RESIDENTS' PERCEPTION OF WATER SUPPLY AND ADEQUACY IN IBADAN, NIGERIA

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Abstract
This paper examined residents' perception of water supply and adequacy in Ibadan, Nigeria. Systematic sampling method was adopted in questionnaire administration, wherein 157 residents of the city were sampled. The study revealed that hand-dug well was the prominent source of water supply in the city, and majority of residents in the city do not have access to piped water. Also the average distance between residents' homes and source of water supply was 71metres. Findings also revealed that respondents perceived water supply as inadequate for the various identified uses such as domestic, commercial and industrial uses. Furthermore, poor sanitation behaviour and hygiene were found to be the predominant effects of water inadequacy in the city. It recommended provision of sufficient water supply through the provision of water supply facilities in the neighbourhood by government, non-governmental organizations (NGOs) and community based organization (CBOs) and also public enlightenment to be done by theses bodies for all residents of the city on the need to guard provided water facilities in the study area.

Keywords: *Adequacy, perception, residents, water, water supply, Ibadan, Nigeria,*

Introduction

Water is one of life's indispensable necessities. It is needed for life supporting systems, food production, economic development and enhancing human health and wellbeing (Mehta, 2001). It is a determinant for survival, basis for good health and socioeconomic development (Daramola, Olowoporoku and Popoola, 2017; Nwankwo, 2011; Tezera, 2011). Urban and rural dwellers need water for various purposes ranging from drinking, cooking, and sanitation to small enterprise (Daramola, Olowoporoku and Popoola, 2017). Furthermore, in order to attain a healthy ecosystem, water is a non-negotiable element. As such availability of water is central towards the attainment of sustainable development.

United Nations (2015) estimated that about 1.2 billion people, constituting approximately one-fifth of the world's population, live in areas of physical water scarcity while another 500 million people globally are approaching this situation. Inadequate water supply has manifested huge economic and health burden on citizens especially in the developing nations of the world. Domestic water demand has grown at more than twice the rate of population increase thus increasing the number of developing cities in shortage of water. These inadequacies have negatively affected human nutrition, production of goods and services, social wellbeing and ecological preservation of human and natural environment (Fayomi, 2014).

African is not spared on issues relating to water scarcity and inadequacies. African cities

face quite a number of domestic water challenges which are worsened by the ever increasing population. World Health Organization (WHO, 2010) observed that less than 10 percent of the population in sub-Saharan African countries like Uganda, Zambia and Rwanda have access to reliable water supply. This view was further complimented by UN-Water (2012) that sub-Saharan Africa has the largest number of water-stressed cities than any other region of the world. Most cities experience acute shortage of domestic water due to additive effects associated with lack of efficient, socio-politically acceptable, and transparent management of water resources. Likewise, Tezera, (2011), Matsa (2012), Ali (2012), Daramola (2015), Daramola, Olowoporoku and Popoola (2017) attributed the water supply problems to poor water supply infrastructure, technical capacity and absence of appropriate regulatory framework.

In Nigeria, the provision of potable water is a responsibility of the three tiers of government. Namely: Federal, State, and Local Government. In spite of these provisions, domestic water supply continues to be a serious challenge in most Nigerian towns and cities (Omole and Okunowo, 2016). The failures of water supply institutions has led residents across most Nigerian cities to rely on water from various conventional sources such as hand-dug wells, boreholes, ponds, streams, and rivers, among others (Daramola, Olowoporoku and Popoola, 2017). Nevertheless, these water sources are characterized by their irregularities, inaccessibleness, and unsafe nature. Implications of poor sources of water on residents health include financial and economic costs, direct medical costs associated with treating sanitation-related illnesses, lost income through reduced productivity and increased government costs of providing health services (Olowoporoku, 2017; FGN, 2005)

Issues pertaining to water supply had aroused the interest of many scholars in different climes. For instance studies that have elucidated information regarding the political and environmental factors affecting water supply (Daramola, 2015; Anijah *et al.*, 2013; Ali, 2012; Aremu, 2012; Akpabio, 2012; Nwankwo, 2011; Ademiluyi and Odugbesan, 2008; WHO and UNICEF, 2008; Telmo, 2002) water supply and infrastructure (Daramola, Olowoporoku and Popoola, 2017; Olawuni, 2007; WHO and UNICEF, 2008; Mathew, 2004; DFID, 1998). Water supply is perceived primarily as an engineering activity; however, there are social components related to it that need to be put into consideration (Daramola, Olowoporoku and Popoola, 2017). These social components can only be judged through residents' perception.

