**ORIGINAL ARTICLE**

# Households' Water-Use Demand and Willingness to Pay for Improved Water Services in Ijebu Ode Local Government Area, Ogun State, Nigeria

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**ABSTRACT**

This study examined the households' water choice decision and willingness to pay for improvement in water services. Data were collected from 216 randomly selected households in Ijebu- Ode local government area, Ogun State. The data were analyzed using descriptive statistics, Ordinary Least Square regression and logit regression models. Result showed that majority of the households' water supply was from private piped/borehole. 58.3% of the households were dissatisfied with the current water supply situation and the households preferred water choices are public piped (64.4%), private piped/borehole (30.1%) and well water (5.6%).. These preferences of household's water choices were determined by quality, convenience, availability and cost with 35.6%, 33.3%, 18.5% and 12.5% respectively. It was revealed further that household per capita expenditure on water was ₦60 (US$0.38) per day an equivalent of ₦1,800 (US$11.5) per month. The mean willingness to pay for the improvement in water service was ₦2,247(US$14.4) per month which is even higher than the amount the respondent are spending per month on private piped and the current connection charge per month on public piped. The result of ordinary least square regression showed that connection charges, household size, distance to water source, availability and quality of water source, unit price paid per liter, and marital status were the significant determinants of households' water demand. Logit regression analysis result showed that age, gender, education, connection charges and household size are the correlates of willingness to pay for improved water services in the study area. It is recommended that the government should facilitate the availability of good and quality public water utilities in this area as the consumers are willing to pay for such beneficial services.

**Keywords**: Households, Water-use, Demand, Willingness to-pay, Ijebu-Ode

## INTRODUCTION

Many developing countries are experiencing rapid urbanization in human settlements, at the same time, available fresh water supplies continue to decline. The interdependence between water availability and development is exemplified by the link between water and poverty. Due to poverty, access to adequate water and sanitation is low in Africa. As a result of inadequate access to safe water and sanitation, there is a high incidence of communicable diseases that reduce vitality and economic productivity on the continent. Inadequate access to water and sanitation is thus both a cause and a consequence of poverty. Similarly, inadequate water resources can become a constraint to improved agricultural development and food security.

Systematic development of water supply and management in Nigeria dates back to the colonial times showed that the colonial administration developed domestic water supply as part of overall programme to improve the level of personal hygiene and environmental sanitation throughout the country, and thereby the health of the people. Unfortunately, as noted by Oyebande (1977), the priority accorded domestic water supply by the colonial administration had not been sustained by post-independence governments of the country.

Nigeria has 37 State Water Agency (SWAs) and 12 River Basin Development Authorities (RBDAs). Several of these water agencies and authorities depend on obsolete water equipment. This has been largely due to poor investments by Government and private sector organizations in the water sector in the last ten years in Nigeria compared to other sectors such as oil and gas, energy, housing among others (Adoga, 2006). These agencies lack capacity and financial resources and so are finding it difficult to meet the existing demand for safe water within their respective areas (Hall, 2006). After almost sixty years of water supply development in Nigeria, it is regrettable that only 60% of the population has access to safe drinking water, and in rural areas less than 50% of the households have access to good portable water (National Millennium Development Goals Report, 2005). Access to piped water is regarded as a measure of access to safe water. It is pathetic to observe that access to piped water among Nigerians has decreased extensively from 14% in 1990 to 6% in 2008 (WHO/UNICEF JMP, 2010). Rural people in the country still depend very much on rivers, streams, ponds, and shallow wells for their water needs. During the dry season, some of these sources dry up and households have to invest a substantial amount of their resources to get water of doubtful quality. This has very serious implications for the economic development and social welfare of the people specifically and the country as a whole. First, there is the tremendous economic waste involved in people spending so much time and effort in search of water. Secondly, lack of water often means relatively low levels of personal hygiene and environmental sanitation. Thirdly, because water is needed for most productive activities, inadequate access to water limits the livelihood options of the people, particularly in rural areas (IDRC, 2002).

