

Evaluation of the Factors Influencing Compliance for Payment of Improved Household Water Supply Service in Akinyele Local Government of Oyo State, Nigeria

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Abstract This study examined the factors influencing the willingness to pay for improved household water supply service in Akinyele Local Government, Oyo State. Data were collected from 107 households randomly sampled from the Local Government Area. A dichotomous choice contingent valuation technique was used to elicit households' willingness to pay for an improved water supply service. The data were analyzed using logit regression technique. The results show that the mean willingness to pay of households for improved water supply service is 0.696. The positive mean willingness to pay implies that the households demand improved water supply service in which the improvement in the water supply service will directly improve their welfare. The results further reveal that the significant factors determining households' willingness to pay for improved water supply service are number of households' adults, minutes taken to fetch water, and the amount willing to pay by the households for the proposed improvement in the water supply service. The willingness to pay for water is useful in informing water policy makers for future water supply and services improvement in the Oyo state, Nigeria.

Keywords: improved water, willingness, households, logit regression, akinyele

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1. Introduction

Millions of people in developing countries experience challenges in obtaining potable water for domestic purpose. Recognizing the harm to health, economic productivity, and quality of life that can result from inadequate water supplies, international donors and the governments of developing countries have mounted numerous efforts to address the challenge. The international community affirmed its commitment to improving water supplies by declaring the 1980s the United Nations' International Drinking Water Supply and Sanitation Decade; that commitment was reaffirmed at the 1990 New Delhi Global Conference on Safe Water and Sanitation [1].

Water is one of the most important natural resources because it support life and is viewed as key to prosperity and wealth [2]. However, water tables are falling [3] and aquifer depletion is now an emerging problem. It is documented that less than 10 countries have about 60% of globally accessible water [4]. This gives an indication of the extent of inequitable distribution of water globally and nationally. The widening gap in demand and supply for water amidst a readily growing urban population and rising cost of developing new sources of water supply has

led to greater attention in water demand management strategies which are less costly and more consistent to ensure sustainability of water supply. Putting into cognizance the environmental objective rather than focusing only on water supply expansion activities.

In Ibadan and indeed many cities in the world, water has become a problem of human survival, and socio-economic development. At the global level, plenty of water is available. But to meet the demand, water has to be supplied where and when needed. The spatial, temporal, and qualitative characteristics pose the greatest challenge to meeting the rising demand in all sectors. Rosegrant, [3] observed that access to clean water for drinking, cooking, bathing and other household needs is fundamental, but over 1 billion people still lack access to safe domestic water supplies. This is due to population growth and rapid urbanization, which may consequently increase in coming years unless serious massive investment in supply infrastructure are undertaken to stem the tide. Massive investments in supply infrastructure are required as well as reforms in the operation and maintenance of supply systems to increase efficiency.

Nigeria ranks amongst the countries with the lowest level of potable water supply in the world, [1] despite the fact that Nigeria was a signatory to the International Water Decade (1981-1990). The status of urban and rural water supply are characterized by low level of coverage which

could be as a result of weak political commitment, lack of operation and maintenance culture for existing facilities and poor workmanship by contractors. The Ibadan councils cannot single-handedly and satisfactorily meet the demand of the improved water by the households, thus, water sourced from the government is generally irregular or unreliable thus inadequate to meet the rising needs of the households.

The Nigerian Government has long considered the provision of water supply services to be at the domain of the federal, state and local governments. However, the public sector has not been successful in meeting more than a small portion of the demand for water and sanitation of residential and commercial users. Services are critically in short supply. For example, out of the 85 million people living in urban and semi-urban areas, less than half have reasonable access to reliable water supply. Many households, often the poorest, end up purchasing water from private vendors much more expensively than from the public supply. Water supply services are unreliable and of low quality and are not sustainable because of difficulties in management, operation, pricing and failure to recover costs. Many water supply systems show extensive deterioration and poor utilization of existing capacities, due to under-maintenance and lack of funds for operation [6].

More than half of Nigeria's growing populations (over 80 million people) do not have access to clean water and sanitation services [7]. However, the crave for a consistent and reliable water source by the citizenry created the need to research into the willingness to pay for alternative water source by the household outside the public water source bearing in mind that a private organization is profit oriented. Considering the demand for improved water supply, the development efforts encourage bottom up approach (that is, households meeting their water needs collectively) to providing water supply services to the end users in order to ensure sustainability. Recent reforms in Nigeria are hinged on private participation in governance. It is in view of this that the study was carried out to examine factors that affect households' willingness to pay for improved water.

