Rural Households' Access, Willingness to Pay (WTP) and Factors Influencing WTP for Safe Water and Sanitation in Southwest Nigeria

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6. PAPER

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Abstract

Access to safe water and sanitation is one of the core development indicators recently gaining pre-eminence in Nigeria. This study examined rural households' access, willingness to pay (WTP) and factors influencing WTP for safe water and sanitation. The study was conducted in Ogun State, Nigeria. A cross sectional survey which involved the use of questionnaire was used. A dichotomous choice (DC) with follow-up was used as elicitation method. A multi-stage random sampling technique was used to select 160 rural households. Descriptive statistics and Logit regression model was used for data estimation. Results revealed that 24.4% had access to safe water; 21.3% and 6.2% had access to improved toilet and refuse dumping sites. Most respondents showed WTP for these improved services. Sex ($p<0.01$), occupation ($p<0.01$) and income ($p<0.1$) significantly influenced rural households' likelihood WTP for these facilities. Inference from this study showed that rural dwellers' access to safe water and sanitation is highly deplorable. Governments and stakeholders should encourage and support to rural people by providing these facilities given their willingness to pay for it.

Key words: Safe water, sanitation, Willingness to pay (WTP)

1.0 Introduction

The Millennium Development Goal (MDG) which calls for environmental sustainability as one of its targets proposes halving the proportion of people without sustainable access to safe water and basic sanitation by 2015 (WHO, 2012). In Nigeria, this means 70% of the household must have access to safe water by 2015 (UNICEF, 2008). Closely related to this is achieving a significant improvement (in terms of standard of living) in the lives of at least 100 million rural farm households' by 2020. On the health front, countries of the world have been mandated to reduce the incidence of water-borne diseases between 1990 and 2015 by two-third (WHO, 2012).

Water is one of the most valuable natural resources vital to the existence of life. Quality of drinking water is a powerful environmental determinant of health. An assurance of quality drinking water serves as a pillar for preventing water-borne diseases for decades (WHO, 2011). Despite the importance of water, a global paucity of safe drinking water had been established across the globe (UN, 2002; UNEP, 2002; WHO and UNICEF, 2004). UN (2002) report showed that 1.1 billion people representing 18% of the world's population lacked access to safe drinking water from 1990- 2002. Majority of these people live in rural areas and are among the poorest and most vulnerable set of people in the world (UN,2002).

UN (2002) confirmed that with adequate supplies of safe drinking water, the incidence of some illnesses and death could drop by as much as 75%. Emphasizing the significance and importance of water, Nielson (2004) asserted that safe drinking water is not just a luxury owing to the fact that it's a necessity: it usually creates a distinction between life and death

Over 40% of the people who lacked access to safe water live in Sub–Saharan Africa. Similarly, 17% of rural dwellers in Latin America and the Caribbean and 9% in Northern Africa still resorted to open defecation. Out of 1.1 billion people who still practice open defecation, majority (94.9 %) live in rural areas (MDG, 2012).

Presently, just 63% of the world population have improved sanitation access, with a projection of 67% by 2015, which is below the 75% target in the MDGs. However, only 61% of the people in Sub-Saharan Africa have access to improved water supply sources (which is still below the 65% target for 2015) as compared to 90% or more in Latin America and the Caribbean Northern Africa and the larger parts of Asia (WHO/UNICEF, 2012).

The Joint Monitoring Programme for water supply and sanitation, (2012) also indicated that at least 11% of the world's population (783 million) still lacked access to safe water, and billions without sanitation facilities. The world is, therefore, seriously on course in its efforts to meet the sanitation targets. Due to this, if an appreciable progress is not made till 2015, 2700 million people will lack access to improved sanitation.

