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Implications of Average Daily Demand for Water (ADD) on Water Supply in Isiala Ngwa, Abia State

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Abstract

Water is essential for life and its sustenance. Availability of water is necessary for rural development. The study identified that ADD (even when based on 90 Litres) is yet to be achieved in the area. By 200l, Average household water generation was 84.64 litres (especially for the communities investigated), but in 2016 it increased to 172.67 litres in 2016. Whereas, ADD was 360 litres. Differences existing in supply, was 275.30 litres in 2006 and 187.33 litres in 2016, representing 76.49% and 52.03% respectively. Nevertheless, it was suggested that improving the ability of the people to harvest more rainwater and rehabilitating public bores could go a long way in improving household water generation capability.

Keywords: *Average Daily Demand (ADD), Average household water generation, Rainwater harvesting.*

Background to the Study

Safe, adequate, and accessible supply of water combined with proper sanitation are surely basic needs and have recently become essential components of primary healthcare, for rural development in Nigeria and many developing countries. (Chima, & Alozie, 2006). For significant socio-economic development of a community, an adequate supply of safe water is a pre-requisite. Factors such as time and energy savings in preventing incidence of disease, through quality water formation can contribute to development provided the time and energy gained are used meaningfully and economically, (Alozie, 2001). In places where water shortages exist, extreme cases of material and human losses exist. For instance, Oriero (1990) recorded that in some communities in Edo State, where reliance on pipe bore water is significant especially in the dry season, not less than 20 police cases were recorded.

Nowadays, fighting's no more erupting at public water taps, since some of them have been operationally moribund. Alozie, 2012 articulated the reasons behind the failures of some of the public water schemes in the area, even in the face of growing demand for water, it becomes imperative for new water schemes developed to compliment the efforts of private Borehole operators in providing water to the people. To achieve this, water demand statistics should be able to march with water generation abilities, and delivery.

Alozie, (2001) and Chima and Alozie, (2006) estimated the average water demand for the area from 2001 to 2010 based on 90 litres per person for human alignmentation. This is less than the WHO standard of 113 litres. Thus in areas where survival is threatened by water shortages, smaller amount per person per day is required, which is 90 litres (VITA, 1985). Given that, improvements have been recorded in the area, interns of energy supply, urbanization processes, complexities of choices, (both social and economic) and improvements in standard of living, it becomes imperative that assessment of water needs should be based on WHO standard 113 Litres per day. Nevertheless for this work, assessment was based on 90 litres per person per day.

Study Location

This research was conducted in Isiala Ngwa North Local Government area and especially in the communities where public water scheme existed or still operating at a minimal level. Isiala Ngwa North is located in the Abia Central Senatorial Zone, occupying an estimated land area of about 420 Square projected populations from the base year of 2006 increased exponentially from 142852 to 194,231 in 2016.

The study area lies between long. $7^{o}20^{'E}$ and Lat 5°28'to Lat 5°20'N to5^{o}20'N. The area share common boundaries with Umuahia South and Ikwuano Local Government areas in the North, Akwa Ibom State in the east and Isiala Ngwa South L.G.A. In the west is Aboh Mbaise Local Government in Imo State. Rainy season commences from early April to October with a break in August. Dry season starts from November to March, with January and March been the hottest Months. Average daily temperature is 25°C.

Drainage network is not well developed. Only two perennial streams, Imo River (with its tributaries well amplified in communities like Eziama Ntigha, Ihie and Owerrinta) and Iyi Umuala.

Methodology

Two survey questionnaires dating 2001 and 2016 were used for analysis. It enabled comparisons to be drawn especially as regards to average household water generation and consumption. To avoid ambiguity, 453 copies of questionnaires were also distributed in the communities that were initially selected in 2001. They include; Amapu Ntigha, Eziama Ntigha, Avor Ntigha, Nbawsi, Agburike, Umuzeogu, Umuomaiukwu, Uratta, Amekpu, Amaputa, Amaoji Ihie, Abayi, Okpuala Ngwa, Ngwaukwu and Osusu. Data retrieved from the field were analyzed using means and percentages. Population projections will be based on the National annual average Growth rate of 3.2%. While the 4 persons per family Natural policy will still be the bench mark for determining household average water demand and at 90 litres per day.

