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EVALUATION OF WATER POVERTY INDEX IN ONDO STATE, NIGERIA

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ABSTRACT

An increasing world population exerts a continually growing demand on usable freshwater resource and matching the demand with supply of safe drinking water has resulted to serious social-economic constraints. Time and drudgery involved to access safe drinking resulted to loss of human capital, thus affects nearly every household activity. This paper focuses on the evaluation of Water Poverty Index (WPI) as an integrated tool veritable for all the local government areas in Ondo State of Nigeria to address their water sector. Simple time analysis and composite index approaches were employed to compute WPI values in all the sampled areas. Variables such as water resource, access to safe water, use of water and environmental impacts were considered. The ranking of WPI values from the two approaches shows that Ese-Odo is the most water-stressed with least WPI values of 10.1 points (composite index) and highest value of 1.4 minsl^{-1} (simple time analysis), while Owo, Ondo-West and Ose local government areas are less water stressed with WPI values of 0.55 minsl^{-1}, 17.8; 0.53 minsl^{-1}, 16.2; and 0.5 minsl^{-1}, 17.1 respectively. The results obtained indicate that constructive investment in water and sanitation improves Human Development Index (HDI). However, this paper concludes that to prevent the occurrence of virtual water situation and improve water supply, researches of this nature should be conducted from time to time and government at all levels should holistically address the problem.

Keywords: water poverty index, Ese-Odo, water stress, freshwater, access, dry, wet, season, household.

1. INTRODUCTION

During the last few years, water has become an increasingly important issue in developing nations. In order to attain the Millennium Development Goals of halving the population of people without access to safe water by 2015, integrated water management approaches are required. In monitoring the achievement of portable water at the local level, appropriate indicators are needed that allow measurement of progress of water sector for each community to be made (Claudia, 2006). However this situation is very complex to explain in a simple language, therefore an index has been found to be a feasible way to express such complex condition (Steven *et al*., 2002)

The Water Poverty Index (WPI) was identified as the possible indicator for monitoring progress at the local level as it puts access to water in a wider water-related context (Sullivan 2000, 2002). The index has been designed to identify and evaluate poverty in relation to water resource availability (Steven *et al*., 2002). Water shortages may relate to the inadequate ability of society to access the small volumes of water needed for drinking and domestic purposes. In most cases in developing world, women and children particularly girls spend most of their productive time trekking long distances sourcing for water. The evidence shows that women's livelihoods are constrained by being tied to sporadic and expensive water supply in urban slums or hours of water-fetching labour in rural areas (UNDP, 2004).

The World Bank's Global Monitoring Report states that although primary school enrolment rates are up, completion of primary schooling, especially for girls, remains a major concern. UNESCO reports that in one third of countries for which data was available, less than two thirds of children enrolling in primary education are reaching the last grade. Findings have shown that 1 in 10 girls still do not complete primary education (UNDP, 2004). Progress in health and education is dependent on access to affordable sanitation and safe water. Children, most especially (girls) educational prospects are similarly constrained. Public health systems are over-burdened by diarrheal diseases- the UN says that at anyone time; half the hospital beds in the developing world are occupied by patients suffering from diarrhea and other water related ailments (UNDP, 2004).

In analyzing the reasons for water problems, it is important to recognize that water scarcity can be considered in two ways. First order scarcity is the shortage of water itself, while second order scarcity is that resulting from lack of social adaptive capacity. The poor lack social adaptive capacity and this suggests that this aspect of development in the water sector is most pertinent to poverty alleviation (Sullivan *et al*., 2001a). Also, the poor frequently put affordable access to safe water and sanitation at the top of their priorities.

Due to the acute water-stress condition in most of the developing world, this paper attempts to develop integrated water management tool veritable in running mathematical- based model useful in arresting shortage of water supplies. For the purpose of the study, Composite Index and Simple Time analysis approaches are employed

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to develop and test the Water Poverty Index (WPI) in all eighteen local government areas in Ondo-State, Nigeria.