Improving the adequacy and quality of water supplies is a priority for community development in developing countries. So far, the strategies of governments and international donors for tackling the problem have been supply-driven; the fundamental importance of the factors affecting households' willingness to pay in the selection of appropriate policies has been virtually ignored. The realization that effective policy and planning must take into account what the households want and are prepared to pay for was the impetus for this study.

The main objective of this study is therefore to examine the factors influencing the willingness to pay for improved water supply service by the households in Akinyele Local Government Area.

2. Concept of Willingness to Pay

Water pricing is the price paid by a domestic user for water distribution, purification and treatment. It aims at determining the amount of money a consumer will pay for the supply of water. For example, a price responsive

consumer might reduce water usage according to rate of increase. Contrary to popular opinion water is not inexhaustible gift of God. Indeed in view of the present state of water supply on the earth, the next world war may possibly not be caused by petroleum but by water [8].

Water has high value which must be paid for. Two extreme views are often expressed as regard availability of water. First, that man is in his critical period of water consumption, because the demand for water has already overtaken its supply. The second view is that water is sufficiently available everywhere and in every part of the world. Indeed, both views may be acceptable in water resources. The world water resources and access to water shows that potable water is scarce. Meanwhile, anything scarce and in high demand commands a price. For example, water is scarce especially in the context of drought and degraded quality. Hence, there is a need to price water [8].

The reserve generated through the purchase of water has been shown to equate to the cost of developing city's public water utility. Whittington's [9] research on willingness to pay is the most popular because of its wide revelation in Onitsha; Nigeria, which illustrates how level of payment for water equate to the finance of urban water supply and infrastructural development. Valuing water is controversial; willingness to pay conceptualizes water as a commodity (i.e. good to be bought).

The variations in perceptions of water are clearly wide ranging and it cannot be assumed that people attached the same value or cost to the provision of water at one time or in any one place. These variations are not always recognized by government organizations and development agencies consequently they tend to over or under estimate the levels of unwillingness to pay for a commodity when implementing water projects. Therefore, water supply projects fail because the needs and requirement of the community have not been met and their willingness to pay is not clearly signaled [8].

Kessler, [10] observed that free access to a resource leads to excessive use and that charging of water rates leads to sustainable water management. In the same vein, Rogerson, [11] observed that State or government tariffs rarely reflect a community's willingness to spend. Many factors affect household water demand and willingness to pay for improved water services. According to [1] many of the water projects implemented over the last decades in developing countries are considered as failures. This is because poor knowledge of the health benefits of improved water supplies, affordability of tariffs, insensitivity by donors and central government to local customs and beliefs and the ability to operate and maintain water systems by local and community participation and local involvement in design and management [12].

It also due to poor emphasis on the importance of improved project identification, design and construction, the level of understanding of the institution providing water and their tendency towards selecting capital intensive projects, the neglect of maintenance schemes and establishment of strategic links between water, the investment sector and micro economic policies [13,14]. Several studies such as [1,9,15,16,17] showed that the willingness to pay for improved services does not depend solely on income, but on both existing and improved supplies. Income elasticity of demand for access to

improved water services have been estimated to be low as 0.15 in Brazil, 0.4 in India and 0.07 in Zimbabwe. The report further showed that, more educated households are willing to pay more for improved water supplies; while gender was also statistically significant in WTP. Secondly demand for improved water supply also relate to the characteristics of the existing water source, such as quality and reliability of supply. Finally, a third demand factor refers to the attitude of government water supply and their inefficiencies [1]. In Brazil and India it was reported that more educated households are willing to pay more for improved services, the characteristics of existing water source in terms of quality and reliability of supply and the attitude of governments' water supply and their purchasing power have also been fingered in the analysis of willingness to pay [8].

3. Materials and Methods

This study was carried out in Akinyele local government area of Oyo state. It is located between latitude 30° 45' and 7° 31'N and on longitude 4° 00'E. It has a population of 211,359 comprising of 105,633 males and 105,726 females [18]. This area falls within the forest and derived savanna, and major streams are Odo-Ose, Odo-Ona and Odo-Oba and a forest reserve at Atan/Imini near Ijaye. The climate of the area is a typical tropical type which is the wet and dry season. The area was selected because it consists of different communities that can be categorized as rural, peri-urban and urban.