The water supply varies dramatically from town to town in Ogun State and so does the cost. In the state capital, most people get free water from public supply, while in most other areas people have to pay for water from private vendors (OGS.W.C., 2010). Ijebu Ode city suffers from limited water supply, and present supply coverage is about 40%. Available water from existing water treatment plant is adequate to supply about 50% of the total estimated water demand of the inhabitants of the city(14,100m3/day out of the needed 28,200m3 /day).i.e. shortfall of 50% at full capacity of the existing plant after rehabilitation (OGSWC,2010). The most important river that supplies water to the inhabitants of the area is river Yemoji with average yield of 49.56. There is also evidence with the pipeline extension from Yemoji/Ijebu-Ode, 400mmØ pump line to Tai Solarin University of Education 8.4 kW, and doubling of Ijebu-Ode (OG.S.WC. 2010).

Overtime, this did not solve water shortages in the area, because most households still depend on water tankers and boreholes for water supply. The implications of the above scenario are that the citizens in the study area are groaning under the acute safe water supply and would be willing to pay for supply of potable, reliable and quality water.

Recognizing the harm to health, economic productivity, and quality of life that can result from inadequate services, international donors and governments of Nigeria have mounted numerous efforts to avert this problem. So far, the strategies of these organizations have been supply oriented, totally ignoring the importance of demand in the selection of appropriate policies. Hence, it is necessary to undertake a study on the demand side, which will depicts the needs of the consumers and whether they are willing to pay for such services. Two main stems in residential/domestic demand economic oriented analysis are found in the empirical literature. The first deals with the estimation of price or income demand elasticity, exploiting either household data or municipal/provincial data as unit of analysis. The price demand elasticity can be used for water demand management purposes while the income price elasticity can be useful in the forecasting process of the water requirements. The second research direction deals with the estimate of consumer willingness to pay for increasing in water service quality in holistic sense or concerning single characteristics of the service. Adekalu and Ojo (2002) reported that owing to deficiencies in piped water availability, households invest in coping strategies in the form of alternative supplies and storage facilities to supplement piped water. Gbadegesin and Olorunfemi (2007) in their study reported that more than half of the total respondents indicated borehole/well as the source of water they used most frequently, while rainwater is the least frequently

used (0.6%) while, in Ibadan rural communities, river/stream is the commonest and most available source of water they use. The reasons for the above distribution may have to do with the fact that most of the sources of water in the areas are seasonal and are incapable of all year round provision of water. Mu *et. al.*, (1990), presents a discrete choice model of households' water source choice decisions in developing countries. The results suggest that households' source choice decisions are influenced by the time it takes to collect water from different sources, the price of water, and the number of women in a household. Gbadegesin and Olorunfemi (2007) observed that there is variation in time spent fetching water among the communities sampled. Agbelemoge and Odubanjo (2001) reported that only 3% of the people have access to clean and safe pipe – borne water while the remaining 97% relied on streams, rain water, wells and springs for their domestic uses.

Previous studies have shown that low-income consumers are willing to pay for service they want including water supply (Cairncross, 1990; World Bank 1995). It has also been argued that if something is worth having, then it should be worth paying for. Chowdhury (1999) uses the contingent valuation method to estimate Dhaka Slum-dwellers willingness to pay for safe drinking water. The finding of the study shows that slum dwellers are willing to pay enough for water to cover the costs of providing it, suggesting that higher water charges would be a financially feasible to generate funds for water system investment.

A study from Nsukka district in Nigeria reveals that consumers are willing to pay for purchasing water from private vendors instead of paying flat rate user fees for potable water, reason being distrust in the quality and reliability of publicly supplied water (Whittington et.al., 1991) Stoveland and Bassey (2000) observed that the water supply situation is so poor that people say they are willing to pay a significant amount in cash on a regular basis is order to have access to reliable and safe water delivered through common types of facilities like wells and boreholes with hand pumps and motorised pumps. Omonona and Fajimi (2011) examine the factors that influence the willingness to pay for improved water supply services in Ibadan metropolis, Oyo State Nigeria. Result shows that price that households' is willing to pay for the service, age, educational level, time of water availability; household expenditure and perception of household on water provision are significant factors that influence the households' willingness to pay for improved water supply services.

Many of the previous studies on water services focused mainly on the supply side while paying little attention to the demand side. This study fills the research gap by focusing on both the demand and supply side of water services, which depicts the improved water services is simply the difference choices of consumers and whether they are willing to pay for such services.

