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REGRESSION ANALYSIS OF RESIDENTS' PERCEPTION ON WILLINGNESS TO PAY (WTP) FOR IMPROVED WATER SUPPLY: A CASE FROM NIGERIA

Purpose. *The purpose of this paper was to investigate residents' perception on willingness to pay (WTP) for improved water supply in Owo Local Government Area of Ondo State, Nigeria using regression analysis.*

Methodology / approach. *Data were collected from 512 households through multistage sampling from eleven political wards in Owo. The data were analysed using descriptive statistics and stepwise regression.*

Results. *Findings showed that 44.9 % of the residents obtained water from public utility while 21.5 % and 18.8 % obtained water from well and borehole respectively. Majority of the residents (72.6 %) were of the opinion that public water supply were irregular and unreliable but were willing to pay for improved water supply (74.6 %). Residents were willing to pay an average sum of ₦972 (US$2.7) per month for improved water supply services.*

Originality / scientific novelty. *The results of stepwise regression analysis revealed that age, income, access to water supply, education, quality of water, frequency of water supply and gender were the factors influencing residents' willingness to pay (WTP) for improved water supply services in the study area. There is need for government to create enabling policy for public-private partnership in the improvement of water supply in the study area.*

Practical value / implications. *The implication of these findings is that government and public-private organisation should consider age, income, access to water supply, education, quality of water, frequency of water supply and gender when evaluating residents' willingness to pay in the study area.*

Key words: *residents' perception, willingness to pay, improved water supply, Nigeria.*

Introduction and literature review. Development is the integration of economic growth, social, cultural and political conditions [1; 2]. In this wise, most of the countries in Sub-saharan African are at a very low stage of development and one of the major reasons for this is lack of effective and sustainable utilization of the available natural and human resources [2; 3]. Water which is natural resources can be seen as a source of life which can sustain life and our environment. It is also one of the precious gifts to mankind and most basic human needs, used for hydration, hygiene and sanitation. Access to safe water supply is therefore an integral part of development in general, it is also considered as one of the basic urban services which highly affects the health of the people and economic progress of developing countries especially Nigeria.

Nigeria was listed among few countries that may not likely meet the millennium development goal 7 c. The goal addressed the reduction of the global population without access to improved water sources by half [4]. Although MDG 7c was realized in 2010 when it was documented that over 2 billion people gained access to improved water sources, projections showed that Nigeria may be an exception, even five years after the goal was met in most countries of the world [5]. This problem is more prevalent in Nigeria which is considered as the most populated countries in sub-Saharan Africa (SSA). Nigeria like any other country in sub-Saharan Africa (SSA) is blessed with abundant surface and ground water yet majority of residents' still struggles with inadequate water supply. This phenomenon has made residents in the study area to rely on water from other sources such as hand dug wells, boreholes, pond, streams, rivers etc.

Water supply in the study area is through Ondo State Water Corporation. However, the continuous population growth and areal expansion of the study area has made water supply to be inaccessible and unreliable. Inaccessibility to public water supply may likely affect residents' willingness to pay (WTP) for water supply services.

Willingness to Pay (WTP) is the maximum amount that a household is willing to pay voluntarily for services rather than do without the services [6]. Willingness to pay conceptualizes water as a commodity (i.e. an environmental good that can 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 one place. These variations are not always recognised by government organisations and development agencies. Consequently they tend to over or under estimate the levels of unwillingness to pay for a commodity when implementing water project [7]. Water supply project therefore fail because the needs and requirement of the community have not been met and their willingness to pay is not clearly signaled [8].

