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An Evaluation of Accessibility and Willingness to Pay for Safe Drinking Water by Rural Households in Ondo State, Nigeria

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Abstract: *This study evaluated accessibility and willingness to pay for water by the rural households in Ondo State. Specifically, the study described the socio economic characteristics of the respondents; identified the sources of safe drinking water available to them; determined the factors influencing per capita water consumption and willingness to pay for water by the rural households. The major problems associated with accessibility and WTP for drinking water were also identified. Descriptive statistics and regression models were used for data analysis. Results showed that the mean age of the respondents was 41.5 years, they were mostly female (67.1 %) and married (83.6). They depended on unimproved water sources and mostly on water vendors. About 70% of the respondents were willing to pay for water majorly because of regular availability (76.19), reduced fetching distance and lack of labour to fetch water (43.81%). The unwillingness to pay (30.6%) was due mainly to economic incapability (83.87%) and anticipatory betrayal of trust in case of advance payment (68.00%). Household size and volume of water fetched were the significant determinants of per capita water consumption. Probit regression results showed that annual income, number of years spent in school, household size and accessibility to water significantly influenced the probability of paying for water. Inability to recycle water, high cost of digging wells and sinking boreholes, poor water conservation methods were the major problems to accessing safe drinking water. Relevant institutions should be established to create relevant infrastructures that would ensure regular rural water supply. Also the senators should as a matter of political expediency sink boreholes and dig wells as constituency projects to make safe drinking water accessible. It is our hope that this will guarantee good sanitation and healthy life to the rural households in Ondo State.*

Keywords: ***accessibility, rural households and safe water consumption***

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I. Introduction

Water is the most essential natural resource in the world, without which man's existence will be impossible. Next to air, water is the most esteemed requirement for survival on earth. It is used for food production and agriculture and the demand is increasing every day. Water is also commonly used for drinking, cooking,, washing and sanitation/ hygiene at the same time it is important for agricultural , industrial, tourism, cultural purposes and sustenance of ecosystem. Also available evidences show that child and infant mortality is strongly associated with water quality and sanitation facilities. For instance, UNICEF in **its** survey in Gaza on water quality and health indicators to correlate the incidence and prevalence of water borne diseases with water quality reported the presence typhoid and hepatitis in children (UNICEF 2010). This implies that any community that has access to proper sanitation and portable water will have improved living conditions, with increased health and well-being and economic productivity. Today, Corovid-19 a global pandemic brings more into focus how important water is to our lives and to public health. It reveals how much more needs to be done to fully ensure water and sanitation are available to everyone both as a human right and as a critical way to protect our community.

Water availability for both domestic, agricultural and or industrial depends on the source which in turn depends on precipitation. The major source of water to man, his crops and animals is precipitation in Nigeria which reduces progressively Northwards with the most arid north eastern wind region receiving as little as 500mm for about 3-4 months (Helmer and Hespanhol, 1977). Widespread flooding occurs in the southern parts of the country where there are two peaks of rainfall in July and September. The North has its peaks only in September and chronic water shortages are experienced during the dry season. This informs the animal rearing southwards in search of greener pasture which now constitutes socio political and socio-cultural problems in Nigeria. Nigeria derives water from springs/streams/rivers, hand dug wells, rain harvesting, public taps, water

vendors and tube well (WHO/UNICEF, 2012). Abundant as it may seem, water in its clean state is very rare implying that Nigeria cannot adequately translate available water into safe drinking water for household consumption. Suffice to say that the scarcity of drinking water in Nigeria is a paradox.

Reduced water accessibility in Nigeria could be attributed to increasing population, rising demands for food and cash crops, increasing urbanisation, increasing drought period due to climate change and rising standards of living. The public water supply is erratic, intermittently unreliable, and in some cases, inaccessible thus resulting in high dependency on supplementary sources such as water vendors. This brings payment for drinking water into fore. Globally access to clean water and adequate hand washing facilities are not yet a reality to billions around the world. Year 2020 marks ten years since the United Nations recognised that water and sanitation must be available , accessible and affordable to all, to keep our communities safe, healthy and thriving (Council of Canadians publication, 2020).