Results and Discussion

Table 1: Projections of Average Daily Demand for Water (ADD) per day in the area from 2001-2010.

Year	Pop Size (1)	ADD (2)	Cumulative Differences in ADD
2001	123224	11090160	-
2002	126921	11422890	332730
2003	130729	11765610	342720
2004	134651	12118590	352980
2005	138691	12482190	363600
2006	142852	12856680	374490
2007	147138	13242420	385740
2008	151552	13639680	397260
2009	156099	14048910	409230
2010	160782	114470380	421470

Source: NPC (1) Population Projections at 3%
(2) ADD (Average Daily demand) based on minimum per person per day water consumption of 90 litres.

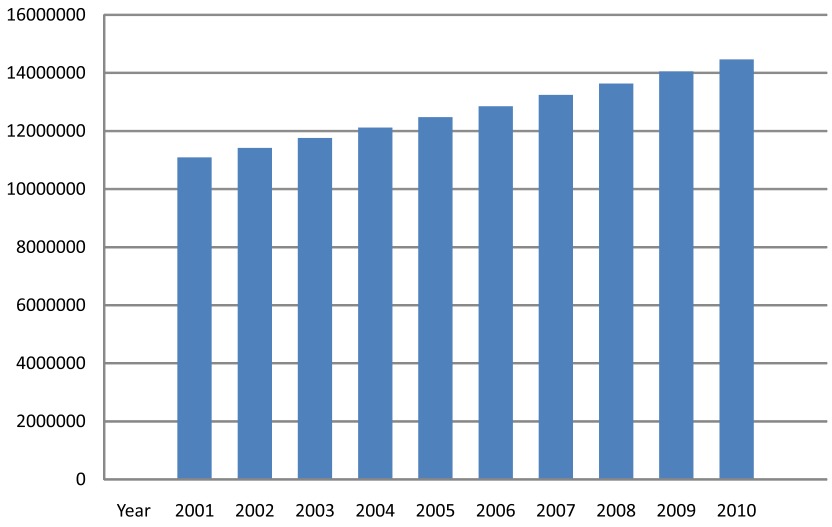

Fig. 1 Projections of ADD From 2001-2010 Based on 90 Litres per Day

Chima and Alozie (2006) noted that by 2010, expected total average water demand would have increased by 34.4% over the total average daily demand for the year 2000. (See also fig 1).

As expected, the increasing quantity of water demand by the people rose astronimically from 11m litres 2001 to 16m litres in 2010.

Table 2: Projections of Population Size in the area from 2010 to 2017 at 3.2% National Growth Rate and Average Daily Demand of Water

2010	2011	2012	2013	2014	2015	2016	2017
160782	165,927	171,237	176,717	182,372	188,208	194,231	200,446
18,168,368	18,749,751	19,349,781	19,969,021	20,608,036	21,267,504	21,948,103	22,650,398

Sources: (1) Alozie, (2001) and Chima & Alozie (2006) Based on 1996 Census results.
(2) 2011 – 2017 Projects at 3.02% growth rate
(3) ADD - Pop Size X 113 Litres per day.

Population increased from 160782 in 2010 to 200, 446, (see table 2) representing an increase of 24.67% At the same time ADD also increased from 18,168,368 Litres in 2010 to 22,650,395 Litres in 2017.

Table:3 Average Daily Demand for Water in the area from 2010 to 2017 at 90 litres per person.

2010	2011	2012	2013	2014	2015	2016	2017
160782	165,927	171,237	176,7171	182,372	188,208	194,231	200,446
14,470,350	14,933,430	15,411,330	15,904,530	16,413,480	16,938,720	17,480,790	18,040,140

Sources: (1) Alozie (2001) and Chima & Alozie (2006)
(2) ADD = Pop Size x 90 Litres.

In addition data presented in table 3 shows that ADD also increased from 14,470,350 litres in 2010 to 18,040, 140 litres in 2017. A comparative assessment of both results indicates that even at 90 litres per person per day water requirement, supply is still unable to March with demand. Although water generation capabilities has increased, especially with the increase in number of private operated boreholes (from 6-18) in some communities, yet differences still exist. This is captured in Table 6.