Several studies have shown that residents' willingness to pay for water supply does not only depend on income but also on existing and improved supplies, water qualities, gender, distance, education, marital status among others [9; 10; 11; 12; 7; 8]. Despite these findings, study on the opinion of the residents' willingness to pay (WTP) for public water supply have not been properly articulated and documented. Although it is widely recognized that public participation in decision making is vital to sustainable development. According to [13; 14; 15] one of the most effective tools for examining public opinion for decision making and prioritization of resource allocation is perception studies. Perception study explains how individuals become aware of and give meaning to information in their environment which eventually affects their responses [16]. The need for perception study in this research as noted by Afon [17] is borne out of the three convictions. First, many environmental problems (especially water supply) require solution which must be sought from various positions of ignorance; second, in many instance, better information on how people perceive and react to environmental issues may lead to more enlightened decisions;

and their perception study reveals to policy makers the action that would be welcome and which programmes are to be embarked on at a given time. This study therefore attempts to examine the perception of residents' on willingness to pay for water supply in the study area.

Based on the foregoing, the need to carry out study on willingness to pay for public water supply especially from residents' perspective is very important. It is on this note that the study is on the analysis of residents' perception on willingness to pay (WTP) for public water supply in Owo Local Government area, of Ondo State Nigeria.

The purpose of the article. The purpose of this paper was to investigate the perception of residents' on willingness to pay for water supply in the study area with the use of regression analysis. The questions addressed in this paper are: (i) who are the residents in the Owo Local Government area, Ondo State (ii) what is their perception on willingness to pay for public water supply and (iii) what are the factors influencing their willingness to pay for water supply. The specific objectives were to (i) identify and examine the socio-economic characteristics of respondents in the study area (ii) examine residents' perception on willingness to pay for public water supply and (iii) determine the factors influencing residents' willingness to pay for water supply.

The study area. Owo Local Government Area is one of the eighteen LGAs in Ondo State, Nigeria. Located in the Northern Senatorial District of Ondo State and it consists of 11 political wards. Owo LGA consists of Iyere, Ipele and Emure-Ile, Uso Emure-Ile, Isuada, Ago-panu, Ipemen, Amurin and Kajola. Its land area is about 15,500 square kilometres and is located between latitude 7^0 15' North and longitude 5^0 35' East of Greenwich meridian. It is 150 meters above sea level and enjoys abundant rainfall of over 1,500 mm annually. The temperature is relatively high throughout the year with an average daily temperature of about 27^0C (80.6^0F), with marked seasonal changes in rainfall and relative humidity. The Local Government falls within the sub equatorial region characterized by a monsoon climate. Available records show that Owo local government area (LGA) has been experiencing population increase before independent. For example Owo LGA had a population of 30,662 in 1952, 80,413 in 1963 and 155,000 in 1991. In 2006, the population census was 222,262 and was projected to about 358,230 by population statistics in 2017. The increase in population has however led to increase in water demand and as outstrips water supply in the study area. The main sources of water for households are piped supply from treated water sources, untreated piped water from groundwater sources, shallow boreholes, wells and pond, springs, lakes, rivers, and streams [18].

Materials and methods. The multistage-sampling techniques were employed for this study. The first stage involved stratification of Owo Local Government area into eleven political wards as delineated by Independent National Electoral Commission.

The second stage involved random selection of political wards from the existing political wards. Pilot survey revealed that there were 11 political wards and 6 were selected randomly. These political wards include Ehinogbe, Ipele, Igboroko I,

Isuada/Ipenmen, Ijebu II, Isaipen. The third stage involved the identification of streets in the selected political wards from which every tenth streets were systematically selected.

The fourth stage was the selection of buildings sampled in each of the streets. Every 10^{th} buildings were systematically selected while the first building was randomly selected. The target respondents are the household head. Systematic sampling techniques were employed to select buildings where head of the family were chosen for questionnaire administration. Total number of questionnaires administered were 512, hence the sample size.