The MDG report confirmed that 2.6 billion people lacked access to basic sanitation in 2002 (WHO, 2012). During 1990- 2002, access to improved sanitation increased by 9% globally i.e. from 49% in 1990 to 58% in 2002(WHO, 2012). In Nigeria, water and sanitation coverage rates are among the lowest in the world; access to safe and improved water source stagnated at 47% from 1990 to 2006, but increased to 54% in 2010. Access to safe water decreased from 80% to 65% in 2006 in urban areas, and increased to 74% in 2010 (Wikipedia, 2012). Likewise, access to adequate sanitation decreased from 39% in 1990 to 35% in 2010; 25% of Nigerians used shared sanitation facilities, which are not

adequate (Wikipedia, 2012). The consequence of the failure to provide safe water is that a large proportion of human beings have resorted to the use of potentially harmful sources of water. The implications of this collective failure are dimmed prospects for the billions of people locked in a cycle of innumerable number of diseases.

An estimate made in 2007 by Africa Development Fund (ADF) affirmed that 70.30 million Nigerians (52.2%), lived in rural areas. Access to safe water facilities is estimated at 43% for rural areas and 70.6% for urban centres, with an average of 54.1%. The sanitation rural population coverage is 32% and urban 75%, with an average of 52.8%.

In rural areas in least developed countries, 97 out of every 100 people do not have piped water , they drink surface water(which is prominent to rural dwellers) from rivers, streams ponds or lakes which is prone to contamination and needs to be piped to the point of need (MDG, 2012; MacDonald, 2005).). The state of water and sanitation in many Nigerian rural areas is deplorable. Since 1990, there had been little change in water and sanitation coverage in Nigeria (Sanitation and water for all, 2012).

In as much as there is no access to supply of safe water and sanitation in rural Africa, and most importantly in Nigeria, the health and livelihood of families had been severely affected (MacDonald, 2005). The Limited access to safe water and sanitation are reported to have adversely affected millions of people in the world most especially the poor in that they die from preventable diseases caused by inadequate water supply and sanitation services (Bogale and Urgessa, 2012). Women and the children are the main victims; burdened by the need to carry water from long distances every day aggravating their

poverty and productivity level, while their sicknesses puts severe strains on health services and hospitals (Bogale and Urgessa, 2012).

Despite government's recent efforts in Nigeria, only 47 percent of the population had access to improved water source in 2008. In 2010, 54% had access to safe water in urban households while 43% of rural households had access to safe water in Nigeria as against the national target of 65%. At the same time, only 35% and 27% in both urban and rural areas had access to sanitation which is far-fetched from national target of 75% by 2015 (Sanitation and water for all, 2012). Subsequently, if Nigeria does not meet the MDG targets in both rural and urban areas, 48% of the rural population and 40% of the urban population would remain without access to improved sanitation; and 22% of the rural population and 11% of the urban population would still be using unimproved sources of water (Sanitation and water for all, 2012) .This suggests that majority of the populace is subjected to higher risk of water- borne diseases, especially people living in rural areas. Moreover, people living in rural areas have been characterized by very poor sanitation thus subjecting them to higher vulnerability from different diseases (MDG Monitor, 2008).

The national estimate in Nigeria revealed that less than half of the population have access to improved sanitation facilities; subject to this, close to one million latrines need to be constructed every year from between 2008 and 2015 to meet the Millennium Development Goal (MDG) target (UNICEF, 2008).

Safe water is a basic need for survival as well as a determinant of health, and should be considered with the use of sanitary facilities and practices of appropriate hygiene behavior if positive health outcomes are to be maximized. The United Nations General

Assembly has recognized drinking water and sanitation as human right that means everybody must have access to it. The benefits related to water supply and sanitation are quite immense. This is true for developed countries, but is quite far-fetched from reality in developing countries, most especially in rural areas.

As a result, this research examined rural household access to safe water and sanitation, willingness to pay (WTP) and factors influencing WTP for safe water and sanitation in Ogun State.