## MATERIALS AND METHODS

This study was carried out in Ijebu-Ode Local Government area of Ogun State. The city is located in South Western Nigeria. With estimated population of 154,032 (NPC 2006) it is the second largest city in Ogun State after Abeokuta since the pre-colonial times it has been the capital of the Ijebu- Kingdom. The city is located 110km by road north east of Lagos; it is within 1000km of the Atlantic Ocean in the eastern part of Ogun State and possesses a warm tropical climate. Agriculture and trading are the major occupation of the inhabitants. It is the trade center of a farming region where yam, cassava, grain, tobacco and cotton are grown.

### Sampling technique and sample size

The study used multistage sampling technique to select the representative households. The first stage involved the use of purposive sampling technique to select area with public water supply and the area without public water supply in the three parts of Ijebu Ode metropolis namely Iwade, Ijasi and Porogun. The second stage involved the selection of four wards each from each of the three parts. The third stage was the use of systematic sampling technique whereby every 5$^{th}$ building in the two areas was sampled in each ward. In all, a total of 230 households were sampled using a well-structured questionnaire however, 216 questionnaires were retrieved and analyzed for the study.

### Theoretical Model

Following Casey *et. al.*, (2006) a simple model for household water demand was formulated.

Typical consumers maximize utility subject to constraints. The demand for water can be viewed as any other good or service and therefore modeled within the utility maximization framework or alternatively within the expenditure minimization model.

$E(H, Q)$……...……1

s.t. $U = U(H, Q)$……2

Faced with expenditures for both water services (H) and a composite good (Q) subject to the utility constraint, the consumer will attempt to minimize the following expenditure function:

$E^* = E(P_h, P_q, U)$……..3

However, since water service is being offered as a take-it or leave-it proposition it makes sense to think of this as a restricted demand problem where the consumer does not observe $P_h$ and choose H, but rather is offered H and can choose to pay for it or not. Therefore, $P_h$ is replaced with H and the expenditure function takes the following form

$E^* = E(H, P_q, U)$……4

In this restricted case, the WTP for water, or between two expenditure functions with $H_1 > H_0$ and

the compensating surplus welfare estimate can be derived from this difference.

$CS (H_0, H_1) = E (P_q, H_o, U_o) – E (P_q, H_1, U_o)$……5

This estimate of compensating surplus is a measure of the willingness to pay for water services in the home. It is the amount that each household is willing to give up and still remain at the previous utility level before the change. One can then infer that this WTP for improved water service is a function of not only the cost of service, but also a host of socioeconomic, demographic, and attitudinal characteristics of the household, which can be represented by g in the expenditure function.

$CS (Ho, H_1) = E (P_q, H_o, U_o; g) – E (P_q, H_1, U_o; g)$……6

**Analytical technique**

This study employed a number of analytical tools based on the objectives of the study. The tools are:

1. Descriptive statistics such as frequency distribution tables, mean and standard deviation were used to analyze the socioeconomic characteristics of the respondents, sources of water supply, households preferred source, availability and quality of water supply, distance to water source, quantity of water demanded, water price regime, etc.
2. Household Demand Function for Water-Use using Ordinary Least Square (OLS) Regression Analysis.

$Y = a + b_1X_1+b_2X_2 +b_3X_3+b_4X_4 +$…… bnXn + u……8

Y = Household water use in liters per day (litre)

X1 = Connection charges (Naira/month)

X2 = Household size (number)

X3 = Household income (naira/month)

X4 = Distance to water source (Km)

X5 = Availability and Quality of source (1=yes,0 otherwise)

X6 = Unit price paid (Naira per litre)

X7 = Educational level (number of years)

X8 = Age of Household head (year)

X9 = Gender (male=1, 0= otherwise

X10 = Marital status (married =1, 0 = otherwise)

bi – bn= parameter coefficient
u = error term

3. The logit model was used to analyze the factors that determined Households' willingness to pay for improved water supply. 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. Logistic regression, according to Roopa, (2000) is a uni/multivariate technique which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables. The model specified by Hanemann (1989) and Whittington et. al., (1990) was adopted for this study as used by Branka and Kelly (2001), Yusuf et. al, (2005), Adepoju and Omonona (2009). Microeconomic theory suggests that WTP should vary across individuals with different demographic characteristic, different residence characteristic and different level of current services. Three price regimes were asked the respondents to indicate their choice of willingness to pay for improvement in water services i.e ₦3,000, ₦2,500 and ₦2,000 respectively. Their responses were subjected to factor analysis using Principal Component Analysis (PCA). The index generated were incorporated into logit model as the dependent variable (WTP) which was regressed against connection charge, income and other socioeconomic characteristics