Data analysis: this research used descriptive statistics such as frequency distribution tables, mean, pie-chart and bar graph to analyse the socioeconomic characteristics of the household head, household characteristics and group characteristics. The stepwise linear regression model was constructed to determine the factors influencing residents' willingness to pay for water supply in the study area. The stepwise regression was used to establish the relationships between residents' willingness to pay and the orthogonal factors [8]. In order to establish this, respondents were asked about the exact amount they will be willing to pay for service in the study area. This was later regressed with the identified variables affecting household decision to pay [19; 20]. Identified these factors to include household characteristics, economic characteristics, water source characteristics affecting the willingness of the respondents to pay for water supply. Variables included in the model are presented as follows:

Y = Reponses of household on how much they are willing to pay for the service

Household Characteristics

X_1 = Age of household head in years

X_2 = Household size

X_3 = Gender of household head (male = 1, female = 0)

X_4 = Educational level (Number of years spent in the school

X_5= Length of stay (Number of years spent in the study area)

X_6 = Marital status

Economic Characteristics

X_7 = Occupation

X_8 = Household monthly income in Naira

Source characteristics

X_9 = frequency of water supply

X_{10} = access to water supply

X_{11} = quality of water supply

Result and discussion.

Socio-economic Characteristics of the respondents. Table 1 showed that majority of the respondents (76.2 %) were within the age bracket of 21–60 years. It can be observed that majority of the respondents were within the active population. The percentage of male and female were 57.4 % and 42.6 % respectively. This implied that there were more female and male in the study area. The result shows that

majority (73 %) of the respondents were married; 31.3 % were civil servant while 43.8 % had tertiary education. The table also revealed that 29.7 % of the respondents earned below ₦18,000 per month.

Table 1

Socioeconomic Characteristics of the Respondents

Variables	Frequency	Percentage
Age		
Below 21	64	12.5
21–40	196	38.3
41–60	194	37.9
Above 60	58	11.3
Gender		
Male	218	42.6
Female	294	57.4
Marital Status		
Single	78	15.2
Married	374	73.0
Separated	50	9.8
Widow/widower	10	2.0
Occupation		
Student	90	17.6
Self employed	142	27.7
Trading	80	15.6
Civil Servant	160	31.3
Artisan	40	7.8
Educational qualification		
No formal education	114	22.2
Primary school	18	3.5
Secondary school	156	30.5
Tertiary	224	43.8
Monthly Income		
Below ₦ 18000	152	29.7
₦ 18001–₦ 43000	42	8.2
₦ 43001–₦ 68000	120	23.4
₦ 68001–₦ 93000	59	11.5
₦ 93000–₦118,000	49	9.6
Above ₦118001	90	17.6

Source: authors' fieldwork (2018).

Source of water supply. Most of the respondents indicated that they obtained water from state water corporation (piped water) were 44.9 %, 21.5 % from well and 18.8 % from borehole. The proportion of respondents that obtained water from surface water were 9 % while 7.7 % obtained water from vendors and packaged water sources (Figure 1) (Table 2).

It could be noted that 72.6 % of the respondents were of the opinion that public water supply were irregular, 3.5 % indicated that water supply was regular while 23.9 % did not have access to public water supply in the study area. With this

proportion of irregularity of water supply in the study area. It can be inferred that respondents were dissatisfied with the present water supply in the study area.