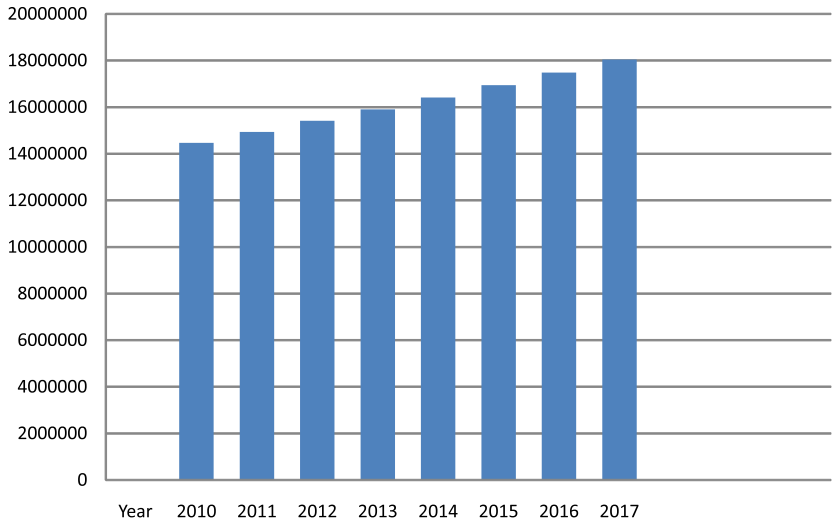

Fig. 2 Projections of ADD From 2010-2017 Based on 90 Litres per Day

Both charts as shown in Fig 2. are rising from 2010 to 2017. The trend will still continue since Population Size is also increasing from 165,927 in 2010 to 200,446 in 2017.

Table 4: Projection of Average Daily Demand for Water in the Area, from 2010 – 2017.

Year	DailyADD (113 litres)	Weekly ADD (113 Litres)	MonthlyADD (113 litres)	Yearly ADD (113 litres)	Dipression Of Yearly ADD
2010	18,168,368	127,178,576	3,815,357,280	45,784,287,369	-
2011	18,749,751	131,248,257	3,937,447,710	47,249,372,520	4,267,108,516
2012	19,349,781	135,413,467	4,062,404,010	48,748,848,120	1,499,475,600
2013	19,969,021	135,448,467	4,063,454,010	48,761,448,120	12,600,000
2014	20,608,036	144,256,252	4,327,687,560	51,932,250,720	3,170,802,600
2015	21,267,504	148,872,528	4,66.175,840	53,594,110,080	1,661,859,360
2016	21,948,103	153,636,721	4,609,101,630	55,309,219,560	1,715,109,480
2017	22,650,398	158,552,786	4,756,583,580	57,079,900,296	1,770,680,730

In Table 4, Average daily water demand is expected to increase from 18,168,368 litres in 2010 to annual demand of 45,784,287,360 litres. While in 2017 it will increase from 22,650,398 litres daily to 57,079,900,296 annually. In addition, daily average demand will increase also from 18,168,368 ltres in 2010 to 22,650,398 litres in 2017; weekly average demand of water from 127,178,576 to 158,552, 786 litres (2010-2017) and monthly average demand from 3,815,357,250 in 2010 to 4,756,583,580 litres in 2017. See also Fig.3

Table 5: Projections of Average Dialy Demand for Water in the Area from 2010 to 2017.

Year	Daily 90 Litres	Weekly 90 Litres	Monthly 90 Litres	Yearly 90 Litres	Differences in ADD Weekly
2010	14,470,380	101,92,660	3,038,779,800	36,46,5,35,5,760	-
2011	14,470,380	104,534,010	3,136,020,300	37,632,243,600	1,166,887,840
2012	15,411,330	107,879,310	3,236,379,300	38,836,655,160	1,204,411,560
2013	15,904,530	111,331,710	3,339,951,300	40,079,415,600	1,242,760,440
2014	16,413,480	114,894,360	3,446,830,800	41,361,969,600	1,282,554,000
2015	16,938,720	118,571,040	3,557,131,200	42,685,574,400	1,323,604,800
2016	17,480,790	122,365,530	3,670,965,900	44,051,590,800	1,366,016,400
2017	18,040,140	126,280,980	3,788,429,400	45,461,152,800	1,409,562,000

From Table 5, daily ADD will increase from 14,470,380 Litres to 18,040,140 Litres by 2017. While Weekly Projection will increase from 101,292,660 Litres in 2010 to 126,280,980 Litres in 2017.