2. MATERIALS AND METHODS

2.1 Study area

Ondo-State is located in South-Western part of Nigeria, West-Africa between 7^0 14' North and longitude 5^0 8' East. The state has a surface area of 20,956 km^2 of which 2,020km^2 are covered by water. It shares boundaries with Kogi and Edo to the east, Oyo and Ogun and the south by the Atlantic Ocean as shown in Figure-1.

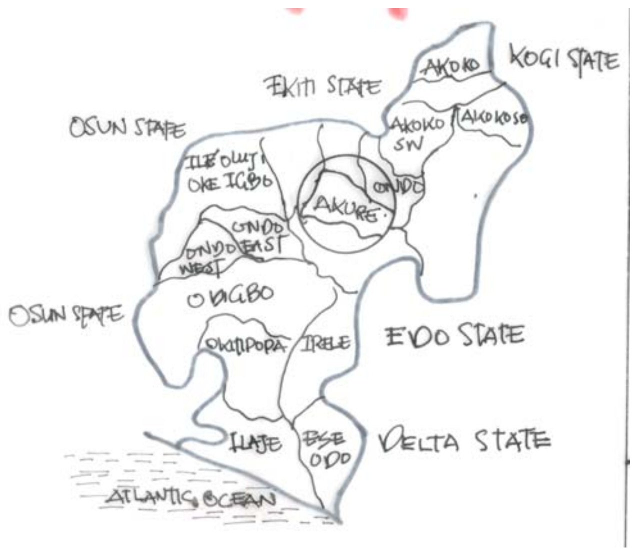

Figure-1. Map of Ondo State showing investigation locations.

The state has a population of 4,475,316 rising about 351m above sea level. Ondo-State enjoys tropical climate with two distinct seasons. These are the wet season (April-October) and the dry season (November-March). It lies in the rain forest zone with mean annual rainfall between 1300-1600 mm and with average temperature between 27.5^0-32.5^0C. The relative humidity ranges between 85% and 100% during the rainy season and less than 60% during the harmattan period. Several rivers run through the state, of which the most important ones are the Owena River in the east (150km), the Awara (120 km) and Ogbese River (20 km). There are other smaller rivers and lagoons across the state.

The WPI is mainly designed to provide a tool with which water engineers and managers can evaluate the water situation in different locations in a holistic way (Claudia *et al.,* 2005). However, in order to make strong comparison in the values of Water Poverty Index estimated in each of the selected communities, WPI values were computed using both adjusted Composite Index and Simple Time analysis approaches.

2.2 The composite index approach

In this approach, the index was constructed from a series of variables which captured the essence of what is being measured using national scale (Rodiya, 2007). A simple relationship was constructed for computing WPI taking into consideration all the key variables as follows:

$$WPI = W_a A + W_s S + W_t (100 - T) \tag{1}$$

Where A is the adjusted water availability (%). The value of A should recognize the seasonal variability of water availability), S is the population with access to safe water and sanitation (%) and T is the index to represent time and effort taken to collect water for the household and WPI is the water poverty index. For the purpose of this study, (T) was modified to take account of gender and child labour issues as follows: (100-T). Since A, S, T are all defined to be between 1 and 100; W_s, W_t is 0.25 by weight and W_a is given 0.5. Therefore,

$$W_a + W_s + W_t = 1.0 \tag{2}$$

The relationship in equation (1) is finally modified as follows:

$$WPI = \frac{1}{3}[W_a A + W_s S + W_t (100 - T)] \tag{3}$$

Where W_a, W_s and W_t are the weight given to A, S and T respectively.

2.3 Simple time analysis approach

WPI is constructed using bottom-up approach considering variables such as total time taken in collecting water including queuing time, volume of water collected in each trip. For the household with pipe borne water, the volume and time taken to collect water per head is assumed to the same across the members of the household. Using time-analysis approach, the index is determined as follows:

$$WPI = \frac{T}{V}(\min sl^{-1}) \tag{4}$$

Where T is the total time (in minutes) spent per person in a day to collect water, while V is the volume of water collected in litres.