Primary data was used in the study, collected with the aid of a well structured questionnaire. The information collected include: household socio-economic characteristics such as age, educational attainment, household size, marital status, households' primary occupation, income and households water characteristics such as hauling time, distance to water source, amount the households are willing to pay for improved water and willingness to pay of households is presented as this: "Has any member of households suffered from any water borne disease before as a result of utilization of unclean water?". "Do you face any hardships before getting water for your domestic use?" If yes, suppose there is a project to improve the supply of portable water in Akinyele Local Government, will you be willing to pay for the improved service? a. Yes () b. No (). How much will you pay for 1 litre of water? e.t.c. A simple random sampling technique was employed. 107 households were randomly selected from the households in the study area. Data was analyzed using descriptive statistics and logistic regression model.

3.1. Descriptive Statistics

Descriptive statistics such as frequency distribution tables and percentages were used to analyze the socioeconomic characteristics of the households.

3.2. Logit Model

The logit model was used to determine the mean willingness to pay for improved water supply service by the households and the factors influencing their willingness to pay. The logit model which is based on the cumulative probability function was adopted because of

its ability to deal with a dichotomous dependent variable and a well established theoretical background. Logit model is a qualitative response regression model i.e. the regress and is a binary or dichotomous variable. Logit regression model is employed to find the probability of occurrence of an event or not. Hence, qualitative response regression models are often known as probability model.

Mean willingness to pay of the households: To obtain the mean willingness to pay of the households for an improved water supply service, the responses of the households to the willingness to pay question were regressed on the amount they are willing to pay for improved water supply service. The co-efficient estimates obtained were then used to calculate the mean willingness to pay of the households.

$$\text{Mean WTP} = \frac{1 + \ln(1 + \exp B_0)}{|B_1|} \tag{1}$$

Where B₁ and B₀ are coefficient estimates obtained from the logistic regression and mean WTP is the mean willingness to pay of households for improved water supply service.

Factors influencing willingness to pay of households: To identify the factors influencing the willingness to pay of households for improved water supply service, the household's responses to the willingness to pay question were regressed on the amount they were willing to pay and other socio- economic characteristics of the households.

The logit regression model is specified as

$$P_1 = E(y = 1 / X_i) = \beta_0 + \beta_i X_i \tag{2}$$

Where X₁ represents explanatory variables included in the model, Y = Response of the households to the willingness to pay question which is either 1 if Yes or 0 if No. Y = 1 means the event occurred, otherwise Y = 0.

$$P_1 = E(y = 1 / X_i) = \frac{1}{|1 + e - (\beta_0 + \beta_1 X_1)|} \tag{3}$$

Therefore,

$$P_1 = \frac{1}{1 + e^{-z_i}} = \frac{e^{z_i}}{1 + E_{zI}} \tag{4}$$

This is (cumulative) logistic distribution function. Where Z_{1=xxxx}Z_i ranges from x P_i ranges between 0 and 1, P_i P is nonlinearly related to Z_i (i.e. X_i).

P_i = Probability of an individual choosing an alternative i

β₀ = Constant

β₁ β₈ = Coefficient of the explanatory variable X₁.....X₈

X₁ = Household family size (continuous variable, in number of household member)

X₂ = Marital status (dummy variable, married =1 and 0 if otherwise)

X₃ = Number of household adults (continuous variable, in number of household adult)

X₄ = Number of household children

X₅ = Household head income (continuous variable in Naira)

X₆ = Minutes taken to fetch water (continuous variable in minutes)

X_7 = Distance to water source (continuous variable in meter)
 X_8 = Amount willing to pay (continuous variable in naira)

The Apriori Expectations of the Households Willingness to Pay for Improved Water Service

Variable	Sign	Source
Household Family Size	-	[19]
Marital Status	+	[19]
Number of Household Adult	No effect	[17]
Number of Household Children	No effect	[17]
Household Head Income	+	[8,17,19]
Minutes taken to fetch Water	+	[17]
Distance to Water Source	+	[17]
Amount Willing to Pay	-	[17,19]
Educational Level of House Heads	+	[8,17]

Source: Field Survey, 2013.

4. Results and Discussion

4.1. Socio-economic Characteristics of the Households

Information on the following socio- economic characteristics of the households was elicited from the respondents: household family size, household heads monthly income and educational level of the households' heads.

