most of their daytime on their farms or in their various daily or periodic markets. Five field assistants were engaged for the purpose of this work.

The composite approach will be adopted in this study. The structure of the WPI as developed by Sullivan et al., (2002) has five components which are combined in the expression (1) and defined in Table 1.

Table 1: WPI Components and their respective subcomponents

	Component	**Subcomponents**
i.	Resources (R)	Assessment of the availability of surface and underground water resources. Quantitative and qualitative evaluation of the, quality, variability and reliability of resources.
ii.	Access (A)	Access to clean water as a percentage of households having piped water supply, % of water carried by women, time spent in water collection, including waiting, reports of conflict over water use
iii.	Capacity (C)	Educational level, under five mortality rate, % households reporting water related illness, % households receiving pension
iv.	Use (U)	Domestic water consumption rate, livestock, industrial and agricultural water use.
v.	Environment (E)	% households reporting erosion on their land, reports of crop loss during the last 5yrs, and people's use of natural resources.

The composite approach is expressed by Sullivan 2002 as equation 1

Where:

w^i = the weight of the component ;

Xi = the component value; and

WPI = Water Poverty Index.

Each of these components has its own subcomponents which are also combined using the using the expression in 2 below:

The expression (2) is the weighted average of the five components (Resources (R), Access (A), Capacity (C), Use (U), and Environment (E)). Each of these components is first standardised such that the final outcome will range between 0 to 100%. In any LGA where WPI value is greater than 50% such has a fairly water advantaged position, where it is less than 50%, such location is water poor. Also, ArcGIS version 10.1 was used to generate water poverty map of the Oyo state.

Result and discussion

Water Poverty Index in Oyo State

a. Permissibly Poor

This sub group appear to have the highest access to water in the study area, with WPI of between 45-49% which is the highest in the study area. Atisbo LGA is in this category. This is in view of its high score of the WPI sub components such as resources (15.66) and access to water (14.29). The strong resource base in Atisbo LGA is expected in view of the fact that it is the food basket of the state, where food crops such as maize, cassava, etc are produced in commercial quantity. In addition, to food crops, tobacco is a common commercial produce crop in the LGA, with the British Tobacco having a strong presence. This suggests access to other sources of income. Azeez and Jimoh (2007) also reported a strong farmers union in the LGA. In addition, agro-forestry and gemstone mining are also important human activities. These show a relatively stronger level of livelihood. All these explain the relatively high WPI in the LGA, particularly in Ofiki town which is renowned for high economic activity. The previous experience of guinea worm infestation explains the presence of several public agencies sponsored boreholes in the area.

According to Table 2 and Figures 2 and 3 water poverty index (WPI) in the twenty five rural LGAs of Oyo state ranges between 11.29% in Itesiwaju LGA to 47.89% in Atisbo Local Government Area.

Table 2: **Water Components and Its Indices in the Rural Areas of Oyo State**

	Local Govt	Resources	Access	Capacity	Water Use	Environment	WPI (%)	Remark
1.	Itesiwaju	2.72	2.72	4.27	1.56	0.02	11.29	Extremely poor
2.	Surulere	8.98	3.83	1.33	0.80	0.32	15.26	
3.	Ibarapa North	6.34	6.90	2.45	3.23	0.03	17.52	Very poor
4.	Iseyin	9.13	4.26	2.68	2.29	0.50	18.86	
5.	Ibaarapa East	9.80	2.97	3.38	1.35	0.02	18.95	
6.	Shaki West	11.44	3.80	3.38	1.67	0.11	20.40	
7.	Iwajowa	10.69	4.24	3.62	1.67	0.37	20.59	
8.	Oriire	12.14	4.08	2.31	1.79	0.28	20.60	
9.	Lagelu	14.09	3.20	2.11	1.61	0.00	21.01	
10.	Ona-Ara	13.95	3.04	3.36	1.06	0.00	21.40	
11.	Irepo	10.66	5.23	3.54	2.62	0.18	22.23	
12.	Shaki East	13.73	3.33	3.53	1.59	0.08	22.26	
13.	Ibarapa Central	11.67	4.61	3.44	2.49	0.10	22.31	
14.	Orelope	14.56	4.34	2.81	1.98	0.37	24.06	
15.	Oyo West	13.66	4.35	4.53	1.62	0.02	24.18	