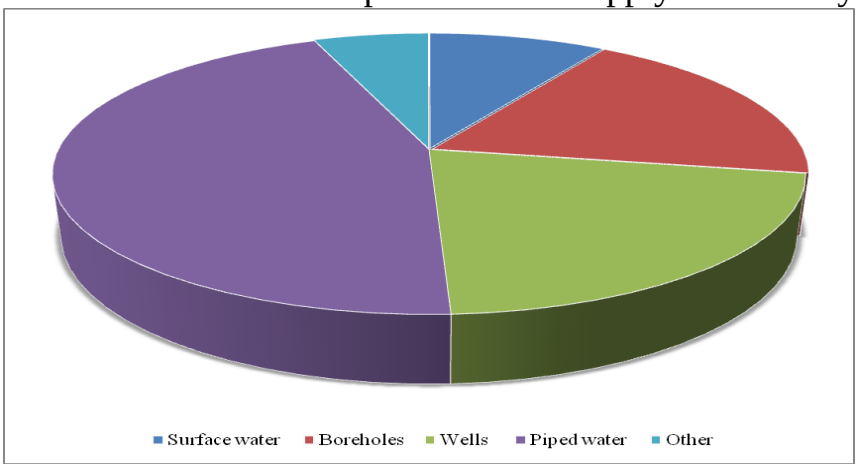

Figure 1. Sources of water supply to Owo residents

Source: authors' fieldwork.

Distance to source of water. Analysis in figure 2 shows that 19.5 % of the source of water were within the household while others need to travel distances ranging from less than 100m to 1000m (Table 2). It can however be observed that majority of the residents have to a long distance to obtain water. Apart from this, much time is being wasted at the point of fetch water. Most of the respondents emphasised that they have to wait for their turn to fetch water. This therefore constitutes constraints to accessibility in the study area.

Table 2

Sources of water and distance to water source

Variables	Frequency	Percentage
Source of Water		
Surface water	46	8.9
Boreholes	96	18.8
Wells	110	21.5
Piped water	230	44.9
Other	30	5.9
Distance to water source		
On site	100	19.5
Less than 100m	114	22.3
100–500m	152	29.7
500–1000m	100	19.5
No response	46	9.0

Source: authors' fieldwork 2018.

Residents' perception on Willingness to pay for Public Water Supply. According to United Nation Development Programme (2014) on human right to water, people are not expected to pay more than 3 % of their household income, this does not mean that the person should not pay for water at all. In this wise, water cost should be on relative terms rather than actual cost of producing and transporting water to households. This however opens room for debates and diverse interpretation of the meaning of human right to water [21].

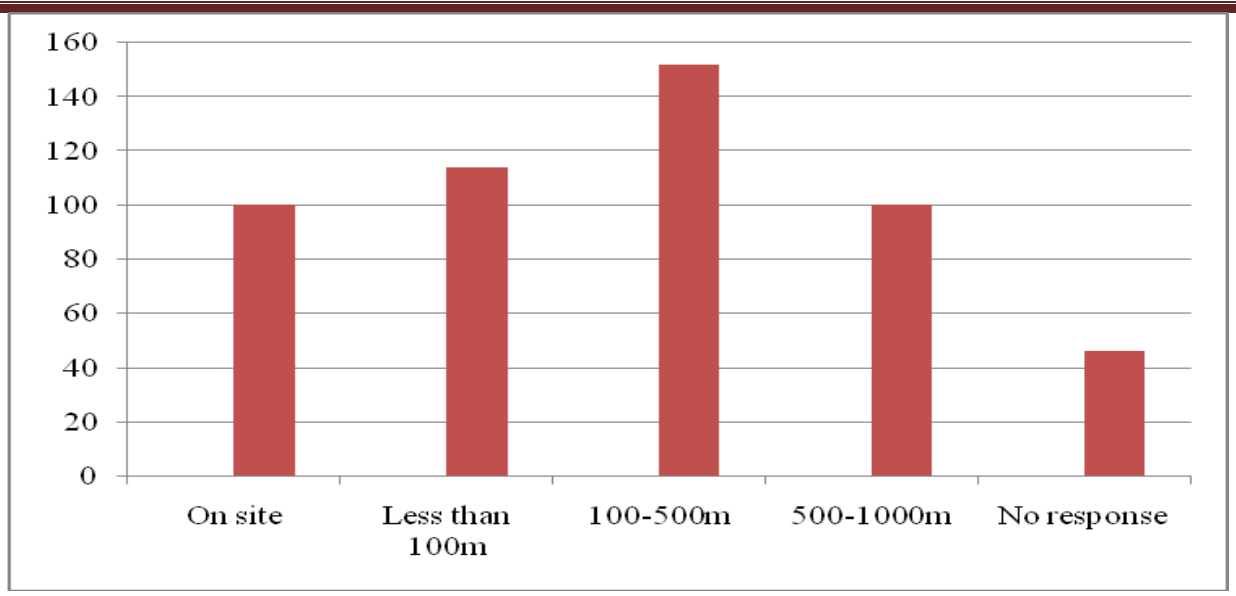

Figure 2. Distance to source of water (meters)

Source: authors' fieldwork.