Monthly preojection for the same period will also increase from 3,038,779,800 Litres to 3,788,429,400 Litres. At the same time yearly estimates will increase from 36,465,355,760 Litres in 2010 to 45,46,152,800 Litres in 2017. Both results as presented in Tables 4 and 5 represents Average Daily Demand at 90 Litres per person per day. Neverthless water demand is still high and unable to be met not minding the improvements made in water generations (See Tables 6 and 7).

Table 6: Margin of Deficiency of household water consumption generation relative to Average Household Water Demand

Community	Average Household Demand (Litre)	Average Household Consumption	Deficiency	Percentage ratio of deficiency
Amapu Ntigha	360	87.25	272.75	75.76
Eziama Ntigha	360	96.42	263.58	73.21
Avor Ntigha	360	100.76	259.24	72.01
Nbawsi	360	91.29	268.71	74.64
Agburuike	360	74.38	285.62	74.33
Umuzeogu	360	91.05	268.95	74.70
Umuomaikwu	360	89.41	270.59	75.16
Uratta	360	83.90	276.10	76.67
Amaekpu	360	78.40	281.60	78.22
Amaputa	360	78.34	281.66	78.24
Amaoji	360	77.60	282.40	78.44
Ilie	360	78.28	281.72	78.26
Okpualangwa	360	80.30	279.70	77.69
Ngwaukwu	360	80.23	279.77	77.71
Osusu	360	87.25	272.75	75.76
Total	5760	1354.25	4404.80	1223.76
Mean	360	84.638	275.30	76.49

Source: Alozie, (2001) and Chima

In Table 6, Alozie (2001) and Chima and Alozie (2006) observed that average household consumption (Water availble to the various household) was even higher because the people had access to alternative source of water.Generally, the mean household margin of defficiency is 75%. The impression conveys the precarious nature of water supply in the area and the relative inefficiency of the public water system. In comparison, recent survey revealed that water generation capacity of the household have increased to mean value of 172.67 litres from 2006 result of 84.638 litres representing an increase of 99.32% (See Table 7) Improvements are mainly due to increase in number of private boreholes in the area from 6 in 2001 to 18 in 2016 (especially in Amapu Ntigha); improvement in rainwater harvest and storage; new motorized boreholes recently provided by the state and local governments in partnership with NGO'Sand Coorporate Bodies.

Table 7: Margin of Deficiency of Households Water Consumption/Generation relative to Average Household Water

Communities	Average Household Demand	Average Household Consumption	Deficiency	Percentage Ratio of Deficiency
Amapu Ntigha	360	206.53	153.47	42.63
Eziama Ntigha	360	188.68	171.32	47.58
Avor Ntigha	360	168.52	191.48	53.19
Mbawsi	360	240.36	119.64	33.23
Abguruike	360	105.25	254.75	70.76
Umuzegu	360	128.26	231.74	64.37
Umuomaiukwu	360	136.42	223.58	62.11
Uratta	360	168.26	191.74	53.26
Amakpu	360	108.26	251.74	69.93
Amaputa	360	106.34	253.66	70.46
Amaoji	360	202.30	157.7	43.81
Ihie	360	189.31	170.69	47.41
Obayi	360	193.41	166.59	46.28
Okpuala Ngwa	360	236.32	123.68	34.35
Ngwaukwu	360	195.33	164.67	45.74
Osusu	360	189.23	170.77	47.44
Total	5760	2762.78	2997.22	832.55
Mean	360	172.67	187.33	52.03

Source: Survey Questionnaire, 2016.

Mean water generation capacity in the area (as shown in Table 7) is 172.67 Litres with marginal deficiency of 187.33 Litres which represents 52.03%. Nevertheless some communities improved tremendously more than others in generation of water for household consumption. This is attributable to the increase in the number of privately operated boreholes and presence of though few motorized boreholes.