In Ondo State, several attempts have been made to improve access to safe drinking water and ensure water security by successive governments. These efforts include construction of dams, provision of water networks in major cities in the state, sinking of boreholes by several organisations and individuals as well as the release of constituency allowance to legislators to construct boreholes in their localities and construction of solar powered boreholes by the state government. This is a seemingly promising effort but the concentration is on the urban to the neglect of the rural areas. Therefore, despite these attempts, the issue of access to safe drinking water is still largely unresolved.

Accessibility to water, to an extent determines the willingness to pay. Free access to a resource leads to excessive use (Kessler 1997) and consequently the unwillingness to pay. For instance rain water is used indiscriminately during the raining season because of **its** abundance. Pearce (1995) posited that environmental goods (water inclusive) do not generally have a market and refers to them as missing markets where resources are treated as free and thus vulnerable to abuse. This probably was the reason Vira (1997) suggested private ownership to be the most effective approach to restricting excessive water use in order to make it more valuable. Water is many things to many people: a gift from God, an indispensable resource, the basis of natural development and economic security, environmental resource and an economic good (Littlefair1998). This implies that water is a controversial resource and people do not attach the same value or cost to **its** provision. The variations in perception of water reduce people**s** Willingness to Pay (WTP) which is often under or over estimated by government or Non-governmental organisations. Consequently, water supply projects fail as the needs and requirement of the community have not been met and their unwillingness to pay is clearly signalled. Adebo and Ajewole (2012) observed that people are usually willing to part with their money for services if the benefits will be commensurate with money expended. There is an inter relatedness between ability to pay and willingness to pay. Whichever, Anne *et al* (1998) suggests that calculations on the willingness and ability to pay for services must consider the household income as well as who controls the cash resource and how it is located in a household. From the fore going, accessibility to safe drinking water, WTP and sanitation are imperatives to healthy living in rural households.

The focus of this study is on accessibility and willingness to pay for safe drinking water by low income households in Ondo State. Specifically, the study will describe the characteristics of households resident in the rural areas; identify available water sources to the respondents and the problems of water accessibility. Also to determine the factors influencing per capita water consumption and willingness to pay by the selected households. This study is very important as a means of meeting the water needs of the rural people and generating revenue for infrastructural development

II. Research Methodology

Study Area, Sampling Procedure and Data Collection

The study was carried out in Ondo Sate, Nigeria. The State has two seasons raining season spanning from April to October and dry season November to March. This supports the growth of both arable and tree crops. Three Local Government Areas were randomly selected for data collection, five rural communities randomly selected and 10 households were randomly selected from each community making a total of 150 households in all but only 146 were accepted for analysis.

Data Analysis

Descriptive statistics such as mean, percentage and frequency were used to describe the socio-economic characteristics of the respondents, available sources of water , regression (OLS) was used to determine the per capita consumption of safe water while probit regression was used to determine the factors influencing WTP mong the respondents in the study area.

Model Specification

Linear, semi log and Cobb-Douglas functions were tried and the lead equation picked based on the econometric criteria. The dependent variable is the per capita water consumption while the specified explanatory variables were:

X_1= quantity of water fetched (accessed) in litres
X_2= distance covered to fetch water (m)
X_3= household size (no of people feeding from the same pot)
X_5= religion
X_6=age in years

Probit model

Probit regression was used to evaluate the probability relationship of the explanatory variables and WTP by the rural households. The probit regression is specified below:

$Pr(Y_i=1)= f(B_iX_i) +$……2

Where:

Y= dichotomous dependent variable which can either assume the value of 0 or 1. It measures the respondents WTP. The estimated equation is:

$Y= B_o+B_1X_1 + B_2X_2+ B_3X_3 + B_4X_4$……$B_7X_7$ + error term……..3

X_1=Age of the respondents in years
X_2= Annual income (#)
X_3=No of years spent in school
X_4= Household size (no of people feeding from the same pot
X_5= Nearness to water source (meters)
X_6= Primary occupation (Farming=1, Others = 0)
X_7= Accessibility to safe drinking water (accessibility 1, inaccessibility, 0)