Perception is the individual awareness of behaviour and how people process raw data received from the environment (Olowoporoku, 2017b; Morris and Maisto, 2009). Perception has to do with the thought process of individuals, variations exist in how people view and respond to issues within the environment. Studies such as (Olowoporoku, 2017b; Odunsi, 2016; Faniran, 2012; Agusomu and Paki 2011; Oyeniyi, 2011) have established that socioeconomic attributes such as age, income, gender, religion and level of education; among others factors could be responsible for the non-uniformity of perception across the globe. Thus information from people who water facilities are provided for is important to policy makers.

Information from perception studies guides policy makers in adopting a bottom-up approach, leading to decision making that will be acceptable to the people at a particular time. As opined by Olowoporoku (2017b) provision of generalized solutions for all environmental problems may not be an efficient approach because of variations in public perception in different geographical locations. Based on the above, this study intends to examine the perception of residents with regards to water supply and its adequacy in Ibadan Nigeria. In achieving this, the study examined the socioeconomic characteristics of residents of Ibadan; identified the existing sources of water supply; and also examined the adequacy of water supply in the study area.

The Study Area
The study area, Ibadan, is the present capital of Oyo State, in the south-western part of Nigeria. It is located approximately between latitude 7^0 00' and 8^0 30' North of the Equator and 3^0 00' and 4^0 45' East of the Greenwich Meridian. It is the

largest indigenous city in tropical Africa (Okolo, 2006), with an estimated population of 2,550,593 (National Population Commission, 2006). However the projected population of Ibadan considering the present yearly growth rate of 4.14% is 3,427,493 covering an area of 128 kilometer square. The city developed particularly

through the establishment of certain institutions and the construction of roads and the railway line. The convergence of the two major trade routes in Ibadan, coupled with the arrival of the railway, accelerated the growth of the city. Most of southwestern Nigeria (excluding Lagos) constitutes its hinterland for the procurement of specialized goods and services.

Fig.1 Map Showing the Study Area: Oyo State within the Nigerian context, and Ibadan within the Context of Oyo State

It comprises eleven local government areas, with five in the inner city and six in the lesser cities. These are Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East and Ibadan South West. The peculiarity of these five areas is that they converge at a point, Mapo hill. The remaining six local government areas constitute the suburbs of the metropolis.

Methodology
This study was based on a field survey through administration of questionnaire. The sampling procedure started with a focus on the five local governments within the inner city of Ibadan. One local government was selected randomly. In the selected local government (Ibadan North West LGA), simple random sampling was used to select four (4) out the eleven (11) political wards as identified by INEC 2015. A total of four political wards were selected for survey. In the four selected wards, every 20th residential building was sampled sequel to listing of buildings based on street numbering system and

counting of buildings where houses were not numbered. In each of the selected residential buildings, the target respondents were adults who were 18 years and above. This is because in Nigeria, 18 years is the statutory age of responsibility.

For the study, 157 residents were sampled on which questionnaires were administered. Issues addressed in the questionnaire included socioeconomic attributes of the residents and those pertaining to residents' perception and response to adequacy/inadequacy of water supply in the city.

The obtained data were analysed using percentages and Relative Importance Index (RII), which was employed to analyzes and operationalize variables with a view to measuring the adequacy of water supply and severity of the effects of water inadequacy. These indices were tagged Water Supply Adequacy Index (WSAI) and Water Severity Effect Index (WSEI). Even though these indices have not been specifically used by name in previous

studies, their use does not constitute a research anomaly inasmuch as their root is traceable, in principle, to the popular RII. They are computed following a process similar to that of RII. Examples of similar uses are found in studies as Olojede, Daramola, and Olufemi (2017), Ogunleye (2017), Olowoporoku (2017b) Afon (2006 and 2000) and Sambasivan and Soon (2006). Respondents were implored to rate each variable of interest following the principle of Likert Scale (Likert, 1961). In each case, the scale was from 5 to 1 in descending order of significance (Not at all Adequate 'NAA', Not Adequate 'NA', Just Adequate 'JA', Adequate 'A', and Very Adequate 'VA'), or (Very Severe 'VS'; Severe 'S', Just Severe 'JS', Not Severe 'NS', and Not at all Severe 'NAS'). The Summation of Weight Value (SWV) for each variable was obtained through the summation of the product of the number of responses for each rating of the variable and the respective weight value. This is mathematically expressed as follows:

$$\text{SWV} = \sum_{I=1}^{5} X_i Y_i \qquad (1)$$

Where:

SWV = Summation of Weight Value,

X_i = number of respondents to rating i;

Y_i = the weight assigned a value by respondents

Thus, for example, the WSAI is computed by dividing the summation of the respondent's responses to each five ratings on the factor. Mathematically, this is expressed as:

$$\text{WSAI} = \frac{SWV}{\sum_{i=1}^{5} i = X_i} \qquad (2)$$

The closer the WSAI value is to 5, the stronger the residents' rating and also the higher it will rank among other variables under consideration. This illustrations also applies to other indicator indexes employed in this study.