The basic logit model is specified below:

$$L_1 = \left(\frac{P1}{1-P1}\right) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \cdots \ldots\ldots\ldots\ldots b_nX_n + u \ldots\ldots\ldots 9$$

Where

$$L_1 = \ln\left(\frac{1}{0}\right) = If\ household\ is\ willing\ to\ pay\ for\ improved\ water\ services$$……10

$$L_1 = In\left(\frac{0}{1}\right)$$

$$= if\ household\ is\ not\ willing\ to\ pay\ for\ improved\ water\ services \ldots\ldots 11$$

$X_1 – X_n$ = Explanatory variables
$b_1 - b_n$ = parameter coefficients

## RESULTS AND DISCUSSION

Table 1 reveals the socioeconomic characteristics of the respondents in the study area. The results show that majority (70.4%) of the respondents' falls within age group 41 to 60 years. This is the active and working population implying economic age group, this indicates that the respondents will welcome improvements and will be willing to pay for improved water services. However, 96.7% of the respondents were married and majorities were female. The result shows that majority of the respondents (87%) are educated and 17% have no formal education. This indicates that the respondents will be receptive to innovations and will be more willing to pay for improvement of water services because they would appreciate the importance of safe water for improved health condition. This result is in line with the findings of Adepoju and Omonona (2009) that education influences household willingness to pay for improved water supply service. The result shows that about 60% of the respondents were trader while 23.6% and 10.2% were artisanal and civil servant respectively.

As shown in Table 2, 64.8% of the respondents derived their water-use from private piped/borehole and 18.5% from public piped while 16.7% from well. On the other hand, 64.4% of the respondents preferred public piped and 30.1% preferred borehole water. About 5.6% of the respondents, however, preferred well water over other water sources. This is an indication that the respondents in this study area are enlightening populace who knows the quality and essential of good water source. About 35% of the respondents adduced quality as reason for their preferences for sourcing water from improved sources while 33.3%, 18.5% and 12.5% gave convenience, availability and cost respectively as reasons for their preferences. .The source of water being use presently by the respondents shows that private piped (borehole) constituted the highest percentage (46.8%), followed by community based water project (37.3%), family owner (13%), public piped own by government (3.3%). This analysis indicates that government presence in the study area is little being felt which should not be in reality because water is an essential services that any government should put as a top priority of its cardinal programme for her citizens. The study also revealed that 93.1% of the respondents trek more than 30 minutes to fetch water on daily basis and 5.6% of the respondents trek more than an hour to water source. This shows that water fetching in this area are tasking and can result in frequent illness of the young ones who are responsible for fetching water. This result corroborated the findings of Gbadegesin and Olorunfemi (2007) that a great deal of time and energy is spent fetching water in the rural areas in Nigeria and that more than half of the total number of respondents spend less than one hour fetching water daily. As regards who's responsibility is to fetch water in an household, result (Table 2) showed that female children bears the burden as it constituted 53.2%, women folks 26.4% and male children 18.5%. This analysis represents a typical southwestern Nigerian culture where female are saddled with house-upkeeps task while male are to work and provide income for the family. The result show further that on average, 150 liters of water are being used per household per day at a cost of ₦10/25lt jerrican. This gives an estimate that a household in our sample is spending an average of ₦60 (US$0.38) per day on water-use which is equivalent of ₦1,800 (US$11.5) per month. However, the connection charges on public piped in this study area is between ₦1,000 (US$6.4) for bungalow building and ₦1,500 (US$9.62) for a storey building. This gives credence to the reasons why majority of the respondents preferred public piped. The above water demand analysis can be used by supplier to forecast the future supply, projected cost and revenue. This will safeguard water shortage and minimize cost.

The result (Table2) revealed further that majority (58.3%) of the households were dissatisfied with the current water supply situation, 88.9% of the respondents gives their support for an improvement in water services in the study area. While 87.4 % express their readiness to pay for an improvement in water services, the remaining 12.6% were indifferent doubting the sincerity of government to undertake any improvement on the current water supply situation.