2.0 Theoretical Framework and Literature Review.

The theoretical framework for the empirical valuation of non-market goods is based on the assumption of neo-classical economic utility maximization. With this, individual or household will demand greater or less quantities of non-market goods if variable price of this amenity exists. It therefore stands that if shadow price for the amenity can be estimated and a demand curve traced out, the familiar of consumer surplus can be used to assign economic value. Consumers make choices among alternatives following their preferences (Johansson, 1991). Preference can be defined as the outcome of a comparative evaluation of a set of objects (Druckman and Lupia, 2000). In economic consumer theory, an individual's response that A is preferred to B is understood to mean how the individual feels under situation A than under situation B.

Consumer's choices are constrained by income. Individuals maximize their utility under budget constraint y and goods set of prices $\beta = [p_1, p_2, ------, p_n]$ for market:

$v(p, y, z) = \max u(x, z)$ s. t. $y = px$.

Issues on water had been reviewed by Sobsey,2006; Arouna and Dabbert (2008) ; Ademiluyi and Odugbesan (2008); Adeboyejo *et. al.,*(2009); Sun *et. al.,* (2010) Raji and Ibrahim (2011)

Sobsey (2006) studied drinking water and its effect on health of Americans. Findings revealed that most rural drinking water supplies are from ground water sources, which are

contaminated with microbes and chemicals and were not willing to pay any increment placed on water rates from a community piped supply.

Arouna and Dabbert (2008) reported the determinant for domestic water use by rural households without access to private improved water sources in Benin. Data were collected from 325 households in 27 villages. Results showed that both free and purchased water consumption in the dry season were positively related to household asset expenditure Better- off people may travel long distances by motorcycle to fetch water; also poverty reduces water use. Household size positively affects water demand, water price had a negative effect on purchased water use.

Ademiluyi and Odugbesan (2008) in their review paper studied sustainability and impact of community water supply and sanitation programmes in Nigeria. It was also revealed that scarcity brings hardship to people and also reduces household capacity to water with other asset in order to produce income.

Adeboyejo *et. al.,*(2009) reported on the Prevalence of Environmental Related Diseases in Peri-Urban Areas of Ogbomoso, Nigeria. 200 respondents were sampled for the study. Descriptive Statistics techniques were used for the analysis of data. The study revealed a general lack of basic infrastructural facilities and services. 26.5% of them had no toilet, 99% of the respondents did not have access to pipe-borne water, with 80% using near by vacant land as refuse dump.

Sun *et. al.,* (2010) reported on providing Access to Safe Water and Sanitation. The study examined the role that Water and Sanitation committees (WATSANs) played in providing access to safe water. Findings showed that more than 50% of the sampled households zones had access to safe drinking water. Household members spent between

20 to 30 minutes every day to fetch water. It was also revealed that less than 20% of a WATSANs were female, higher percentage of households in communities with a WATSAN were satisfied with the quantity and quality of drinking water than in communities without a WATSAN. The presence of a WATSAN in the community had a significant positive influence on the payment for water services in the communities

Raji and Ibrahim (2011) studied prevalence of waterborne infections in Northwest Nigeria. It was revealed that waterborne infection constituted 10.03% of the reported 8,353 diagnosed infections. Sources of drinking water available to the residents in the study area were not fir for drinking and this was suspected to be the cause for the prevalence of diarrhoea(62.2%).

2.1 Concept of Willingness to Pay (WTP)

Willingness To Pay (WTP) value of a good or service may be elicited in two ways:

directly by asking consumers, through carefully orchestrated elicitation methods; indirectly by examining market prices. The Contingent Valuation (CV) method is survey-based elicitation technique to estimate WTP values of a good that is not traded in the conventional market. The CV method is often referred to as stated preference method, in contrast to revealed preference methods, which use actual revealed behaviour of consumers in the market. The CV method directly asks consumers' WTP for a non-marketed good under a given condition or a prescribed circumstance. To elicit consumers' WTP values for non-marketed goods, a hypothetical market scenario should be formulated and described to the survey respondents. Thus, the elicited WTP values of a good are "contingent upon" the hypothetical market prescribed in the survey instrument. More specifically, the progress on econometric analysis, survey research methods, sampling and experimental design, and policy applications in the last 50 years has been remarkable. In Smith's assessment, concerns relating to measurement bias in estimating non-use values can be excessive. In the case of Water Supply and Sanitation (WSS), however, similar measurement bias is a lesser concern because of estimation of

