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Water Availability and Sustainability in the Federal University of Technology, Akure Environs, Nigeria

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Abstract

This paper discusses residents' appraisal of available water in Akure South Local Government Area, Ondo State, Nigeria. The research was carried out in February 2013 and is limited to the Federal University of Technology Akure (FUTA) environs in the millennium city of Akure, Nigeria. The research method used entails survey method and interview. The analysis was carried out using frequency, percentages, chi square and Karl Pearson's correlation technique. The research aims to study the association between the satisfaction level with the major source of water provision (LEWATPROV) and distance to water source (DISTOWATR). Questionnaires were administered to residents in 100 Buildings, 36.4% of the residents have wells as the source of water running in the residential buildings while 34.83% harvest rainwater. The Ministry of Water Resources at Federal and State level need to complete the Igbara Oke water scheme to improve residents' access to safe water.

Keywords: Borehole, Rain water harvesting, Sustainability, Wells

1. Introduction

Water is required for washing of cars, plates, bathing, cleaning of the environment, to mention but a few of the uses of water. Gleick (1996) presents the concept of a basic water requirement (BWR) for human domestic needs and recommends that a 'BWR for drinking, basic sanitation services, human hygiene, and food preparation be guaranteed to all humans. Specifically, 50 liters per person per day of clean water should now be considered a fundamental human right'. The United Nations assembly in the 21st Century in her millennium declaration, target 7c most appropriately discusses the importance of the provision of access to safe drinking water: 'to halve, by the year 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation'.

2. Literature Review

Water availability is a worldwide problem, especially in the developing nations. Residents in the area around Federal University of Technology, Akure, Ondo State, Nigeria have been in the search of local solutions to the problem of availability of water especially during the dry season. Water pipes from the Ondo State Water Corporation do not extend to the research area, the corporation's facilities covers 30% of the population as at 2009 (OSWC, 2013). Olotuah (2006) reports a research conducted in the core area of Akure, 600 residents were interviewed, The source of water supply for 80% of the buildings were hand dug wells, 10% relied on tanker services for water, a further 10 % had access to public mains. Dividing Akure into twelve zones, Olotuah and Aiyetan (2007) carried out a study of the quality of the built environment in Akure, using 10.1% of the total number of buildings as the sample for the study (1440 buildings), it was discovered that public water service is available to 5.4% of the population, wells amounted to 40.4%, while tanker service is the major source of drinking water for the population – 29.6% with borehole - 2.5%. In a study of Araromi, Oja Oshodi, Isolo and Ijomu area within Akure South Local Government Area, of the 252 buildings sampled, hand dug well is the major source of water and it accounted for 85.7%, however, 14.3% of the residents interviewed have access to tap water which is reported as not regular, in conclusion Omole and Owoeye, (2011) confirmed that rainwater, residents use as substitute during rainy season has the possibility of being contaminated as majority of the roofing sheets are rusty and dirty. The age long solution to that problem is that; the water collection system is designed to be flexible and can be tilted in such a way to prevent the early, dirty, beginning of the rainy season water from entering the storage system. The cleaner water is thus collected when the frequency of the rain have significantly improved

Olajuyigbe (2007) discusses the issue of domestic water need in Ado Ekiti, the capital of a sister state in south west Nigeria. In his study of 1200 cases, he suggested a token charge of 250.00 Naira/ month to residents as a form of incentive for the government to provide water for the citizens. Although the study revealed that only 60% of the respondents were willing to pay for the service. Adesoji (2010) assessed the quality of infrastructure development in Osogbo, the capital of Osun state in south west Nigeria, in a study of 406 dwellings, 76.4 % had access to the state government provided house connection. This is due to the Ede water scheme and the provision of area offices to oversee the water distribution.

2.1 Rain water harvesting technique as an environmental sustainability principle

Ibrahim, Onwonga, Mburu, and Elhadi (2013) evaluated factors influencing adoption of rainwater harvesting techniques in Yatta district – a semi arid area of Kenya; 'education level had the highest positive influence on adoption of water harvesting techniques followed by experience of water shortage, farm size and awareness of water harvesting techniques for farmers in the district'. Gleick (1996) discusses factors affecting governments or water providers' ability to make available the BWR to citizens; 'Rapid population growth or migration, the economic cost of water-supply infrastructure in regions where capital is scarce, inadequate human resources and training, and even simple political incompetence'. Tackling the problem of water provision should begin from education of the professionals Bashir, Hamdan, Dodo and Ojobo (2012) advises that sustainability should be included in the already existing curricular at Universities, such courses as environmental science or introduction to the built environment in Nigeria to create awareness on environmental issues and improve the ability of the students to design sustainable buildings.