The respondents were asked to be categorical on what amount they are willing to pay for an improvement in water services. 57.4% constituting the majorities said they will pay ₦2,000 (US$12.8) while 35.2% and 7.4% of the respondents said they will pay ₦2,500(US$16.03) and ₦3,000(US$19.2) per month respectively for an improvement in water supply. The mean willingness to pay by the consumers was estimated to be ₦2,247(US$14.4) per month which is even higher than the amount the respondent are spending per month on private piped water and the connection charge per month on public piped. The task on the state water corporation is to decide if the amount the consumer are ready to pay will commensurate with the quality of improvement in services they will offer.

Table 3 revealed the result of the household water-use demand model. The $R^2$ value of 0.2294 implied that the explanatory variable included in the model were able to explain 22.94% of the variability in the household water-use demand. The adjusted $R^2$ (0.1919) is a little lower than R-squared but not too much suggesting that the model do not have a serious over fitting problem. The F-statistic (F = 6.10***) shows that the overall model is significant at 1% level. The result (Table 3) shows that household water-use demand is positively and significantly influenced by connection charges, household size, availability and quality of water source, and marital status while distance to water source, unit price paid

per litter and gender of the household negatively and significantly influenced water-use demand. A unit increase in connection charges increases quantity demand of water by 12%. This may be because of improvement in ease of getting the water to their home, better quality of water and government policy that increases the purchasing power of consumers, The coefficients of household size and availability and quality of good water source are positively signed and statistically significant. This implies that a unit increase in household number will result in 37.2% increases in water usage. As additional member is added to a household it increases the demand for water uses. Similarly, availability and quality of good water source increases water demand by 20.4%. Being married increases the demand for water by 51.7%. This is because the daily water consumption of household will increase as more people are added to a household. Results (Table 3) revealed further that a unit increase in price paid per litter of water will lead to a decrease of about 0.1% in the quantity of water demanded for daily use. The price elasticity of demand for water is normally negative because the demand curve is downward sloping, which means that an increase (decrease) in price is expected to lead to a reduction (increase) in demand. It is important to note that our demand function analysis here is based on demand for water from all sources. It is thus expected to yield inherently lower price elasticity than in a source specific. The relatively low price elasticity of demand in this analysis is a reflective of the prevailing water supply situation in the study area. On the other hand, the coefficient of the distance to water source is negatively signed and significant. This implies that a unit increase in the number of hour spent to reach the source of water supply decreases demand by 28.1%. The result indicates that households place a very high value on the opportunity cost of their time. This result support the findings of Agbemolege and Odubanjo (2001) that the rural dwellers had to reduce their rate of water consumption as a result of having to trek long distance before getting safe water supply. Result showed that water-use demand decreases with male households. This indicates that women folks were responsible for major water use in households most especially for domestic uses.

Table 4; summarize the variables used in the regression along with our hypotheses about the expected relationship between WTP and the ovariates. Table 5 presents the result of the household willingness to pay for improved water services. The chi-square (L-R statistics) shows that the overall goodness of fit of the model was statistically significant at 1% level. The pseudo R square indicate that 42.26% of the variance was explained by the explanatory variables. The results (Table 5) showed that age, gender, education, connection charges and household size positively and significantly influenced household's willingness to pay for improved water services while income negatively and significantly influenced it. Result showed that as respondents' increases in age the likelihood of paying for improved water service increases. Gender of respondents has positive and significant ($p<0.001$) relationship with willingness to pay for improved water service. This implies that male respondents have higher likelihood of paying for improvement in water services. This may be because male household head bear the expenditure on water and other domestic expenditures hence will be willing to pay for improved water services rather than spend large proportion of his income on hospital bills. Educational level of the households increases their awareness and exposure level, thus they will be more receptive to policy that lead to improved livelihood and welfare. This result corroborated the findings of Haq et. al., (2008); Adepoju and Omonona (2009) that education level has direct relationship with willingness to pay for safe drinking water. The connection charge is also positively correlated and significant ($p<0.05$) with household willingness to pay. This implies that the household will be willing to pay for improved service if they were sure that their lot or situation will be better off with new water regime. This would not only reduce the drudgery associated with water fetching but also reduce per capita expenditure on water on daily basis. This result is in line with Omonona and Adeniran (2012) who reported that the likelihood of households paying a given price for improved water supply increases as the price of the improved service increases. The Household size coefficient has positive sign and significantly ($p<0.01$) influenced the willingness to pay for improved water services. The implication of this is that as household increases in number their water need increases hence; per capita expenditure on water also increases. However, income is negatively correlated and statistically significant ($p<0.05$). The marginal impact of income is negligible implying that regardless of the amount of wage earned by these societies they were willing to pay for the improvement of water services in their area. This showed the degree of need for public piped in the study area. This result corroborated the findings of the Mu et. al., (1990); Cairncross, (1990); World Bank, (1995) that even low-income consumers are willing to pay for the service they want. This confirms that willingness to pay for any service is the foundation of the economic theory of value.