Based on a reconnaissance survey of eighteen local government areas in Ondo-State, four most water-stressed towns in each of the local government areas were randomly selected for sampling purposes. Two hundred scientifically-structured questionnaires were randomly administered to 200 households in each of the 72 sampled communities in all the local government areas. Data obtained were subjected to statistical analysis to determine the following variables; percentage of people with access to safe water and not, water availability, total time spent to collect water and Human Development Index (HDI). Data were collected for wet and dry seasons for two consecutive years (2007 and 2008).

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2.4 Human development index (HDI)

The HDI gives a measure of social and economic progress which is built from an average of three separate indicators: life expectancy at birth; knowledge, as measured by the adult literacy rate (with a two-thirds weight) and the combined primary, secondary and tertiary gross enrolment ratio (with a one-third weight); and a decent standard of living, as measured by per capita GDP. HDI values for two consecutive years in all the local government areas were computed using Goalposts method of calculating the HDI developed by UNDP (2004) as follows:

$$\frac{X_i - X_{\min}}{X_{\max} - X_{\min}} = X_i^{\;1} \tag{5}$$

Where the X_i^1 for all three indicators are measured to derive the HDI, while X_{max} and X_{min} are the maximum and minimum values of standardized dataset of indicator component such as life expectancy, adult, GDP per capita, education, health etc.

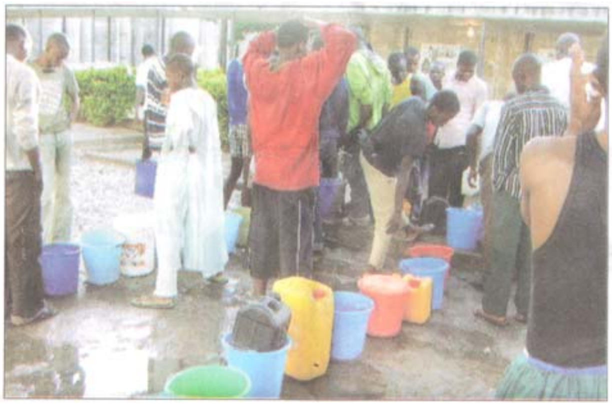

Plate-1. The students queuing for portable water from solar-powered borehole at Adekunle Ajasin University, Akungba, Nigeria.

Plate-2. A lady fetching water from traditional well.

Plate-3. Young girls queued up to fetch water from the municipal water supply.

Plate-4. Reticulated solar-powered borehole.

3. RESULTS AND DISCUSSIONS

3.1 Estimate of water poverty index using simple time analysis approach

From a test-bed of collected data in 72 water-stressed communities in all the 18 local government areas in Ondo-State, WPI values were calculated using composite index and simple time analysis approaches. The summary of the dataset, showing average mean, total volume of water collected (T_V), total time spent to collect water (T_T), total number of local government areas (LGA), is presented in Tables 1 and 2.

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Table-1. WPI values for all the local government areas in Ondo-State in wet season.

#	L.G.A	T_T (min)	T_V (litres)	WPI
1.	Akoko N-E	110	200	0.55
2.	Akoko N-W	130	200	0.65
3.	Akoko S-E	140	200	0.70
4.	Akoko S-W	110	200	0.55
5.	Akure-North	102	200	0.51
6.	Akure-South	105	200	0.53
7.	Ese-Odo	240	200	1.20
8.	Ifedore	130	200	0.65
9	Ifelodun	130	200	0.65
10.	Ilaje	226	200	1.13
11.	Ileoluji/Okegbo	130	200	0.65
12.	Irele	200	200	1.00
13.	Odigbo	180	200	0.90
14.	Okitipupa	150	200	0.75
15.	Ondo-East	125	200	0.63
16	Ondo-West	89	200	0.44
17	Ose	90	200	0.45
18.	Owo	100	200	0.50

Source: Field data

Table-2. WPI values for all the local government areas in Ondo-State in dry season.