Rainwater harvesting is an improved source of water as defined by World Health Organization (WHO) / United Nations Children Educational Fund (UNICEF) Joint Monitoring Program (JMP) for Water Supply and Sanitation as: 'one that, by nature of its construction or through active intervention, is likely to be protected from outside contamination, in particular from contamination with faecal matter' (WHO and UNICEF, 2012a). Amoah and Dorm – Adzobu (2013) reports a study of two regions in Ghana on the demand for improved rainwater: 'improved rainwater harvesting system introduced to the people has been accepted by majority of the respondents' and that 93.2% of the sample were willing to pay Ghc0.025 for a bucket of 18.75litres of improved rainwater. The difference between the mean will to pay value and the mean estimated cost of improved rainwater supply per day results in a loss of Ghc1.47 thus Private Direct Investment is not recommended for rainwater harvesting in poor areas. Some form of government intervention is therefore required to enable the communities' bye into the idea. Rain water production according to (Baiche & Walliman, 2000) can be calculated from:

$$\textit{Rainwater Production} = \textit{net roof area } (m^2) \times \textit{annual rainfall } (l/m^2) \times \textit{run – off value } (f) \quad (1)$$

Where the net roof area = the plan area of the roof connected to the gutters, annual rainfall is local to the area (in this case, the mean annual rainfall is between 2000 – 3000 litres per square metre), run off value (f) equals 0.75 for pitched and flat roofs.

3. Research Methodology

The research method used entails survey coupled with expert walk through and interview. In all, questionnaires were distributed to residents in one hundred buildings in the research area. The data was analyzed using frequency distribution, the chi square and Karl Pearson's coefficient of correlation. The relationship between provision of house tap (WATINBLDG, Table 5) and owners residing in the yard or building (LORDRESD, Table 4) was analyzed using Chi square with manual calculations. In a study of the association between the satisfaction level with the major source of water provision (LEWATPROV, Table 8) and distance to water source (DISTOWATR, Table 10), Karl Pearson's coefficient of correlation, r, was calculated to determine whether their exists an association between the two variables? If yes, of what degree and in which direction? The correlation was carried out using Microsoft Office Excel 2007 software.

3.1 The Research Area

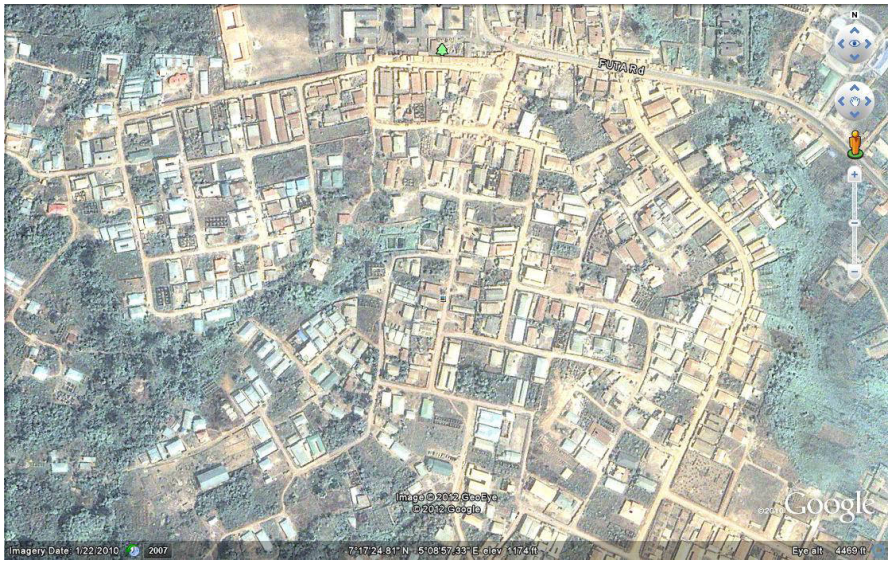

Figure 1: The Research Area showing Federal University of Technology (FUTA) South Gate area. It is bounded by FUTA road, Redemption road and Stateline road.