direct use values. As Smith further elaborates, hypothetical bias can also be large because of the nature of CV surveys. Careful development of survey instruments (through initial preparatory work, focus groups, cognitive interviews, and pretests); conscientious implementation of field work; and rigorous econometric analysis that link the data to underlying theoretical models can help hypotheticality in a CV study. Another important reason behind the expressed reservations about the CV method is the potential divergence between responses and actual behavior.

The emerging evidence shows that predictions from "hypothetical" CV scenarios seem to compare well with actual behavior (Cameron *et. al*., 2002, Vossler and Kerkvliet 2003). Griffin *et. al*., (1995) show similar predictable behavior in the case of WSS improvements.

3.0 Methodology

The Study was conducted in Ogun State, Nigeria. It has four agricultural zones and this study cut across all the zones. A cross-sectional survey which involved the use of questionnaires was employed. A multistage random sampling was used for data collection. The first stage involved a random selection of two blocks from each zone. The second stage involved a purposive sampling of sixteen cells from the eight blocks. In the third stage, a systematic random sampling of ten households from each of the cells was done. The last stage involved the collection of data from sampled 160 households. For this study, Dichotomous choice (DC-CVM) with follow-up was employed.

Descriptive statistics and logit regression model were used for data estimation.

3.1 Estimation Techniques.

3.1.1Descriptive Statistics: This involved the use of frequency, percentages and tables.

3.1.2 Logistic Regression Model.

The logistic model predicts the logit of *Y* from *X*. The logit is the natural logarithm (ln) of odds of *Y*, and odds are ratios of probabilities (P_i) of *Y* happening to probabilities of *Y* not happening ($1 - P_i$). This will be used to analyse factors influencing households willingness to pay (WTP) for safe water and improved sanitation (i.e. toilet and refuse disposal).

The linear probability model can be generally expressed as:

$P_i = E(Y = 1 / X_i) = \beta_0 + \beta_1 X_s + \varepsilon$ (1)

Equation 1 shows the cumulative logistic distribution function.

Zi ranges from $-\infty$ to $+\infty$, while P_i ranges between 0 and 1.

$$P_i = E(Y = 1/X_i) = \frac{1}{1+\exp[-(\beta_1 + \beta_2 X_i)]} = \frac{1}{1+\exp(-Z_i)} \qquad (2)$$

Where Zi = $\beta_1 + \beta_2 X_i$

The probability of WTP for safe water and improved sanitation, therefore, is specified as

$$\frac{1}{1+\exp(-Z_i)} \qquad (2a)$$

while 1-Pi is the probability of not having WTP for safe water and improved sanitation which can be expressed as

$$\frac{1}{1+\exp(Z_i)} \qquad (2b)$$

Following from equations 2(a) and 2 (b), it can be said that the probability of WTP for safe water and improved sanitation in relation to probability of not having WTP safe water and improved sanitation can be written in equation 3

$$\frac{P_i}{1-P_i} = \frac{1+\exp(Z_i)}{1+\exp(-Z_i)} \qquad (3)$$

$P_i / 1-P_i$ is the odd ratio in favour of WTP to safe water and improved sanitation to the probability of not having WTP for safe water and improved sanitation . Taking natural log of (3), we obtain

$$L_i = \ln[P_i/(1-P_i) = Z_i = \beta_1 + \beta_2 X_i \qquad (4)$$

The log of the odds is not only linear in X, but also linear in the parameters. L is the Logit

Model.