4.0   Result and Discussion

4.1   *Socioeconomic Characteristics of Residents of Ibadan*

This section discussed the results of socioeconomic characteristics of respondents as presented in Table 1. Variables discussed include gender, age, and household size among others. Findings revealed that 56.0% of the respondents were males, while 44.0% were females. Impliedly, the proportion of males that participated in the study were more than females. Information obtained on the ages of respondents indicated that majority (86.4%) were between the ages on 21-60, 9.3% were under 21 years of age while 4.3% of the respondents were over 60 years (retirement age). Further findings revealed that majority of the respondents are within the working class category in the country while 4.3% were above 60 years.

As established by Greenbaum (1995) McCright (2010), people's belief is one of the factors that influences their perception of the environment. Findings on religion practiced by residents in the study area revealed that majority (59.2%) were Muslim, 38.9% were Christians, while the remaining 1.9% were traditional worshippers. Findings were also made on the marital of the residents. This was based on the proposition that marital responsibility affects demand for water. Marital status was also categorised into three: single, married and those that have been married (widowed or divorced). Findings revealed that 65.8% of the respondents were married; 23.6% were single and others comprised 8.9% of the respondents. Thus, it can be inferred that the respondents were in position of marital responsibility that may affect their demand and use of water. On educational attainment, it was discovered that all the respondents acquired formal education. In Ibadan, 16.1% of the respondents had primary education, 33.5% secondary education and little above half (50%) had tertiary education.

For easy analysis, the initial quantitative data on residents' average monthly income were grouped into three: low, middle and high. Income below N 20,000 categorised as low income. The reason is that the minimum wage at the federal level in Nigeria is N 18,000 while it ranges from N 15,000 to N 20,000 in the states of the federation. The middle monthly income was categorised from N 20,000 to N 70,000 while residents earning above N 70,000 were categorised as high income earners. Based on the categorization, 25.7% of the respondents earned

less than N20,000, 59.0% earned between N 21,000 and N 70,000 while 15.3% of the respondents earned over N 70,000. Further findings on the average monthly income across was N 41,057.42

A household was defined as a person or group of people with shared cooking and living arrangements. Thus, household size was measured by the number of people living together with common eating arrangement. Based on this,

the household size of the residents was categorised into three. The household sizes of one to five members were categorised as small, those with six to ten members as medium while those with more than ten members was categorised as large. Findings revealed that, in general, 23.6% had small household size with maximum of five members, 65.2% had medium household size of six to ten members while 11.2% had large household size, with over 10 members.

Table 1. Socioeconomic Attributes of Residents

Socioeconomic Characteristics	Percentage (%)
Gender	
Male	56.0
Female	44.0
Total	**100.0**
Age	
<21	9.3
21-40	43.7
41-60	42.7
>60	4.3
Total	**100.0**
Religion	
Christianity	38.9
Islam	59.2
Traditional Religion	1.9
Total	**100.0**
Marital Status	
Single	25.3
Married	65.8
Others	8.9
Total	**100.0**
Education	
Primary	16.1
Secondary	33.5
Tertiary	50.4
Total	**100.0**
Income	
< N 20,000	25.7
N 21,000- N 70,000	59.0
> N 70,000	15.3
Total	**100.0**
Household Size	
<5	23.6
6-10	65.2
>10	11.2
Total	**100.0**

Water Sources, Availability and Accessibility in Ibadan

Information on the sources, availability and accessibility of water are presented in Table 2. Starting with residents' sources of water,

followed by availability to residents, and accessibility to water source in the city.

As presented in the Table, 2 major water sources were identified in the study area; these are pipe-borne water, borehole, hand-dug wells,

streams/rivers, and rainfall. Findings showed that majority of the residents (61.2%) source for water from hand-dug wells, 18.1% from boreholes, 8.5% depend on rain water, piped water 7.5% while 4.7% of the residents' source for water from streams and rivers. It is important to note that most of this mentioned water sources are not reliable in both qualitative and qualitative regards. This indicates a poor contribution of the government in the provision of potable water for residents in the city.