## CONCLUSION

The study finds that households' water supply situation is mainly from private piped/borehole, public piped, and well. However, majority of the households were dissatisfied with the current water supply and their preferred sources are public piped followed by, private piped/borehole and well water. This preference of choices was determined by quality, convenience, availability and cost. Also majority of the households trek more than 30 minutes to fetch water daily and women folks were responsible for fetching water. The results revealed further that on average, 150 liters of water are being consumed per

day by an household and the per capita expenditure per day is N60 (US$0.38). This demand information can be used by supplier to forecast future water supply and minimize wastage. The households' water demand situation was analyzed using ordinary least square regression model. It was found that household water-use demand is being positively and significantly influenced by connection charges, household size, availability and quality of water source, and marital status. The study shows that majority of the respondents were willing to pay for improved water supply with mean WTP of ₦2,247(US$8.01) per month which is significantly higher than the current water charge by state water corporation. Household willingness to pay for an improvement in water services was positively and significantly determined by age, gender, education, connection charge and household size. Based on the findings above, we recommend that the government should facilitate the availability of good and quality public water utilities in this area to reduce drudgery associated with long distance trekking to water source and health safety , government should also improve the water supply services and connection charges should be increase to commensurate with the quality of improvement in services since majority are willing to pay for the improvement, positive relationship between education and WTP for improved water service indicate the need to educate people about the benefit associated with water service improvement, public –private partnership should be encourage in water project and supply services in order to improved water infrastructures and quality control for be benefit of the society.

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**APPENDIX**

**Table 1. Socioeconomic Characteristics of the Respondents**

| Variable | Frequency | Percentage |
|---|---|---|
| **Age (yrs)** | | |
| < 40 | 12 | 5.6 |
| 41-50 | 68 | 49.1 |
| 51-60 | 84 | 38.9 |
| >60 | 14 | 6.4 |
| **Marital** | | |
| Married | 196 | 96.7 |
| Single | 20 | 9.3 |
| **Gender** | | |
| Male | 100 | 46.2 |
| Female | 116 | 53.8 |
| **Education** | | |
| Informal | 28 | 13.0 |
| Primary | 24 | 11.1 |
| Secondary | 103 | 47.7 |
| Tertiary | 61 | 28.2 |
| **Occupation** | | |
| Trading | 131 | 60.6 |
| Civil servant | 34 | 15.8 |
| Artisanal | 51 | 23.6 |