III. Results and discussion

Socio-economic characteristics of the respondents

The socio-economic characteristics of interest to this study are presented in Table 1. The mean age of the respondents was 41.2yeara while the modal group was 41-50 years accounting for 45.2% suggesting that the respondents were physically active and young. Females dominated the respondents accounting for 67.1% and were mostly Christians (83.6%). Majority (84.2%) of the respondents were married, only 5.5% were single. About 90% were educated, 32.2% attended tertiary institutions. The household size was large with 54.1% having 6 to 10 members and mean of 7.5. Large household size could influence the quantity of water consumed and at the same time serves as a source of labour for fetching water. The respondents annual income was fairly high with majority (39.7%) earning ₦300,000 and above (Table 1) . The mean income of 287, 410.95 gives another impression. However, with a monthly income of ₦26000, the respondents would be able to afford relatively clean water for the household. About 60% of the respondents depended on non-farm income from farming.

Sources of water accessed by the rural households

The World Health Organisation (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for water supply and sanitation (2010) divided water sources into improved and unimproved. Using this categorisation, the water sources accessed by the respondents during raining and dry seasons are presented in Table 2. The sources of water accessed by the respondents would influence their sanitation, distance covered to fetch water, and time spent on water collection by the selected households. As indicated in Table 2, all the respondents depended mostly on rain water during the raining season. Among the improved water sources, protected dug wells was the most common during the two seasons as claimed by 46.58% and 50.00% of the households during the raining and dry seasons respectively. The proportion of those households using improved water sources was more during the dry season than the raining season probably because of the unavailability of rain water. During the raining season, the respondents still used unimproved water sources such as brooks (10.27%), water vendors (12.33% and unprotected wells (17.12%) to supplement rain water. The use of unimproved water sources was worse during the dry season as majority of the households depended on water vendors or water tankers whose water quality could not be ascertained. About 48% used unprotected wells and springs/ brooks (44.52%) during the dry season. This implies that the respondents are prone to serious health challenges particularly during the dry season. The use of unimproved water sources could be detrimental to health conditions of the households**.**

Domestic Water Consumption and Excess water Storage by the Rural Households.

Table 3 shows the breakdown of water consumed or utilized by the respondents. Water was used mostly for drinking, cooking, bathing and washing of clothes, plates and other kitchen utensils. The quantity of water used by the rural households shows that washing took the largest (68.97litres) followed by cooking (23.42%) while drinking and bathing had 11.41 litres each. The respondents made efforts to store excess water in various containers as shown in Table 3. Bucket with lid (cover) was the most common water storage containers as claimed by about 53% of the respondents followed by plastic jerry cans (24.7 %) and plastic tank (8.9%). The proportion of the respondents using plastic tanks was small probably because of the cost of purchase. That of open bucket was also small because it is not hygienic so to do. However, that a proportion of the respondents still used open bucket for water storage has some sanitary / health implications. Despite the anticipated effects of this unhygienic method of water storage, findings show that water treatment was not a widely spread practice among the interviewee. Of the rural households surveyed, 84.9% reported they did not treat drinking water before consumption and/or storage.

Determinants of per capita water consumption among Rural Households in Ondo State

Results of the specified model on the factors influencing per capita water consumption is presented in Table 4. The linear function was taken as the lead equation based on the magnitude of R^2, number of significant variables and the significant F-value. The F-value of 46.78 shows that the entire explanatory variables in the model jointly and significantly influenced per capita water consumption while the R^2 of 66.9% shows that the variation in per capita water consumption was explained by the specified explanatory variables. The results showed that the coefficient of distance covered (X_2), household size (X_3), religion (X_4), marital status (X_5) and age (X_6) were negative indicating an inverse relationship between these variables and per capita water consumed. This means that an increase in these variables would reduce the capita water consumption of the rural households. For instance, a 1% increase in the distance covered would reduce the per capita water consumption by 0.01. This is expected because the longer the distance covered to fetch water, the less the volume of water fetched especially in the rural areas where head loading is prevalent. Similarly, a unit increase in age of respondents, will decrease per capita water consumption suggesting that the older a household member, the less the quantity of water consumed. This is contrary to *apriori.* It was expected that older people would consume more water judging by the present emphasis on water therapy among elderly citizens. On the other hand, the quantity of water fetched (X_1) and marital status(X_5) were positive suggesting that an increase in the coefficient of these variables would increase the per capita water consumption. This was expected because the more the quantity water fetched, the more the litres of water available for use. Similarly, an increase in the no of wives of the respondents (X_5) would lead to increase in per capita water consumption by the rural households.