16.	Oyo East	11.42	6.04	4.13	3.05	0.00	24.64	
17.	Olorunsogo	11.39	3.79	3.74	5.12	1.06	25.10	
18.	Ido	8.58	8.71	3.28	4.47	0.24	25.28	
19.	Akinyele	15.93	3.93	4.47	1.94	0.08	26.35	
20.	Egbeda	15.69	5.62	4.61	2.06	0.11	28.09	
21.	Oluyole	14.54	7.16	4.74	2.45	0.03	28.92	
22.	Afijio	10.17	9.67	4.71	7.57	0.87	33.90	Moderately poor
23.	Kajola	11.00	10.69	5.91	6.47	0.49	34.56	
24.	Ogo-Oluwa	12.67	8.06	6.47	3.70	3.80	34.70	
25.	Atisbo	15.66	14.29	6.82	7.94	3.18	47.89	Permissibly poor

b. Moderately Poor

Access in this category ranges from 33.9 to 34.70%. Three LGAs are found in this category. They are: Afijio, Kajola and Ogo-Oluwa. These LGAs have a relatively strong resource base and have some level of access to water. Majority of people in these LGAs combined one or more employment with such as farming, trading and civil service. These 3 LGAs have high population of schools and large population of teachers and farmers; hence, they enjoyed a strong livelihood base. Yam flour business and Yam and cassava farming are dominant business particularly in Ogo- Oluwa which happens to supply these products to many western and northern Nigerian markets. Big national food stuff markets are found in many parts of these LGAs.

c. Very Poor

Twenty LGAs are found here of which values of WPI ranges between 18.86 in Surulere to 28.92% in Surulere to Oluyole LGAs. These categories of LGAs have relatively weak resource base and poor access to water and resources compared to what obtains in the two categories above. The residents are largely local farmers who depend mainly on food and seasonal fruits crops; peasant agricultural production is a common occupation in these LGAs. Access to water is as low as 3.83 in Surulere; water use is 0.80, the environment also scored low. In Oluyole LGA environment scored is as low as 0.03. Water use in these LGAs is mainly rural. All these are indications of high level of water scarcity.

d. Extremely Poor

Itesiwaju LGA is the only one in this category, it is the poorest in this category, resource base is the weakest in the 25 LGAs (2.72) while its access to water is also low (2.72), the score of the environment is also very poor (0.02). WPI is only 11.29. This suggests the need for government intervention in this LGA.

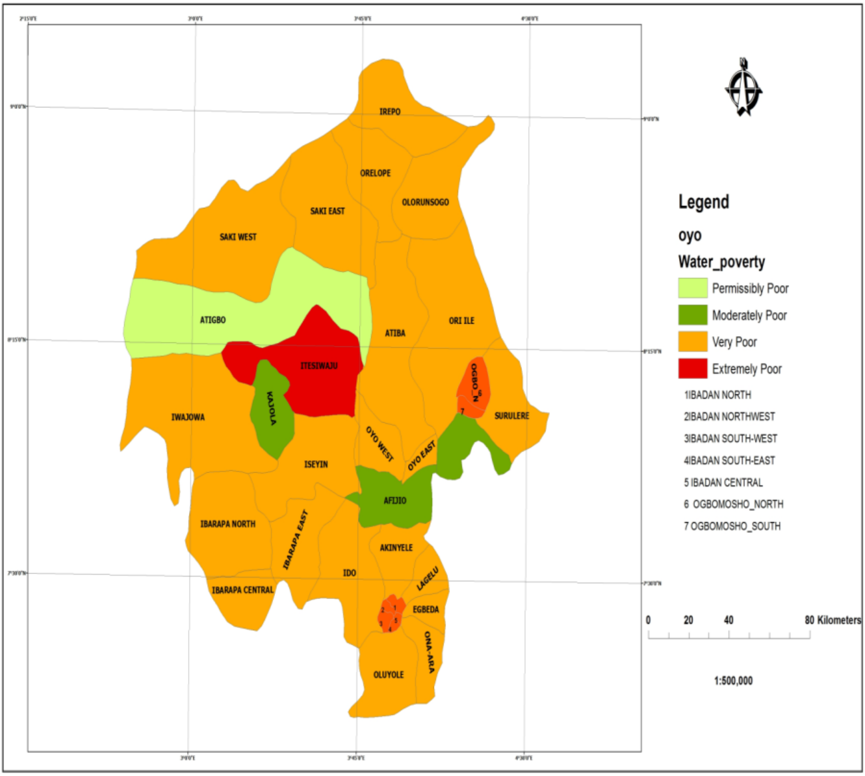


Figure 2: Pattern of Water Poverty Index

Conclusion

The results presented here indicated that the score of resources is generally higher for most LGAs compared to other components, suggesting the fact that water may be available but people are deprived of exploring the opportunity. For example, accessibility to water resources in the rural areas of Oyo State is poor (Table 2; Figure 3). The result showed that the rural areas of the state are experiencing water scarcity. Water use is mainly agrarian. This condition is worsened by low productivity, low income earnings, poor revenue generation and endemic spread of diseases and that a lot of man hour goes into searching for water. All these point to the fact that the problem of water scarcity is a management or rather a man made problem. The result presented in this study agrees with Alatise and Yahaya, et. al (2009) who both concluded that most of the LGAs in Ondo State are water stressed with WPI values ranging from 10.1 in Ese-Odo LGA to 17.8 in Owo LGA. This report agrees values from a number of west African countries such as Burkina Faso , Benin Republic, Niger, etc (Olhson ,1999; Lawrence, et al. 2002)

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