With the current situation of public water supply in the study area (unreliable and inaccessible), respondents were asked on how comfortable they were with respect to their willingness to pay for public water supply services. Analysis in table 3 shows that 74.6 % of the respondents were willing to pay for public water supply services provided if the service can be improved upon, while 25.4 % of respondents were not willing to pay for the service. This implies that most of the respondents were still willing to pay for public water supply in the study area. However, water supply situation in the study area calls for government's intervention and non governmental organisation (international and national) for asistance. Further analysis revealed different reasons why proportion of respondents that were not willing to for water supply services in the study area. Out of 25.1 % of the respondents that were not willing to pay for the service, 6.6 % were of the opinion that the cost of water supply is too costly (i.e it is unbearable), 2.7 % noted that they cannot afford to pay for the scheme, this can be because of their low income. About 7.3 % of the respondents asserted that the scheme is not important to them due to the fact that they depend on alternative sources of water supply (i.e. water surface, borehole, well among others) while 8.5 % of the respondents opined that they are not satisfied with present supply of water due to the fact that the water supply is not regular.

Table 3

Willingness to pay for improved water supply services

Willingness to pay	Frequency	Percentage
Yes	382	74.6
No	130	25.4
Total	512	100.0

Source: author's fieldwork, 2018.

Mean Current charge and WTP of water supply. The mean current charge of water supply in the study area was estimated to be ₦1,679.41 (US$4.6). The mean willing to pay (WTP) for public water supply was also estimated to be ₦972

(US$2.7). The result of the differences in the mean shows that mean WTP is negative and respondents were not willing to pay more than the current water charges of water supply. The mean WTP results can be attributed to the fact that majority of the household surveyed were middle and low income earners. This result goes in line with the theory that the higher the household's income the more they are willing to pay for public water supply. Also majority interviewed were living in a rented apartment and jointly pay for public utilities such as electricity and thereby makes the amount payable for such service to be relatively low.

Factors influencing residents' willingness to pay. In other to examine the factors influencing residents' willingness to pay, this study hypothesis that there was no significant difference between the amount that resident were willing to pay and the identified factors [19; 20]. These factors were tested using ANOVA and Stepwise regression. Stepwise regression analysis was used to determine the factors that influence the probability of respondents' willingness to pay for public water supply services. Table 4 reveals the model summary of dependent variable regressed against predictors/ independent variables (i.e. income, quality of water supply, accessibility to water supply, frequency of water supply, gender, education, length of stay, occupation, marital status, age and household size).

Table 4

Model Summary[f]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.331[a]	.110	.103	.773	.110	17.142	1	139	.000
2	.541[b]	.293	.283	.691	.183	35.806	1	138	.000
3	.617[c]	.381	.367	.649	.088	19.440	1	137	.000
4	.668[d]	.446	.430	.616	.065	15.951	1	136	.000
5	.689[e]	.474	.455	.603	.028	7.274	1	135	.008
6	.710[f]	.504	.482	.587	.030	8.036	1	134	.005
7	.721[g]	.519	.494	.580	.015	4.259	1	133	.041

Note. a. Predictors: (Constant), Age;

b. Predictors: (Constant), Age, Income (In Naira);

c. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply;

d. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education;

e. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of Water Supply;

f. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of Water, Frequency of Water Supply;

g. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of Water Supply, Frequency of Water Supply, Sex.

Source: authors' field survey (2018).