Source: Google Maps (2013)

The Federal University of Technology, Akure, (FUTA) environs is located in the millennium city of Akure, Akure South Local Government Area in Ondo State, Nigeria (figure 1). There are two hundred and forty three (243) buildings in the research area, out of which eighteen (18) buildings are either for commercial or religious purpose. The population of the Local Government Area is 353,211 persons. It has a land coverage area of 328.592 Sq. Km. It is characterized by two distinct seasons; the raining season, which begins in April and ends in October and the dry season which begins in November and ends in March (Ondo, 2012).

The maximum mean global radiation which occurs around (14:00hrs LT) varies in the course of the year from 512 W/m^2 in the wet season to 543 W/m^2 in the dry season (Falodun & Ogolo, 2007). In a seven year average (between 2001 and 2007) Akure received statistical mean daily sunshine hours of 5.21 hours. Adediji and Ajewole (2008) measured values for relative humidity of Akure in 2007, the researchers recorded values close to 100% for the rainy season months. Average rainfall measurement for year 2010 review in the South West States (including Ondo State) was 2,000mm to 3,000mm (NIMET, 2010).

3.2 The Population and Sample

There are two hundred and twenty five residential buildings (225) in the research area bounded by FUTA road, Redemption road and Stateline road establish the research population. The sample of one hundred buildings/yards was estimated from a professional knowledge of the research area (Table 1).

Table 1: Residential building types in FUTA environs

s/n	Building Type	Sample	Completed	Response (%)
1	Rooming Apartment (face to face)	36	33	91.67
2	Semi Detached Bungalow (2 or 3 Bedroom)	19	17	89.47
3	Detached Bungalow (2,3,4 or 5 Bedroom)	22	19	86.36
4	Block of 4, 6 flats with 2 or 3 Bedroom.	18	16	88.89
5	Detached Maisonette	5	4	80.00
	Total	100	89	

The sample was taken through simple random technique without replacement. On an assumed street in the research area, the first, third, fifth building/yard and so on was visited on the left and right hand side of the street and questionnaires administered to a resident above eighteen years in the building/yard. Only residential buildings in the research area were considered in the work. Table 1 shows the characteristics of the sample.

4. Discussion

4.1 Social Characteristics of the research area

The research reveals that 55.05% of the respondents are students (Table 2). The total student enrolment into the Federal University of Technology, Akure (FUTA) for 2012-2013 academic session is 5,014. On the other hand, FUTA's Halls of Residences can only accommodate a total of 1,639 students (FUTA Pocket Statistics, 2013). The gap in accommodation of students on the campus develops a very vibrant student community around the university campus. This explains the reason 55.05% of the respondents is students.

Table 2: Status of respondents

s/n	Status	Frequency	Percentage (%)
1	Student	49	55.05
2	Employed	25	28.09
3	Unemployed	7	7.87
4	Retired	5	5.62
5	Others	3	3.37
	Total	89	100

The minimum wage as approved by the Nigerian State is eighteen thousand Naira (₦18, 000.00). This was selected as the benchmark for the study (Table 3).

Table 3: Monthly Income of residents in FUTA environs

s/n	Monthly Income	Frequency	Percentage (%)
1	₦18,000.00 and Above	42	47.19
2	Below ₦18,000.00	41	46.07
3	Unanswered	6	6.74
	Total	89	100

More than 50% of the Landlord of the buildings studied resides within the building or yard (Table 4). The fact that the landlord stays in the building or in the premises may be an advantage, because most landlords would be interested in water provision in the building interior. Therefore adequate provision is usually made ahead of the dry season where residents normally scout for water.

Table 4: Analysis showing whether the building landlord resides in the yard / building

S/n	Response	Frequency	Percentage (%)
1	No	37	41.57
2	Yes	52	58.43
	Total	89	100

4.2 Physical Characteristics of the research area

A house tap is usually provided in buildings to provide easy access to water in the buildings.