#	L.G.A	T_T (min)	T_V (litres)	WPI
1.	Akoko N-E	120	200	0.60
2.	Akoko N-W	140	200	0.70
3.	Akoko S-E	135	200	0.68
4.	Akoko S-W	130	200	0.65
5.	Akure-North	130	200	0.65
6.	Akure-South	120	200	0.60
7.	Ese-Odo	273	200	1.40
8.	Ifedore	152	200	0.76
9	Ifelodun	150	200	0.75
10.	Ilaje	240	200	1.20
11.	Ileoluji/Okegbo	152	200	0.76
12.	Irele	216	200	1.08
13.	Odigbo	190	200	0.95
14.	Okitipupa	165	200	0.83
15.	Ondo-East	145	200	0.73
16	Ondo-West	106	200	0.53
17.	Ose	100	200	0.50
18.	Owo	110	200	0.55

Source: Field data

The results of water poverty index (WPI) obtained during wet and dry season using simple time analysis approach presented in Tables 1 and 2 showed that Ese-Odo local government has the highest value of WPI (1.20 minsl^{-1}), while Ondo-West has the least value of 0.44 minsl^{-1} during the wet season as presented in Table-1. It was also found that Ese-Odo local government still recorded highest WPI value of 1.40 minsl^{-1}, while Ose local government has the lowest WPI value of 0.5 minsl^{-1} during the dry season as presented in Table-2. This simple analysis shows that Ese-Odo local government is the most water-stressed region in Ondo State followed by Ilaje, while water stress was considered to be least at Ondo-West and Ose local government during wet and drying seasons respectively. During the consultation process, it was discovered that the dwellers derive their drinking water from a variety of sources such as; direct withdrawal from pond, streams and river, traditional wells of up to 1.5-2.0 m diameter with local construction, modern wells that are usually filled with concrete in order to prevent outside contamination and seepage flow and reticulated solar-powered boreholes of cleaner and high quality water. However, the presence of Owena multipurpose dam reduced the water-stress condition of Ondo-West, Ondo-East and Akure South local government. In addition, Awara dam serves Akoko N-E and some part of Akoko N-W, while Ose dam serves Owo and Ose local government areas as presented in Table-3. Aquifer in this region discharges sufficient amount of water which improves the yield of an average borehole in the above-named local government areas. Most of the faulty boreholes happened as a result of mishandling by dwellers, minor electric and mechanical problems which could be easily corrected by community project management team.

Table-3. Source of functional safe drinking water in Ondo-State.

#	L.G.A	No of solar-powered boreholes	No of hand pump boreholes	No of modern grouted wells	No of dams
1.	Akoko N-E	8	32	24	1
2.	Akoko N-W	9	26	22	-
3.	Akoko S-E	7	23	20	-
4.	Akoko S-W	10	33	25	-
5.	Akure-North	12	37	44	-
6.	Akure-South	10	30	40	-
7.	Ese-Odo	4	14	9	-
8.	Ifedore	8	23	21	-
9	Ifelodun	10	20	20	-
10.	Ilaje	5	20	14	
11.	Ileoluji/Okegbo	9	24	21	-
12.	Irele	6	22	17	-
13.	Odigbo	7	23	21	-
14.	Okitipupa	8	22	23	-
15.	Ondo-East	9	30	23	-
16	Ondo-West	10	35	28	1
17.	Ose	11	32	27	1
18.	Owo	12	34	30	-

Source: Data from the survey

Water from pond, stream, river, sea and traditional well is generally considered unsafe for drinking. Due to the presence of abundant salty seawater at Ese-Odo, Irele and Odigbo local government areas, development of surface and underground water becomes a problem. Despite the huge financial resource expended on provision of portable water at Ese-Odo and Irele local government areas, majority of the boreholes were not functioning and most of the functional ones are not very good for drinking as shown in Table-6. Finding also reveals that seepage of salty seawater into boreholes has contaminated most of the boreholes in the region and becomes highly unsafe for drinking. Thus, in turn make the development of underground water to be highly difficult and expensive. Converting seawater to safe drinking water either by desalination or any other processes has not been developed in this part of the world and this makes the exploitation of surface water impossible