Willingness to pay for safe drinking water by rural households in Ondo State

The respondents were asked to indicate their willingness to pay for safe drinking water. About 70% of them (69.4%) were willing to pay for water while the remaining 30.6% were unwilling. Efforts were made to find out reasons for their willingness or otherwise. The results were presented in Tables 5 and 6. About 70% representing 105 respondents indicated their willingness to pay for water. As presented in Table 5, 76.19% of them agreed to pay for water because they believed it will make quality drinking water available to them. This implies a presumption that the water paid for will be of value and of better quality. About 62.86% claimed it will safe the time spent for fetching water thereby enabling them to concentrate on more productive ventures. Another reason for their willingness to pay was regular water availability particularly during the dry season. These respondents believed that water would be available so long they have their money. This was claimed by 57.14%. Some respondents (43.81%) claimed they did not have people to help them fetch water from distant sources. This probably were the old respondents whose children did not reside in the community to provide the labour required for water collection and felt their money should work for them**.** However, about 30 respondents were unwilling to pay for water because of the following reasons. First, financial incapability, this was the most important reason given for the unwillingness to pay as claimed by 83.87% of the 30 respondents. This could be due to low income typical of rural dwellers. Second, availability of rain water which they claimed was always available in abundance during the raining season as claimed by 77.42%. Third, about 68% of the unwilling respondents anticipated that water may not be available if payment is made in advance as typical of most government developmental projects. Fourth, some respondents (48.39%) anticipated discrimination in water supply between the rich and the poor that more attention may be given to the rich people who can pay big money to the neglect of the low income earners. Fifth, (58.06%) there is a limit to the quantity of water they could afford which may not be sufficient for domestic uses and sixth, the presence of personal well (48.39%)

Factors influencing Willingness to pay for water by rural households in Ondo State

The probit regression results showing the factors influencing WTP for water by rural households in Ondo State are presented in Table7. The results showed that Household size, Distance to water source, Primary occupation and Accessibility to water were negatively signed indicating that they had negative influence on WTP for water by the respondents. For instance, Household size reduces the probability of paying for water by the respondents. This was expected because the larger the household size the more the family labour available to fetch water. Similarly, accessibility to water reduces WTP. This is natural because one may not be willing to pay for a resource that is available in avoidance. On the other hand, other explanatory variables like Age, Annual income, No of years spent in school and Distance to water source were all positive suggesting that they influenced the willingness to pay for water. The positive sign on Annual income implied that the higher the income of the respondents, the higher the probability of paying for water. Similarly, Distance to water source positively influenced WTP suggesting that the longer the distance to water, the more the WTP and vice versa. Tenable reason is that the water supplier may want to bring it nearer to the buyer in the eagerness to sell. This supports the findings of Adebo and Ajewole, (2012) that distance to dump site positively influenced the WTP for waste disposal in Ekiti State. However, only Annual income, No of years spent in school, Household size and accessibility to source of water were significant at 5% probability level.