Table 5 shows that 44.94% of the samples have a house tap running in the building interiors.

Table 5: Availability of a house tap running within the building

s/n	Availability of a house tap running in the buildings	Frequency	Percentage (%)
1	No	49	55.06
2	Yes	40	44.94
	Total	89	100

$H_0$1: there is no significant relationship between provision of house tap (WATINBLDG, Table 5) and owners residing in the yard or building (LORDRESD, Table 4).

Table 6: Contingency table of WATINBLDG and LORDRESD showing the expected frequencies in brackets

	No	Yes	Totals
WATINBLDG	49(43)	40(46)	89
LORDRESD	37(43)	52(46)	89
Totals	86	92	178

The χ^2 critical value at 5% level of significance for one degree of freedom is 3.841 (Kothari, 2004). However the calculated value is 3.24, therefore $H_0$1 is accepted; that there is no significant relationship between provision of house tap (WATINBLDG) and owners residing in the yard or building (LORDRESD). The research did not look at the income level of the building owner.

4.3 An Appraisal of the Existing Water System in FUTA Environs

The major source of major drinking water is the popular water packaged in 50Cl sachet. It is the major source of drinking water for 34.83% of respondents (Table 7). Water is commercially available in this format for prices as low as N10.00 per sachet making it a preferred source of clean water. The Nigerian Food, Drugs Administration and Control (NAFDAC) regulate the source and the process of packaging the water. Many companies packaging water in sachets also have bottled water alternative. It is a reliable source of water since it provides immediate economic gains. It will make economic sense if residents buy a pack at a discount of ₦120 per pack of 20 sachets.

Table 7: Major source of drinking water

s/n	Source of Drinking Water	Frequency	Percentage (%)
1	Bore hole	25	28.09
2	Wells	30	33.71
3	Water in Sachet	31	34.83
4	Bottled Water	1	1.12
5	Others	2	2.25
	Total	89	100

Expert walkthrough within the research area shows that harvesting of rainwater in buildings within the research area reveal the simplest form of the RWH technique (Table 8).

Table 8: Harvesting of rainwater

s/n	Do you harvest rainwater in any part of the building?	Frequency	Percentage (%)
1	No	61	68.54
2	Yes	28	31.46
	Total	89	100

4.4 Methods of Harvesting Water in FUTA Environs

The twenty eight (28) cases of HRW in FUTA environs are based on the roof to tank method whether plastic, concrete or galvanized tank method in some cases large bowls are positioned to collect water during a rainfall. Whether this source of water is a sustainable water source is yet to be verified.

Table 9: Main use of the harvested water

s/n	How do you make use of the water harvested?	Frequency	Percentage (%)
1	Bathing	2	7.14
2	Cooking	2	7.14
3	Drinking	1	3.57
4	Washing	20	71.44
5	Others	3	10.71
	Total	28	100

The main use of harvested is washing of cars, clothes, plates and cooking utensils – totaling 71.44% as seen in Table 9.

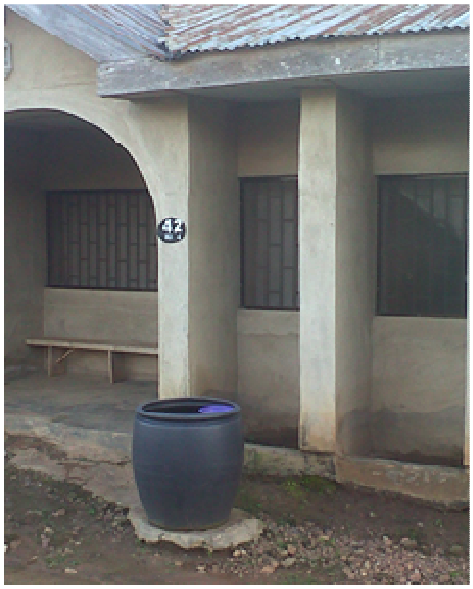

Figure 2: Traditional method of water collection in Akure South Local Government Area, Ondo State, Nigeria, from corrugated roofing sheets to plastic drums.