Table 8: Some communities with the highest improvement in household water generation.

Communities	Average Household Generations in 2001 Litres.	Average Household Generation in 2016 Litres	Differences Litres	Percentage Rating
AmapuNtigha	87.25	206.53	119.28	136.71
EziamaNtigha	96.42	188.68	92.28	95.69
Mbawsi	91.29	240.36	149.07	163.29
Amaoji	77.60	202.30	124.7	163.29
Ihie	78.28	189.31	111.03	141.84
Abayi	79.28	193.41	114.09	143.77
Okpuala Ngwa	80.30	236.32	156.02	194.30
Ngwaukwu	80.23	195.33	115.10	143.46
Osusu	87.25	189.23	101.98	116.88
Total	**757.9**	**1811.47**	**1,083.55**	**1,299.23**
Mean	**84.21**	**201.27**	**120.39**	**144.36**

Improvement in household water generation was high. For instance, AmapuNtigha, Nbawsi, and Amaoji increased by as much as, 119.28 litres, 149.07litres and 124.70 litres. Thus, the mean average household generation was 84.21litres while in 2016 it rose to 201.27 representing an increase of 139%. Again the mean value of Average household generation (which is 201.27 litres)is greater than the combined mean value 2016 (which is 172.67 litres) and much more than the 2001 result of 84.638 litres.

Recommendations

Harmonization of the activities of Private Borehole operators and water vendors. It is necessary to know the activities of private borehole operators and water vendors in order to achieve improvement in household water generation. In the dry season when reliance of water supply is on boreholes, water vendors and streams/rivers, it becomes imperative that operational mechanisms and guidelines be developed and implemented for purposes of achieving sustainability in water supply. To do this price control and inspections of materials to enforce hygienic standards are very necessary. However, price control, will mean setting up maximum price levels for selling water to consumers, but it can only succeed if considerable subsidies (financial, material and technical support) are given to the alternative generators of water supply.

Hygienic standards are very important safe water policies that must be strictly enforced. Public awareness and appropriate education on hygienic standards and what they should expect as minimal acceptable hygienic norms from the private borehole operators are also very necessary to adopt and implement.

Making ROH was more Effective

The problem of inadequate storage facilities is principal to rain water harvesting not contributing immensely to household water generation beyond the second month into dry season. Infact, by December, stored rainwater would have been exhausted in most households in the in the area. Thatched roofs are visible in the areas, but, even in

extreme cases, the family members collect water from nearby buildings with zinc roof-tops. Improvement of rainwater harvest will be beneficial and sustainable. The idea of ROHWAS is not new, Igbozurike, (1991) had applied and recommended that provision of reservoirs, (underground or Overhead) to store rainwater which is excessively lost in the rainy seasons can help extend sustainability in household water generation capacity. Interestingly in the study area, localized concrete reservoirs which contain as much as 500 litres of water were built to harvest water. At the present cost; a 500 litre concrete reservoir will only require N30, 250 to be constructed. Break down of cost estimates are as follows.

1. 3 bags of cement @2700……8,100
2. 15 Wheel barrows of Sand @400……..6,000
3. 50 Litres of water @300……..150
4. Labour
   a. Two Masons @ 3000 for 2 days……12,000
   b. Labour 2000 for 2 days……..4,000

   30,250

For households that are unable to raise the amount of money required, two or three families can combine to achieve the purpose. The situation gives room for governments and NGO's to participate in material provisions, technical assistance, safe water regulations and meeting of hygienic standards and funding.

Conclusion

Average daily demand of water for the inhabitants was higher than actual quantity of water received, both for 2001 and 2016, even when ADD was based on 90litres, which is the most minimal daily water requirement for areas under severe water stress.

Projections for ADD was continued from the previous works of Alozie, (2001), from 2010 to 2017. Eventually average household water generation increased in 2016 from the 2001 mean values. Infact in 2001 mean generation value was 84.64 litres while in 2016 it increased to 172.67 litres representing an increase of 99.32%. Deficiency between ADD and AHWG was 275.30 litres in 2001 but decreased to 187.33. Nevertheless improvements in household water generation can be made if rainwater harvesting system is amplified, and more public boreholes sunk., while the existing public boreholes will be rehabilitated.

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