The model shows that out of the eleven possible determinants that can influence residents' willingness to pay (WTP) in the study area, only seven determinants were identified to have a significant influence on residents' willingness to pay (WTP) in the study area. These determinants include age (11.0 %), income (18.3 %), access to water supply (8.8 %), education (6.5 %), quality of water supply (2.8 %), frequency

of water supply (3.0 %) and sex (1.5 %). The model output together explains 51.9 % (R^2 = 0.519) of the variance in the ratings of all the predictors together as major determinants that influences residents' WTP while the correlation coefficient between the variables (independent and dependent variables) was 0.721 which was highly significant at 0.05 confidence level. The model also revealed that marital status, occupation, household size and length of stay were excluded in the model output. This implied that they do not contribute significantly as part of the factors to the model. This is in consonance with Omonona and Fajimi [6].

Furthermore, ANOVA test in table 5 was also used to know whether there is significant variation in the regression analysis.

Table 5

ANOVA Test

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	10.237	1	10.237	17.142	.000[b]
	Residual	83.011	139	.597		
	Total	93.248	140			
2	Regression	27.338	2	13.669	28.620	.000[c]
	Residual	65.910	138	.478		
	Total	93.248	140			
3	Regression	35.529	3	11.843	28.110	.000[d]
	Residual	57.719	137	.421		
	Total	93.248	140			
4	Regression	41.588	4	10.397	27.371	.000[e]
	Residual	51.660	136	.380		
	Total	93.248	140			
5	Regression	44.229	5	8.846	24.361	.000[f]
	Residual	49.019	135	.363		
	Total	93.248	140			
6	Regression	47.002	6	7.834	22.698	.000[g]
	Residual	46.246	134	.345		
	Total	93.248	140			
7	Regression	48.437	7	6.920	20.537	.000[h]
	Residual	44.811	133	.337		
	Total	93.248	140			

Note. a. Dependent Variable: if yes, how much are you willing to pay for water supply services;

b. Predictors: (Constant), Age;

c. Predictors: (Constant), Age, Income (In Naira);

d. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply;

e. Predictors: (Constant), Age, Income (In Naira), , Accessibility to water supply;

f. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of water supply;

g. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of Water supply, frequency of water supply?;

h. Predictors: (Constant), Age, Income (In Naira), Accessibility to water supply, Education, Quality of water supply, Frequency of water supply, Sex.

Source: authors' field survey (2018).

The table shows that F = 17.14 (1st stage); 28.62 (2nd stage); 28.11 (3rd stage);

27.37 (4th stage), 24.36 (5th stage), 22.7 (6th stage) and 20.54 (7^{th} stage) were significant at 95 % (p = 0.05) confidence level. It can be deduced form the ANOVA table that all the identified predictors in the model are significant.

Table 6 shows the coefficient of regression analysis for the aggregated factors of WTP.