4.2. Distribution of Households according to Family Size

It was revealed from the result in Table 1 that the majority (69.2%) of the households have a family size of between 1- 5 in number, 29.0% of the households have family size of 6 -10 members, while only 0.9% have family sizes of 11 -15 and 16- 20 members. It is expected

that the higher the number of family size the more the demand for water by the household. Large households may not be willing to pay for improved water services as they are saddled with enormous financial responsibilities (such as children clothing, education, feeding, health and so on). Also, large households will have more family labour to fetch water for the household from various sources irrespective of the distance, instead of paying exorbitant price to get water.

Table 1. Distribution of Households according to Family Size

Household Family Size	Frequency	Percentage
1-5	74	69.2
6- 10	31	29.0
11- 15	1	0.9
16- 20	1	0.9
Total	107	100.0

Source: Field Survey, 2013.

4.3. Distribution of Respondents according to Household Heads Monthly Income

Table 2 reveals the monthly income pattern of the households' heads, majority (57.9%) of the households heads earn between 11,000- 50,000 naira per month, while 9.3% and 1.9% earn below 10,000 and above 150,000 naira respectively.

Table 2. Distribution of Respondents according to Households Heads Monthly Income

Household Heads monthly income	Frequency	Percentage
<= 10,000	10	9.3
11,000- 50,000	62	57.9
51,000- 100,000	33	30.8
101,000- 150,000	-	-
151,000- 200,000	1	0.9
>200,000	1	0.93

Source: Survey, 2013.

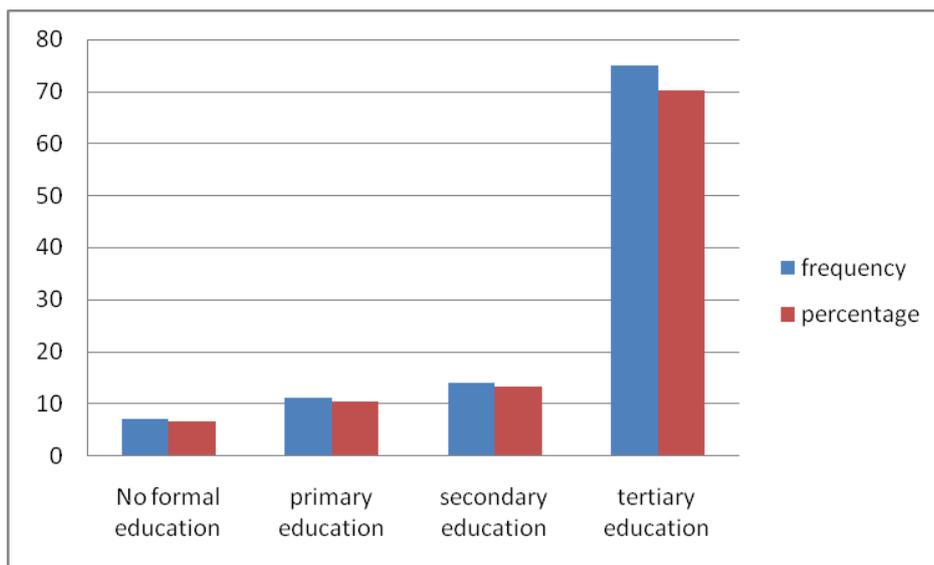


Figure 1. Distribution of Household Heads according to their Educational level (Source: Field Survey, 2013)

4.4. Distribution of Respondents according to Educational Level of Household Heads

The result from Figure 1 shows the educational level of the household heads, majority (70.1%) of the households'

heads have tertiary education, while only 6.5% have no formal education. According to [1,17], their empirical results generally confirm that better educated households are willing to pay more for improved water supplies. One might expect that as levels of education increase among household members, those households would be more

aware of the health benefits of improved water supplies and would thus be more likely to use improved services if they were available. If improved services were not available, one would expect that such households would be willing to pay more to obtain them than would households with lower educational levels. Also because better educated households might, for a variety of reasons, have higher opportunity costs for time spent collecting water from a source outside the house, they might well be willing to pay more for improved service than would other households.

4.5. Households Willingness to Pay for Improved Water Service

The willingness of the households to pay for the desired improvement in water service was determined using logit model. The mean willingness to pay for the improved water service was estimated to determine the economic benefit of the proposed improvement. The result of the logit regression is presented in Table 3; it shows the obtained parameter estimates that were used to calculate the households mean willingness to pay. The calculated mean willingness to pay is 0.696097, which is positive.