In explicit terms, the probability model to determine factors influencing WTP for safe water and improved sanitation will be operationalised as equation 1

$$P_i = E\,(Y = 1 / X_i) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \text{----------} + \beta_8 X_8 \qquad (5)$$

Where the dependent variable (Y) = WTP for safe water and improved sanitation (Dummy)

β_s are the regression coefficients

X_s are the explanatory variables

X_1= Age (years)

X_2 = Sex - dummy (1- female, 0 otherwise)

X_3 = Marital status (1-Married, 0 otherwise)

X_4 = Household size (number of people)

X_5 = Level of Education (number of years)

X_6= Occupation (1- farming, 0 otherwise)

X_7 =Water distance (kilometres)

X_8 = Monthly Income (naira)

Note: The same explanatory variables were used for WTP for safe water and sanitation, except for X_7 in which toilet distance and distance of refuse disposal from the house ware used for improved sanitation.

4.0 Results and Discussion

4.1 Access to safe water by Respondents.

Findings from table 1 revealed that only 24.4% of the households had access to borehole (which was recorded in literature to be safe).This was asserted by IFPRI (2010) and Shittu *et. al* (2010).The percentages of households with access to stream, river, well without cover, deep well without cover and rain were 18.1%,46.9%, 33.8%,4.4%and 4.4%. This showed that households in the study were still devoid of safe water in their rural communities.

Table 1: Respondents Access to Safe Water

Variable	Frequency	Percentage*
Stream	29	18.1
River	75	46.9
Well	54	33.8
Deep well	7	4.4
Borehole	39	24.4
Spring	0	0
Pipe borne	0	0
Rain	7	4.4
Others	0	0

Note: * = Percentage for multiple response data.

4.2 Access to Improved Sanitation by Respondents.

It could be observed from table 2 that only 21.3% of the households had access to toilet while 78.7% of the households defecate within their vicinity. Likewise, only 6.9% of the households had access to refuse disposal while majority (80%) dispose their refuse in to bushes within their environment. These connote that households still lacked toilets and proper refuse disposal and these are injurious to their health.

Table 2: Respondents Access to Sanitation.

Access To Toilet			Access To Refuse Disposal		
Variable	**Frequency**	**Percentage**	**Variable**	**Frequency**	**Percentage**
Pit latrine without slab	19	11.9	Refuse Dumping site	11	6.9
Bucket	3	1.9	Bush	128	80.0
Water closet	11	6.9	Stream/River	1	0.6
Pit latrine with slab	23	14.4	Flood	1	0.6
Bush	91	59.9	Others	19	11.9
Others	13	8.1	Total	160	100.0
Total	160	100.0			

4.3 Willingness to pay for Safe water and Sanitation by Respondents.

From table 4, results revealed that 75.6%, 64.4% and 55.6% of the respondents were willing to pay for safe water, improved toilet and improved refuse disposal. This implies that respondents realized the significance of safe water and the associated positive benefits of living in a clean and healthy environment which necessitate their willingness to pay for safe water and improved sanitation.

Table 3: Respondents Willingness to Pay for Safe Water and Sanitation.

Variable	Frequency	Percentage
WTP for Safe water	121	75.6
WTP for Improved toilet	103	64.4
WTP for refuse disposal	89	55.6

Source: Field Survey, 2013.

4.4 Factors Influencing Respondents Willingness to pay for Safe Water.

Table 4 showed Logit regression model result determining factors influencing WTP for safe water by rural households in the study area. The calculated Chi- square value

associated with the likelihood ratio (LR) test was significant ($p<0.01$) which indicates the goodness of fit of the model. The McFadden R-square also depicts goodness of fit which however, is of secondary importance in Logit Regression model.

Findings revealed that occupation was positively significant ($p<0.01$). This implies that occupation influenced households willingness to pay for safe water. Likewise, it connotes that farming as an occupation has widened the intellects of households via the support of the extension agents in various rural communities on water issues. The result of the marginal effect of the variable being positive indicates farming as an occupation increases the probability of willingness to pay by rural households.