Table 2. Water Sources, Accessibility and Availability

Attributes	Percentage (%)
Source of Water Supply	
Piped	7.5
Borehole	18.1
Hand-Dug well	61.2
Stream/River	4.7
Rain	8.5
Total	**100.0**
Provider	
Self-Supplied	71.2
Community (CBO	18.4
Government	8.3
NGO	2.1
Total	**100.0**
Distance of Water Sources (m)	
>50	10.7
<50-100m	28.7
101-200m	38.4
>200	22.2
Total	**100.0**
Availability of Water Supply	
Daily	55.2
Weekly	44.8
Total	**100.0**
Availability to Water Supply during Dry Season	
Yes	40.7
No	59.3
Total	**100.0**

On the provider of water in the study area, findings showed that majority (71.2%) of the respondents were responsible for the water consumed in their houses, 18.4% was provided by the communities, 8.3% of the available water was provided by the government, while Non-Governmental Organizations (NGOs) provision of water accounted for 2.1%. Findings on distance of water sources to respondents' homes revealed that 38.4% travel between 101m and 200m to get water, 28.7% travel between 50m and 100m, 22.2% travel over 200m to get access to water, while 10.7% of the respondents travel less than 50 m to get access to water sources in

the study area. Further findings revealed that the average distance travelled by the respondents to get access to water was 71m.

Information on availability of water supply showed that 55.0% of the residents in Ibadan had access to water daily while 44.8% had access to source of water weekly. On availability of water during dry seasons, the majority (59.3%) of residents claimed that water was unavailable to them during dry season. This can be attributed to drying up of streams, rivers, hand-dug wells, and other water sources during the dry season.

Respondent's Perception of Water Supply Adequacy in Ibadan

Sequel to the findings on water sources, availability and accessibility in Ibadan, findings on the adequacy of water supply for important uses are presented in Table 3. Using Water Supply Adequacy Index (WSAI) earlier discussed, it was found that the average WSAI denoted by

Table 3. Adequacy of Water Supply for Important Uses

SN	Water Use	N	SWV	WSAI
1.	Domestic	141	411	2.9
2.	Commercial	139	396	2.8
3.	Religious	139	332	2.4
4.	Industrial	141	319	2.3
5.	Agricultural	139	309	2.2

Table 4 provides information on resident's responses to water inadequacy in the study area. As presented in the table, 37.1% of the residents resorted to fetch water early in the morning, 25.4% fetched late at night, 6.6% engaged water vendors, 5.1% conveyed water in their personal vehicles, 4.5% made use of wheel barrow to get water in the study area. However due to the inadequacy of water 21.3% of the respondents reduce the quantity of water used in their homes. However these responses to inadequacy of water supply could have effect on sanitation and hygiene behaviour of residents in the study area.

Table 4. Residents' Responses to Water Inadequacy

Responses	Percentage (%)
Fetch early in the Morning	37.1
Fetching late at Night	25.4
Paying People to fetch	6.6
Wheel Barrowing	4.5
Convey water with personal vehicles	5.1
Economize the use of water	21.3
Total	**100.0**

Presented in Table 5 are the findings on the effects of water inadequacy in Ibadan. The effects were measured using the Severity Effect Index (SEI). The mean SEI computed was 3.2. Residents in the study area indicated poor sanitation and hygiene as the most significant effect of inadequate water supply with a SEI of 3.6, an indication that water inadequacy had serious effect on residents' sanitation behaviour and hygiene. Other effects included dirtiness of environment (3.3). This could imply that residents' living environments are dirty. Other identified effects include impeding of daily activities (3.1), stress and fatigue 3.0, and ill health with indices of 2.9.

Table 5. Effects of Water Inadequacy

SN	Effect of Water Inadequacy	N	SWV	SEWI
1.	Dirty Environment	141	469	3.3
2.	Impeding of other Daily Activities	141	436	3.1
3.	Poor Sanitation and Hygiene	138	491	3.6
4.	Stress and fatigue	141	430	3.0
5.	Ill Health	141	413	2.9

Conclusion and Recommendations

Water is an essential life resource that is required in adequate supply to enhance healthy living, as well as economic development. However, the result of residents' perception revealed that residents were not satisfied with the inadequacy of water in the study area.

Specifically in the study area, it can be concluded that:

- The quantity of the available water does not meet the demand of the respondents. Added to these was accessibility to water as the majority of residents travel more than 50metres in order to have access to water.
- Owner provided water sources was the most predominant source within the city. These inadequacies in the availability of water supply in the city could lead to poor environmental sanitation habits by the residents and invariably lead to the breeding if diseases vectors such as flies, rodents, cockroaches etc. in residents living environment.

Based on the findings, the following recommendations are provided in improving water supply in the study area.

- Households in Ibadan should be provided with adequate and sufficient water through the provision of water supply infrastructure by the government, NGOs, CBOs in order to aid the ease to obtain water by the respondents.
- The provision of water should be supported by effective cost recovery framework in order to ensure the sustainability off the supply.
- The public must be properly enlightened on proper maintenance of water resources provided within the study area.
- Home owners should be made by law to provide water supply facilities in their homes.

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