This implies that household’s demand improved water provision service in which will directly improve their welfare. The positive mean willingness to pay estimate obtained may be due to the fact that the majorities of the heads of the households are earning steady monthly salaries, thus they would be able to afford monthly payment for the improved service

Table 3. Results of logit regression

Variable	Coefficient	Standard Error	Z- Statistics
Constant	1.310	0.457	2.87 ***
Amount willing to pay	-0.020	0.009	-2.23 **

***-Statistically significant at 1%, **- Statistically significant at 5%, Restricted log likelihood = -71.5554, R-Squared = 0.4132, Chi- squared (LR) =2.34.

Multivariate logit model was adopted in determining the factors influencing the probability of households’ willingness to pay for improved water supply service. The result is shown in Table 4. The chi-squared (LR) reveals that the overall goodness -of- fit of the model was statistically significant at 1% level. Pseudo R- squared indicates that 41.32% of the variance was explained by the explanatory variables.

Table 4. Results of the Multivariate Logit Regression

Variable	Coefficient	Standard Error	Z – Statistics
Constant	-0.368	1.648	-0.22
Household Family Size	0.124	0.736	0.64
Marital Status	0.238	0.217	0.32
Number of household adults	-0.539	0.262	-2.48 ***
Number of household children	0.424	7.830	1.62
Household Head income	-1.480	0.016	-0.19
Minutes taken to fetch water	0.046	0.010	2.88 ***
Distance to water Source	-0.006	0.021	-0.60
Amount willing to pay	-0.039	1.648	-1.80 *

***-Statistically significant at 1%, *-Statically significant at 10%, Log likelihood = -58.632508, Chi- squared (LR Statistics) = 19.41, Pseudo R-squared = 0.1420.

4.6. Factors Affecting Households Willingness to Pay

Multivariate logit regression result in Table 4 shows the factors that influence the probability of households’ willingness to pay for improvement in their water supply service. It could be observed from the estimates of the multivariate logistic regression that three variables are significant, these are, number of household adults which is significant at 1%, minutes taken to fetch water also significant at 1%, and the amount willing to pay which is significant at 10%.

The result reveals that the marginal effect on probability of households paying for the improved water service with respect to the number of households is -0.539. This implies that for every 1 unit increase in the number of households’ adults, the likelihood of household paying a given price for the service decreases by 0.539. Likelihood of households paying a given price for improved water service increases as the minutes taken to fetch water increases.

The result also reveals that the marginal effect on probability of households paying for the improved water service with respect to the time taken to fetch the water is

0.046; this means that as minute taken to fetch water increases by 1 minute, the likelihood of the households paying for improved water service increases by 0.046.

Likelihood of households paying a given price for improved water service decreases, as the amount willing to pay by the households increases. The result reveals that the marginal effect on probability of households paying for the service with respect to the amount willing to pay by the households is -0.039. This implies that as the amount willing to pay by the households’ increases by 1 naira, the likelihood of households paying for improved water service decreases by 0.039.

5. Conclusion and Recommendations

Growing water scarcity requires sustainable water use, especially in urban areas where household water use requires high quality characteristics. To design effective water policy, households’ willingness to pay for improved water supply service should be sufficiently analyzed and broken down. The case of the Akinyele Local Government area presents certain interesting aspects in this context. In Akinyele Local Government the population density is

averagely high which led to intensified water use, while water resources are substantially scarce and the various economic growth scenarios alter water use patterns and habits. In this context, to design sustainable water policy is vital for the future of the area.

The results of the study revealed that the mean willingness to pay for improved water supply service by the households is positive. The positive mean willingness to pay for improved water supply service by the households shows that households demand improved water provision service in which will directly improve their welfare. The factors that affect the willingness-to -pay of the households for improved water service include; number of households adults, minutes taken to fetch water and the amount willing to pay by the households.

The conclusion is that water use will increase regardless of the evolution of water prices in the future, because of ever increasing human population. The information on the willingness to pay for water is useful in informing policy makers for future water supply and services improvement in the Oyo state, Nigeria. Since the households are willing to pay, if correct, these conclusions could lead to policy relevant recommendations.

Based on the findings of this study the following recommendations are made:

The positive mean willingness to pay for improved water supply service by the households shows their readiness to pay for any improvement in water supply service, since it's going to socio-economic development. Thus, the households should be encouraged to purchase this service.

In line with the households mean willingness to pay also, Government should provide portable water facilities such as piped water supply systems exploit and develop water sources such as ground water and surface water through boreholes drilling and construction of dams.

The government should pay due cognizance to the number of the households that are willing to pay for improved water service, the price of water provision service must be relatively affordable by everyone.

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