3.2 Calculation of water poverty index using composite index approach

Composite index approach draws on the structure and methodologies used by the Human Development Index, and it is based on the combination of relevant variable components collected and summed, to an index, based on the range of values on each variable in that location (Steven *et al*., 2002). Several indicators have been used to describe water availability or access and composite approach focused on water stress, water productivity, or crop productivity (Claudia, 2006). The development of composite indexes combining these elements needs to be done in a transparent manner. To develop an appropriate and transparent indicator, standardized data set is required Due to the wide coverage of composite index approach; it is preferred to simple time analysis approach. Tables 4 and 5 show the computed WPI values for wet and dry season using composite index approach.

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Table-4. WPI values for all local government areas in Ondo-State during wet season.

#	L.G.A	Water availability (%) weight: 0.5	Access to water (%) weight: 0.25	T_{Index}	Index to time spent (100-T) weight: 0.25	WPI
1.	Akoko N-E	59.6	56.1	30.0	70.0	15.9
2.	Akoko N-W	28.7	53.2	35.0	65.0	14.6
3.	Akoko S-E	40.3	51.0	50.2	49.8	15.0
4.	Akoko S-W	45.9	49.8	56.1	43.9	15.5
5.	Akure-North	50.1	58.1	29.3	70.7	19.1
6.	Akure-South	57.8	63.2	28.6	71.4	20.9
7.	Ese-Odo	74.6	6.0	93.6	6.4	13.5
8.	Ifedore	33.2	50.1	49.9	50.1	13.9
9	Ifelodun	40.4	49.3	57.3	42.7	14.4
10.	Ilaje	71.8	10.0	91.6	8.4	13.5
11.	Ileoluji/Okegbo	60.2	39.8	75.0	25.0	15.4
12.	Irele	68.2	14.0	86.7	13.3	13.6
13.	Odigbo	67.9	16.0	80.1	19.9	14.3
14.	Okitipupa	65.5	18.0	75.3	24.7	14.5
15.	Ondo-East	43.4	55.2	36.7	63.3	17.1
16	Ondo-West	59.6	60.3	29.0	71.0	20.9
17.	Ose	50.2	68.3	25.0	75.0	20.3
18.	Owo	48.1	55.1	26.2	73.8	19.6

Source: Field data

Table-5. WPI values for all local government areas in Ondo-State during dry season.

#	L.G.A	Water availability (%) weight: 0.5	Access to water (%) weight: 0.25	T_{Index}	Index to time spent (100-T) weight: 0.25	WPI
1.	Akoko N-E	30.3	52.1	40.5	59.5	14.4
2.	Akoko N-W	25.1	49.6	46.9	53.1	12.7
3.	Akoko S-E	24.0	49.8	46.4	53.6	12.6
4.	Akoko S-W	22.6	42.3	50.1	49.9	14.5
5.	Akure-North	41.6	50.1	44.6	55.4	15.7
6.	Akure-South	32.6	60.0	35.4	64.6	15.8
7.	Ese-Odo	55.1	5.3	94.6	5.4	10.1
8.	Ifedore	29.6	48.2	48.9	51.1	13.2
9	Ifelodun	26.1	40.3	56.7	43.3	11.3
10.	Ilaje	50.3	10.2	82.4	17.6	10.7
11.	Ileoluji/Okegbo	45.6	33.2	65.9	34.1	13.2
12.	Irele	49.3	20.8	78.6	21.4	11.7
13.	Odigbo	37.2	30.6	68.9	31.1	11.3
14.	Okitipupa	45.3	30.1	69.6	30.4	12.6
15.	Ondo-East	40.3	51.6	42.0	58.0	15.9
16	Ondo-West	40.1	53.2	39.6	60.4	16.2
17.	Ose	40.1	60.2	35.2	64.8	17.1
18.	Owo	42.1	62.1	32.4	67.6	17.8