However, income as a variable was negative and significant ($p<0.1$). This indicates that as income increases, paying for safe water also increase. In the same vein, the higher the income of the ruralites, the more the ruralites willingness to pay for safe water. This implies that households with lower income had the likelihood of not paying since they had the notion they are incapable and believed that water is a free gift of nature. The marginal effect of income which was negative depicts that the lower the income of the rural household, the lesser the probability of their willingness to pay for safe water by 0.22%.

Table 4: Logit Regression on Factors Influencing Rural Households' WTP for Safe Water.

Variable	Coefficient	T-ratio	Marginal effect
Age	-0.0038	-0.27	-0.00064
Sex	-0.45	-0.96	-0.076
Marital status	-1.13	-1.37	-0.19
Household size	0.0095	0.16	0.0016
Education	0.040	0.79	0.0067
Occupation	1.28***	2.98	0.22
Water distance	-0.0070	-0.015	-0.0012
Income	-0.000013*	-1.76	-0.0000022
Constant	2.12	1.76	
Log likelihood Function	-80.04		
Number of Observation	160		
McFadden's R-square	0.09		
Likelihood Ratio Test	χ^2 (df =8); 17.63		

The statistical significance is denoted as follows: *p<0.10, **p<0.05, ***p<0.01

4.5 Factors Influencing Respondents Willingness to pay for Improved Toilet.

Table 6 below revealed Logit regression model result examining factors influencing WTP for improved toilet by rural households in the study area. The calculated Chi-square value associated with the likelihood ratio (LR) test was significant ($p<0.01$) which depicts the goodness of fit of the model. The McFadden R-square also depicts goodness of fit but is of secondary importance in Logit Regression model. Sex and occupation had significant effects on factors influencing respondents willingness to pay for improved toilet.

The variable sex (female =1, 0 otherwise) had a negative and significant effect ($p< 0.01$) on rural households willingness to pay for improved toilet. This contradicts the work of Bogale and Urgessa (2012),but support the study of Alebel (2002). Inference could be drawn that male had lesser tendencies or likelihood of paying for toilet facilities in the study area. This means that male-headed households were non-challant and lackadaisical about improved toilet since bushes surround their environment. The result of the marginal effect showed that being a male reduces the probability of willingness to pay by 0.33%.

Occupation of the respondent had a positive sign and was significant ($p<0.01$) on rural households willingness to pay for improved toilet. It is evident that rural households involvement in farming as occupation increase or improve paying for toilet facilities in the study area. Marginal effect denotes that occupation improves the likelihood or probability of rural households willingness to pay for toilet facilities by 29%.

Table 5:Logit Regression on Factors Influencing Rural Households' WTP for Improved Toilet.

Variable	Coefficient	T-ratio	Marginal effect
Age	-0.0059	-0.45	-0.0013
Sex	-1.49***	-3.18	-0.33
Marital status	-0.099	-0.16	-0.022
Household size	-0.011	-0.21	-0.0025
Education	0.076	1.61	0.017
Occupation	1.33***	3.30	0.29
Toilet distance	0.41	1.17	0.089
Income	-0.000010	-1.40	-0.0000022
Constant	0.92	1.09	
Log likelihood Function	-90.45		
Number of Observation	160		
McFadden's R-square	0.13		
Likelihood Ratio Test	χ^2 (df =8); 27.49		

The statistical significance is denoted as follows: *p<0.10, **p<0.05, ***p<0.01

Conclusion

Evidences from this study revealed that rural households access to safe water is devastating. More than 70% of the respondents did not have access to good water sources, only 24.4% had access to protected borehole. However, 59.9% of them defecate in the bush within their vicinity as this is injurious and dangerous to their health. Consequently, 80% of the ruralites dispose refuse into bushes. Moreover, 75.6%, 64.4% and 55.6% of the respondents were willing to pay for safe water, improved toilet and

improved refuse disposal. Occupation had a positive and significant effect while households income had negative and significant effect on the probability of WTP for safe water. Sex and occupation had negative and positive effects on the probability of household WTP for improved toilet facilities. Government and stakeholders should support ruralites WTP for these services by providing it.

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