Source: Field Survey, 2014

**Table 2. Choice and Sources of Water Supply**

| **Available sources** | Frequency | Percentage | **Mean** | **SD** |
|---|---|---|---|---|
| Public piped | 40 | 18.5 | | |
| Borehole | 130 | 60.2 | | |
| Well | 36 | 16.7 | | |
| Stream/River | 10 | 4.6 | | |
| **Preferred Source** | | | | |
| Public piped | 139 | 64.4 | | |
| Borehole | 65 | 30.1 | | |
| Well | 12 | 5.5 | | |
| Stream/River | - | - | | |
| **Reason for preference** | | | | |
| Availability | 40 | 18.5 | | |
| Quality | 77 | 35.6 | | |
| Cost | 27 | 12.5 | | |
| Convenience | 72 | 33.3 | | |
| **Source of water use presently** | | | | |
| Public piped | 24 | 11.1 | | |
| Borehole | 109 | 50.5 | | |
| Community | 80 | 37.0 | | |
| Fed. Govt | 03 | 1.4 | | |
| **Distance to source** | | | | |
| 30mins - 1hr | 201 | 93.1 | | |
| 1hr – 2hr | 12 | 5.6 | 1.10 | 0.45 |
| >2hrs | 3 | 1.4 | | |
| **Who fetch water on daily basis?** | | | | |
| Male children | 40 | 18.5 | | |
| Female children | 115 | 53.2 | | |
| Mother | 57 | 26.4 | | |
| Husband | 4 | 1.9 | | |
| **Quantity fetch per day** | | | | |
| 50lt – 100lt | 164 | 75.9 | | |
| 101lt – 200lt | 43 | 19.9 | 150 | 72.30 |
| >200lt | 9 | 4.2 | | |
| **Satisfies with current water supply** | | | | |
| Yes | 90 | 41.7 | | |
| No | 126 | 58.3 | | |
| **Support an improvement in water services** | | | | |
| Yes | 192 | 88.9 | | |
| No | 24 | 11.1 | | |
| **Ready to pay for an improvement** | | | | |
| Yes | 188 | 87.0 | | |
| No | 24 | 11.1 | | |
| Indifferent | 4 | 1.9 | | |
| **WTP for improvement in water supply** | | | | |
| 2,000 | 124 | 57.4 | | |
| 2,500 | 76 | 35.2 | 2,247 | 316.22 |
| 3,000 | 16 | 7.4 | | |

Source: Field Survey, 2014

**Table 3. Result of the Household Water Use Demand : Ordinary Least Square Regression**

| Variables | Coefficients | Standard error | T-value |
|---|---|---|---|
| Connection charges for public piped | 0.012 | 0.006 | 2.050** |
| Household size | 0.372 | 0.099 | 3.769*** |
| Household income | 1.35E-0.006 | 0.000 | 0.150 |
| Distance to water source | -0.281 | 0.174 | -1.613* |
| Availability and Quality of source | 0.204 | 0.067 | 3.047*** |
| Unit price paid for private piped | -0.001 | 0.000 | -4.245*** |
| Educational level | -0.089 | 0.076 | -1.172 |
| Age of Household head | -0.016 | 0.011 | -1.455 |
| Gender | -0.436 | 0.146 | -2.981*** |
| Marital | 0.517 | 0.262 | 1.975* |
| Constant | 3.133 | 0.694 | 4.517*** |
| No of observation | 216 | | |
| F (10, 205) | 6.10 | | |
| Prob > F | 0.0000 | | |
| $R^2$ | 0.2294 | | |
| Adj $R^2$ | 0.1919 | | |

Source: Field Survey, 2014

**Note:**
***Significant at 1%; **Significant at 5%; *Significant at 10%

**Table 4. Description of variables included in the logit regression model**

| Explanatory variables | Variable definition | Expected sign |
|---|---|---|
| Age | Age of respondents in years | negative |
| Gender | Respondents is male (1=yes, 0 otherwise) | negative |
| Marital status | Respondent is married (1=yes, 0 otherwise) | |
| Occupation | Occupation of the respondents (1= formal, 0 otherwise) | negative |
| Education | Number of years spent in school | |
| Connection charges | Monthly bill | negative |
| Household size | Number of people living in the household | positive |
| Income | Monthly household income | positive |
| Satisfaction with current water source | Satisfy (1=yes, 0 otherwise) | positive |
| Unit price paid | Monthly expenses on water outside the home | positive |

**Table 5. Result of Logistic Regression Analysis**

| Independent variables | Co-efficient | Std.error | Z | P> \|Z\| |
|---|---|---|---|---|
| Age | 0.2798 | 0.8040 | 3.33*** | 0.001 |
| Gender | 1.8138 | 0.6021 | 3.01*** | 0.00l |
| Occupation | 0.5311 | 0.4396 | 1.21 | 0.227 |
| Education | 1.6699 | 0.6106 | 2.74** | 0.006 |
| Connection charges | 0.0230 | 0.0076 | 3.01*** | 0.003 |
| Household size | 3.6628 | 1.0666 | 3.43*** | 0.001 |
| Income | -0.0002 | 8.86e-06 | -2.29** | 0.022 |
| Satisfaction with current water source | -0.9719 | 0.7098 | -1.37 | 0.171 |
| Constant | -30.5817 | 9.2206 | -3.32*** | 0.001 |
| Log likelihood | -117.65245 | | | |
| Number of observation | 181 | | | |
| LR Chi2(8) | 65.90 | | | |
| Prob > chi2 | 0.0000 | | | |
| Pseudo $R^2$ | 0.4226 | | | |