Source: Field data

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The comparison of water poverty index using the composite index approach in Tables 4 and 5 show that Akure-South and Ondo-West local government areas recorded highest WPI value of 20.9 (index point) each during the wet season. This indicator shows that the two local government areas experienced lowest degree of water stress. In addition, the water situation in Akure-South and Ondo-West can still be improved focusing on access to water, water availability and also on environmental aspects, particularly water recycling which have not been converted into use in these areas and Ondo State in general. Ese-Odo and Ilaje local government areas recorded the lowest WPI value of 13.5 (index point) each. The region is heavily water-stressed and special attention should be given to the use components and also to increase investment to improve access to water resource. The values of WPI obtained during the drying season period showed that Owo local government area has the highest value of 17.8 (index point), while Ese-Odo local government recorded the least value of 10.1 (index point). This development showed that Ese-Odo local government and its environs are strongly water-stressed at both dry and wet seasons, while Ondo-West, Ose, Owo, Akoko N-E, Akoko N-W, Akoko S-W, Akoko-South and Akure North are generally less water-stressed with fair access to safe drinking water at all season. The summary of HDI values computed for year 2007 and 2008 in all the local government areas are presented in Table-6.

Table-6. Ranking of human development Index in all the local government areas in Ondo-State.

#	L.G.A	HDI 2007	Ranking 2007	HDI 2008	Ranking 2008
1.	Akoko N-E	0.34	5	0.36	5
2.	Akoko N-W	0.30	7	0.33	7
3.	Akoko S-E	0.28	8	0.29	10
4.	Akoko S-W	0.34	5	0.35	6
5.	Akure-North	0.35	4	0.37	4
6.	Akure-South	0.35	4	0.41	3
7.	Ese-Odo	0.15	13	0.27	13
8.	Ifedore	0.30	7	0.31	9
9	Ifelodun	0.30	7	0.32	8
10.	Ilaje	0.19	12	0.22	14
11.	Ileoluji/Okegbo	0.30	7	0.33	7
12.	Irele	0.22	11	0.27	12
13.	Odigbo	0.24	10	0.28	11
14.	Okitipupa	0.25	9	0.31	9
15.	Ondo-East	0.32	6	0.38	3
16	Ondo-West	0.47	1	0.49	1
17.	Ose	0.41	2	0.43	2
18.	Owo	0.37	3	0.38	3

Source: Data from the survey

The ranking of computed HDI values showed that highest Human Development Index of 0.47 and 0.49 were obtained at Ondo-West in year 2007 and 2008, while lowest values of 0.15 and 0.22 were recorded at Ese-Odo and Ilaje local government areas for 2007 and 2008 respectively. Figures 2, 3, 4 and 5 show the relationship between Human Development Index (HDI) and Water Poverty Index (WPI) during dry wet and dry season for the year 2007 and 2008, respectively.

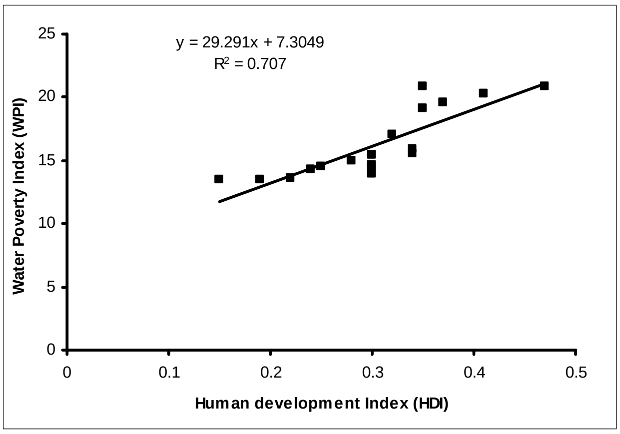

Figure-2. Relationship between WPI and HDI during wet season in 2007 using composite index.