Problems of safe water Accessibility among Rural Households in Ondo State

Access to water, sanitation and hygiene are indispensable to human existence, yet some people still unable to access or pay for safe drinking water due to some problems. Some of which are presented Table 8. Results of oral interview showed that all the respondents had problem accessing drinking water even though in varying degrees. The major problem encountered as claimed by 82.9% was the inability to recycle water meaning that there was no way they could recover used or lost water. This, coupled with inability to preserve rain water posed a lot of challenge to water accessibility. This is a serious problem because majority of them depended on rain water (as reported earlier) which is seasonal. This followed by high cost of sinking borehole or digging wells. As of the time of this survey, the cost of sinking a borehole ranged between ₦400,000 and ₦500,000 while digging of a well cost between ₦80,000 and ₦120,000 which they claimed was too exorbitant. Unstable weather condition which causes incessant drought was another problem claimed by 68.4% of the rural households. During the dry season, wells mostly the uncovered ones dried up thereby creating water scarcity leading to irregularity and reduction in per capita water availability. About 58% of them attributed inaccessibility to safe water to poor water conservation technology (Table 8). Distance to safe drinking water was a problem to 66 of the 146 respondents interviewed. The location of source of water was usually too long to allow frequent water fetching by head loading. Other problems included inadequate and distant boreholes or dug wells (45.21%), uncovered dug wells (42.21%) and pollution (41.02%). Surface water contamination/ pollution of some rivers and other water bodies was common in the dry season as reported by the respondents.

IV. Conclusion, policy implications and Recommendations

Safe and adequate quantity of drinking water is an essential input for life. However, the accessibility to safe drinking water was worrisome in the area of study judging by the respondents dependence mainly on unimproved sources of water following the classification of WHO and UNICEF. The dependence on rain water by all the rural households, inadequate dug wells, inadequate boreholes, the use of contaminated brooks and unprotected wells threatened the accessibility to safe drinking water by the respondents. Also the use of water vendors whose water quality could not be ascertained coupled with the use of primitive water storage methods was equally detrimental to the sanitation and heath conditions of the people. Water storage in plastic containers has been seriously condemned in the medical parlance as been life threatening because of the production of some chemical compounds during sunny periods which can cause cancer in water consumers. Findings showed that all the respondents had problem in accessing safe drinking water. Sadly, there was no meaningful assistance inform of water scheme given by the government in this regards. However, the consolation is that majority of the selected rural dwellers were ready to pay for quality water if and when made available. This hopefully will serve as a basis for planning rural water schemes in the state. It is imperative that water institutions like Water Corporation should be reinvigorated to create relevant infrastructure and ensure regular maintenance of same to ensure rural water supply rather than limiting their activities to the urban areas. Such institutions should make safe drinking water available at the cheapest price possible for the affordability of the rural dwellers. Also, the rural dwellers should be taught simple methods of water preservation particularly excess rain water in order to break the seasonality of water availability and reduce patronage of water vendors and other unimproved water sources. Lastly, the senators should as a matter of politics and expediency be enforced to sink boreholes and protected wells in the rural areas as their constituency projects to reduce the distance to water sources and time spent in search of water. This will enable the rural households concentrate on more productive activities. It is

our hope that all this would increase accessibility to safe drinking water, serves as a source of revenue to execute water projects and guarantees good sanitation and healthy life to the rural households in Ondo State.

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Appendix

Table 1: Socio-Economic Characteristics of the Respondents

Distributions	Frequency	Percentage
Age		
≤30	19	13.0
31-40	46	31.5
41-50	66	45.2
51-60	10	6.8
60 above	5	3.4
Mean	41.19 years	
Sex		
Male	48	32.9
Female	98	67.1
Marital Status		
Single	8	5.5
Married	123	84.2
Widow	12	8.2
Divorce	3	2.1
Level of Education		
Primary Education	32	21.9
Secondary Education	52	35.6
Tertiary Education	47	32.2
No Formal Education	15	10.3
Household Size		
≤5	47	32.2
6-10	79	54.1
11-15	12	8.2
16-20	8	5.5
Mean	7.47	
Household Annual Income (₦)		
60,000-120,000	5	3.4
120,001-180,000	33	22.6
180,001-240,000	26	17.8
240,001-300,000	24	16.4
300,001 above	58	39.7
Mean	287,410.95	