Note: *** significant at 1%, ** significant at 5%
Field Survey, 2014

**Note: 1US$ = ₦156 (April, 2014)

```
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Notes:
      1.  (/v# option or -set maxvar-) 5000 maximum variables

. *(33 variables, 216 observations pasted into data editor)

. regress qtyfetch connectcharge hhsize hholdincome distsourc availsourc unitprice educlev age gender marital

      Source |       SS       df       MS              Number of obs =     216
-------------+------------------------------           F( 10,   205) =    6.10
       Model |  58.0494716    10  5.80494716            Prob > F      =  0.0000
    Residual |  194.945899   205  .950955604            R-squared     =  0.2294
-------------+------------------------------           Adj R-squared =  0.1919
       Total |  252.99537   215  1.17672265            Root MSE      =  .97517

------------------------------------------------------------------------------
     qtyfetch |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+---------------------------------------------------------------
connectcharge |   .0116454   .0056812     2.05   0.042     .0004443    .0228466
       hhsize |   .3722707   .0987814     3.77   0.000     .1775129    .5670285
  hholdincome |    1.35e-06  9.01e-06     0.15   0.881    -.0000164    .0000191
    distsourc |  -.2806279   .1740123    -1.61   0.108    -.6237111    .0624553
   availsourc |  -.2041573   .0669934    -3.05   0.003    -.3362418   -.0720728
    unitprice |  -.0007383   .0001739    -4.25   0.000    -.0010812   -.0003954
      educlev |  -.0893921   .0762858    -1.17   0.243    -.2397974    .0610132
          age |  -.0155551    .009949    -1.56   0.119    -.0351707    .0040604
       gender |  -.4361642   .1462954    -2.98   0.003    -.7246006   -.1477278
      marital |   .5166524   .2616617     1.97   0.050     .0007593    1.032545
        _cons |   3.133498   .6937811     4.52   0.000     1.765636    4.501359
------------------------------------------------------------------------------

.
```

```
  ___  ____  ____  ____  ____ (R)
 /__    /   ____/   /   ____/
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Notes:
      1.  (/v# option or -set maxvar-) 5000 maximum variables

. *(28 variables, 216 observations pasted into data editor)

. logit wtpindex age gender marital occu distsourc educlev  connectch hhsize income satisfy

note: marital != 1 predicts success perfectly
      marital dropped and 20 obs not used

note: distsourc != 1 predicts success perfectly
      distsourc dropped and 15 obs not used

Iteration 0:   log likelihood = -77.969234
Iteration 1:   log likelihood = -59.365878
Iteration 2:   log likelihood = -50.302796
Iteration 3:   log likelihood = -46.850907
Iteration 4:   log likelihood = -45.059595
Iteration 5:   log likelihood = -45.020215
Iteration 6:   log likelihood = -45.020163
Iteration 7:   log likelihood = -45.020163

Logistic regression                               Number of obs   =        181
                                                  LR chi2(8)      =      65.90
                                                  Prob > chi2     =     0.0000
Log likelihood = -45.020163                       Pseudo R2       =     0.4226

------------------------------------------------------------------------------
    wtpindex |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .2798205   .0840165     3.33   0.001     .1151511    .4444898
      gender |   1.813814   .6021249     3.01   0.003     .6336706    2.993957
     marital |          0  (omitted)
        occu |   .5311368   .4395682     1.21   0.227    -.3304011    1.392675
   distsourc |          0  (omitted)
     educlev |   1.669982   .6105726     2.74   0.006     .4732816    2.866682
   connectch |   .0230413   .0076554     3.01   0.003     .0080369    .0380457
      hhsize |   3.662812   1.066739     3.43   0.001     1.572042    5.753582
      income |  -.0000203   8.86e-06    -2.29   0.022    -.0000377   -2.96e-06
     satisfy |  -.9719323   .7099116    -1.37   0.171    -2.363333     .419469
       _cons |  -30.58173   9.220919    -3.32   0.001     -48.6544   -12.50906
------------------------------------------------------------------------------
Note: 0 failures and 27 successes completely determined.

.
```