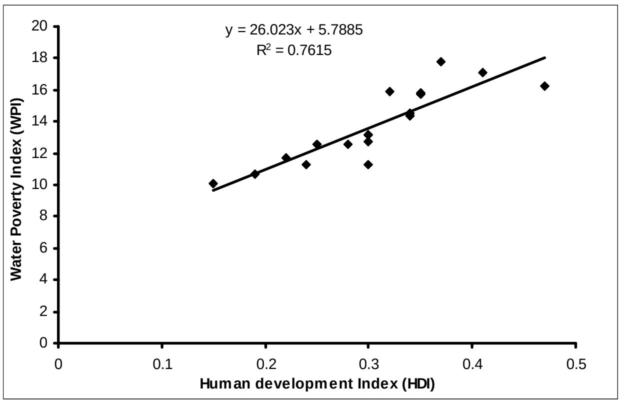

Figure-3. Relationship between WPI and HDI during dry season in 2007 using composite index.

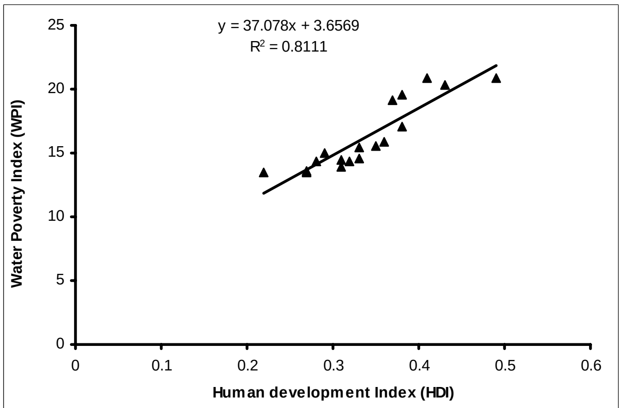

Figure-4. Relationship between WPI and HDI during wet season in 2008 using composite index.

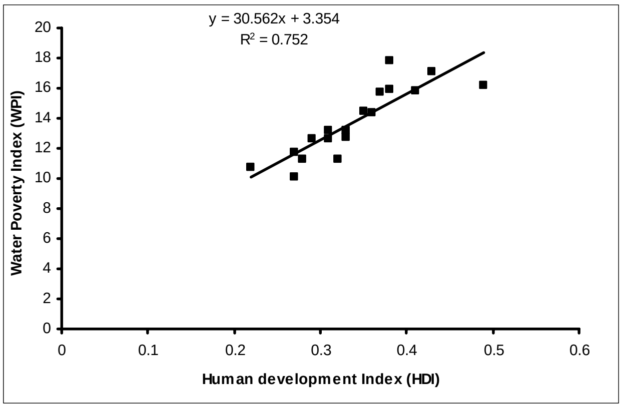

Figure-5. Relationship between WPI and HDI during dry season in 2008 using composite index.

The graphs show a gradual increase in WPI values with corresponding increase in HDI values for the two consecutive years during wet and dry season. This fairly strong relationship showed that increase in access to safe drinking improves social- economic and human development capacity of the communities. The increment of allocation spent on water and sanitation as presented in Table-7 resulted to increase in access to safe drinking water and Human Development Index (Table-6) in most of the local government areas in the state. The population of people that have no or poor access to safe drinking water was estimated for two concurrent years and the result in Table-8 shows that Ese-Odo was ranked to be the highest with 94.7% and 89.2%, while lowest values of 37.9% and 35.9% for the year 2007 and 2008 respectively. This also explains further the degree of water stress status at Ese-Odo local government area despite the financial commitment on the provision of portable water between year 2007 and 2008 by government at every level and some donor agencies. However, fairly accessibility of portable water at Owo local government area and its environs is not enough to satisfy the water demand of the dwellers and so more technical and financial commitment must be invested to improve the volume of safe drinking water and the percentage of dwellers that can access it. Analyzed data in Table-9 shows that the percentage of people that had no access to freshwater water reduced from 58.4% (2,613,584) to 54.8% (2,452,472) between the year 2007 and 2008, respectively. The reduction is strongly correlated to the investment in water and sanitation within the period of assessment.