The percentage of satisfied residents (42.7% - addition of 'satisfied' with 'very satisfied' value in Table 10) with the unsatisfied residents (43.82% - addition of 'unsatisfied' with 'very unsatisfied' value) is almost balanced numerically. But putting the values to Pierson's correlation test below, certain characteristics evolve:

Table 10: Residents' satisfaction with the level of water provision in Federal University of Technology, Akure's South Gate environs

s/n	Satisfaction level	Frequency	Percentage (%)
1	Very Unsatisfied	16	17.98
2	Unsatisfied	23	25.84
3	Neutral	12	13.48
4	Satisfied	25	28.09
5	Very Satisfied	13	14.61
	Total	89	100

$H_0$2 = there is no correlation between distance covered to source for water and satisfaction level of occupants?

The hypothesis was tested using Pearson correlation coefficient, r = - 0.125.
The Pearson correlation coefficient, r, depicts that for the sample of residents in FUTA environs, there is a weak association between distance to the source of water and the satisfaction level of occupants since the value of the correlation is less than 0.3 (Association between Variables, 2013). Borehole is the most constant source of water in Akure South Local Government Area. The numbers of residence with borehole in FUTA environs are 28 out of 89. Noting that the value of r = – 0.125, the direction of the relationship shows that as the distance to safe water increases, the satisfaction level with the level of water provision reduces, which is to be expected. Clearly, factors affecting satisfaction level may be more than the distance to the source of water; others may include the types of water source, relationship between the donor and the neighbor and ease of access to the water source.

Table 11: Distance covered to source for water in buildings within FUTA environs

s/n	Distance Covered to access water	Frequency	Percentage (%)
1	The next street/ other sources(above 108m)	17	19.10
2	5-6 Plots away (90 -108m)	0	0
3	3-4 plots away (54 – 72m)	8	8.99
4	1-2 plots away(18 - 36m)	40	44.94
5	Water runs in the building/ yard (less than 18m)	24	26.97
	Total	89	100

Historically, Nigerians living in the south western part of the country make use of surface water for their daily needs. From Table 10 it is obvious that residents share the water available with themselves, this is expected. Residents in 65 out of 89 (73%) households in FUTA area source for water outside their plot or residence (Table 11). Other sources includes: public stand post from a different location in Town, or a friend/ colleague that have a private bore hole and electric pump in other parts of Akure metropolis. Requesting for water from neighbours especially where it can be accommodated is a socially accepted behaviour amongst Akure residents. It is obviously a sign that the responsibility of the Nigerian Government to make water readily accessible to the populace is unsuccessful. However the Federal Government of Nigeria in collaborations with Ondo state government have channeled her efforts towards the construction of the Igbara Oke Water Works in recent years but the construction works is still in progress. The Capacity of the Water Works would readily provide for the Residents of Akure and Environs (interview with the Area Engineer, Ondo State Water Works, Akure, Ondo State on 25 September 2013)

Table 12: Community service in FUTA environs through provision of private stand posts in building surrounding

s/n	Presence of private stand post for public use	Frequency	Percentage (%)
1	No	61	68.54
2	Yes	28	31.46
	Total	89	100

4.5 Recommendations

Community participation in water sourcing and distribution is recommended. The reality on ground is that drilling a bore hole is very expensive, as high as N500, 000.00 and not all the bore hole dug eventually become a viable water source. Usually there is a lucky land lord whose borehole, by providence produces a good source of water, in collaboration with the Land Lord Association; this source of water can perform the role of mini water works to the community; supplying and distributing water to the community. If this is done in a sizeable number of areas the issue of lack of provision of portable water would be a thing of the past. The government's state owned water corporation can serve as semi regulators / control for this sources in terms of treatment required. The concept of shared water source for the community in anticipation of future supply from the government is proposed. Rainwater harvesting as a technique for providing safe water can be introduced to the people through the media and extension workers. Each building/yard should provide at least a 2000 litres drum size for collection of rainwater. This will ameliorate the water problem in Akure South Local Government Area.

5. Conclusion

Rainwater in FUTA area serves as a complimentary source of water. During the rainy season, limited storage is carried out and when the stored water is depleted, residents turn to other sources of safe water. The implications for planning is that Government at all levels; Local, State and Federal should as a matter of urgency target funds towards the completion of the Igbara Oke water works, which is a more dependable source of water for Akure South residents.

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