Source: Field Survey, 2019

Table 2: Distribution of Respondent by Available Water Source in Ondo State

Source	Rainy Season		Dry Season	
	Frequency	Percentage	Frequency	Percentage
Improved Water Source				
Pipe Borne Water (Govt.)	58	39.72	50	34.25
Boreholes with Pump (Senators)	42	28.77	60	41.10
Protected Dug Wells	68	46.58	73	50.00
Unprotected Water Source				
Rain Water				
Unprotected wells	25	17.12	70	47.95
Springs/Brooks	15	10.27	65	44.52
Water Supplied by Vendors or Tanker truck	18	12.33	80	54.79

Source: Field Survey, 2019 Multiple sources/responses

Table 3: Distribution of Respondents by Water Consumed Domestically and Water Storage

Litres	Drinking	Cooking	Washing	Plate	Bathing
≤10	104(71.2)	1(0.7)	-	90(61.6)	44(30.1)
11-20	42(28.8)	63(43.2)	1(0.7)	54(37)	96(65.8)
21-30	-	81(55.5)	2(1.4)	-	6(4.1)
31-40	-	1(0.7)	2(1.4)	-	-
41-50	-	-	62(42.5)	-	-
50 above	-	-	79(54)	-	-
Total	146(100)	146(100)	146(100)	146(100)	146(100)
Water storage		**Frequency**		**Percentage**	
Water pot		11		7.5	
Plastic jerry can		36		24.7	
Plastic tank		13		8.9	
Bucket (open)		9		6.2	
Bucket with cover		77		52.7	
Total		146		100	

Source: Field Survey, 2019 Figures in parenthesis are in percentage

Table 4: Regression Result Showing Factor Influencing per Capita Water Consumption

Variable	Coefficient	T-value	P-value
Constant	3.635**	12.120	.000
Water fetch X_1	0.0404**	7.605	.000
Distance covered X_2	-0.001	-1.783	0.479
Household size X_3	-0.299**	-16.130	.000
Religion X_4	-0.184	-1.541	0.253
Marital status X_5	0.082	0.296	0.788
Age X_6	-0.005	-0.923	0.864
F value	**46.781****	**0.00**	
R^2	**0.669**		
R^2 Adjusted	**0.665**		

Source: Field Survey, 2019 ** Significant level @ 1%

Table 5: Distribution of Respondents according to their Willingness to Pay for Drinking Water

Reasons	Frequency	Percentage
It will make drinking water available	80	76.19
It reduces distance to water source	40	38.10
Saves time for fetching	66	62.86
Improve regularity of water supply particularly during dry season	60	57.14
I don't have people to help with water fetching	46	43.81

Source: Field Survey, 2019 Multiple responses

Table 6: Distribution of Respondents according to their Unwillingness to Pay for Safe Drinking Water

Reasons	Frequency	Percentage
I don't have the money	26	83.87
Water is a gift from God	20	64.52
Rain water is available	24	77.42
I have my own well	15	48.39
I will not be able to use it the way I want	18	58.06
More attention will be given to the rich people who can afford to buy in large quantity leading to the neglect of the low income earners	15	48.39
The water may not be available regularly even in cases of advance payment	21	67.74
I cannot ascertain the quality of water	23	74.19

Source: Field Survey, 2019 Multiple responses

Table 7: Probit Regression Results

Variable	Coefficients	P>|t|
Age (X_1)	0.210	0.000
Annual income (X_2)	0.415	0.010
No of years spent in school (X_3)	2.114	0.000
Household size (X_4)	-0.141	0.0105
Nearness to water source (X_5)	0.620	0.865
Primary occupation (X_6)	-0.210	0.551
Accessibility to safe drinking water (X_7)	-0.521	0.016

Source: Field Survey, 2019 * Significant level @ 1%

Table 8: Distribution of Respondents according to the Problem encountered with Safe Water Accessibility

Problem	Frequency	Percentage
Poor water conservation technologies	85	58.22
Inability to recycle water (particularly rain water)	120	82.19
Distance to safe drinking water	70	47.95
Uncovered dug wells	66	45.21
High cost of digging wells or sinking boreholes	110	73.34
Inadequate boreholes/dug wells	66	45.21
Drought	100	68.49
Pollution	66	41.02

Source: Field Survey, 2019 Multiple responses

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