Table-7. Ranking of investment in water and sanitation in all the local government areas in Ondo-State.

#	L.G.A	Investment (₦)	2007	Investment (₦)	2008
1.	Akoko N-E	80,333,245.16	8	89,769,240.23	9
2.	Akoko N-W	70,900,345.96	11	77,780,236.19	12
3.	Akoko S-E	63,567,176.00	15	65,467,105.19	18
4.	Akoko S-W	78,670,200.17	9	86,450,789.16	10
5.	Akure-North	88,540,070.33	7	99,765,129.26	8
6.	Akure-South	89,205,100.56	5	102,134,256.18	6
7.	Ese-Odo	90,105,255.13	4	105,452,245.10	4
8.	Ifedore	70,000,200.45	12	73,265,105.99	14
9	Ifelodun	68,900,245.12	14	73,451,243.86	13
10.	Ilaje	89,205,070.12	6	106,126,243.23	3
11.	Ileoluji/Okegbo	69,540,100.13	13	78,900,733.45	11
12.	Irele	59,240,100.43	17	70,106,345.67	15
13.	Odigbo	59,470,214.12	18	67,780,567.88	17
14.	Okitipupa	60,120,473.10	16	68,450,453.12	16
15.	Ondo-East	75,245,250.77	10	100,500,345.18	7
16	Ondo-West	98,000,582.22	1	124,578,217.24	1
17.	Ose	95,325,420.19	2	108,432,106.13	2
18.	Owo	93,216,110.10	3	103,221,103.25	5

Source: Data from the survey

Table-8. Ranking of population without access to safe water in all the local government areas in Ondo-State.

#	L.G.A	Population (2007) (%)	Population (2008) (%)	Ranking
1.	Akoko N-E	47.9	43.2	14
2.	Akoko N-W	50.4	47.3	10
3.	Akoko S-E	50.2	49.6	11
4.	Akoko S-W	57.7	53.3	8
5.	Akure-North	49.9	45.9	12
6.	Akure-South	40.0	36.3	16
7.	Ese-Odo	94.7	89.2	1
8.	Ifedore	51.8	49.1	9
9	Ifelodun	59.7	55.3	7
10.	Ilaje	89.8	84.7	2
11.	Ileoluji/Okegbo	66.8	66.2	6
12.	Irele	79.2	75.2	3
13.	Odigbo	69.4	65.1	5
14.	Okitipupa	69.9	65.3	4
15.	Ondo-East	48.4	40.8	13

Source: Data from the survey

Table-9. Estimated average total population without access to safe water in all the local government areas in Ondo-State

Year	Average total population (%)	Estimated population
2007	58.4	2,613,584.
2008	54.8	2,452,472

4. CONCLUSIONS

The study evaluated water poverty index using two approaches and also some other index such as human development and related the finding together to determine the degree of water stress in all the local government areas in the state and recommend realistic measures to address the pathetic situation. The results obtained from the two approaches indicated that Ese-Odo, Ilaje and Irele local government areas are the most water-stressed region coupled with low Human Development Index in the state, while areas such as Ose, Owo, Ondo-West, and Ondo-East local government areas have fair access to portable water and improved Human Development Index. Heuristic application of composite index approach to test the generated dataset provided flexible and strong decision-making strategies in such a way as to construct a holistic water management tool to address the problems of poverty, and its relation to water access and use. However, simple time analysis cannot link complex multidimensional aspects of water management together as a result of this, composite approach is always preferred. The results presented here using various approaches to test our standardized data sets are expected to enhance our understanding of the significant effects of water poverty to economy, human development, health and education. Many states and local government areas are moving towards a point where water resources are insufficient for agriculture, drinking and other domestic uses and to prevent the occurrence of virtual water, further researches are needed to be conducted from time to time on water problems and proffer realistic and technical solution to enhance the supply of safe drinking water at reasonable distance in all strategic locations across communities and regions.

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