Table 6

Coefficients of Regression

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.278	.198		21.591	.000
	Age	-.018	.004	-.331	-4.140	.000
2	(Constant)	4.099	.180		22.808	.000
	Age	-.024	.004	-.445	-6.007	.000
	Income (in naira)	6.675E-006	.000	.443	5.984	.000
3	(Constant)	4.788	.230		20.820	.000
	Age	-.051	.007	-.944	-7.104	.000
	Income (in naira)	5.666E-006	.000	.376	5.284	.000
	Access to water supply	.042	.009	.599	4.409	.000
4	(Constant)	4.544	.227		20.040	.000
	Age	-.057	.007	-1.070	-8.228	.000
	Income (in naira)	6.669E-006	.000	.443	6.359	.000
	Access to water supply	.044	.009	.631	4.885	.000
	Education	.138	.034	.276	3.994	.000
5	(Constant)	4.589	.222		20.642	.000
	Age	-.053	.007	-.997	-7.671	.000
	Income (in naira)	7.374E-006	.000	.489	6.969	.000
	Access to water supply	.037	.009	.527	3.991	.000
	Education	.153	.034	.307	4.471	.000
	Quality of water supply	.115	.042	.181	2.697	.008
6	(Constant)	3.988	.303		13.147	.000
	Age	-.053	.007	-.997	-7.868	.000
	Income (in naira)	7.657E-006	.000	.508	7.388	.000
	Access to water supply	.034	.009	.489	3.775	.000
	Education	.123	.035	.247	3.515	.001
	Quality of water supply	.142	.043	.225	3.346	.001
	Frequency of water supply	.203	.072	.195	2.835	.005
7	(Constant)	4.332	.343		12.626	.000
	Age	-.054	.007	-1.008	-8.044	.000
	Income (in naira)	7.757E-006	.000	.515	7.567	.000
	Access to water supply	.037	.009	.528	4.080	.000
	Education	.120	.035	.242	3.485	.001
	Quality of water supply	.138	.042	.217	3.273	.001
	Frequency of water supply	.191	.071	.183	2.691	.008
	Gender	.209	.101	.128	2.064	.041

Note. a. Dependent Variable: if yes, how much are you willing to pay for water supply services.
Source: authors' fieldwork 2018.

The table shows coefficients from 1st stage to 7th stage of the stepwise regression analysis. The table reveals the standardized beta coefficient in stage one (age as -0.331); stage two (age as -0.445, income as 0.443); stage three (age as -0.944, income as 0.376, access to water supply as 0.599); stage four (age as -1.070, income as 0.443, access to water supply as 0.631, education as 0.276); stage five (age as -0.997, income as 0.489, access to water supply as 0.527, education as 0.307, quality of water supply as 0.181); stage six (age as -997, income 0.508, access to water supply as 0.489, education as 0.247, quality of water supply as 0.225, frequency of water supply as 0.195); and stage seven (age as -1.008, income as 0.515, access to water supply as 0.528, education as 0.242, quality of water supply as 0.217, frequency of water supply as 0.183, gender as 0.128). The significant values for each of the stages were less than 0.05. From the result, it can be inferred that age, income, access to water supply, education, quality of water, frequency of water supply and gender were major factors that influences residents' willingness to pay for public water supply in the study area while occupation, length of stay, household size and marital status were not identified as a determinant in the stepwise regression model. This agree with the findings of [6; 10; 22].

The finding agrees with [6] where it was reported that the number of times public water supply is available can determine residents' WTP for public water supply. The standardized coefficients of time of water availability is negatively related to the WTP to pay for water supply services at 5% significant level. This implies that the likelihood of paying for water supply decreases number of time the water is unavailable increases. This study disagrees with the work of [23] in Mali, where distance to the source of water was dominant in the determination of willingness to pay.

Household income as expected to determine WTP of residents is in line with the study carried out by [24; 25; 22; 8]. The result also confirms economic theory, which states that an individual/ household demand for particular commodity depends on his/her income. Therefore an increase in respondents' income will increase the likelihood of paying for public water supply service. Gender as part of the determinants shows differences between men and women willingness to pay for the service. Female household heads were more willing to pay for the service than their male counterparts. This is similar to the work of Herath and Masayuki [26] in Bangladesh.

Conclusions. The study has examined residents' perception on willingness to pay (WTP) for public water supply in Owo local government area of Ondo State, Nigeria. In examining the residents' perception on willingness to pay (WTP) for public water supply, the socioeconomic characteristics of the respondents; residents' perception on willingness to pay for water supply and factors influencing residents' willingness to pay for water supply were examined. It was established in this study that majority of the respondents were within the active and productive population (21–60 years). Many of the respondents were educated with few having no formal education. Although more than three quarter of the respondents obtained water from

State Water Corporation, majority of these respondents were of the opinion that public water supply were irregular. Despite the irregularity in the water supply, majority of the respondents were still willing to pay for the service provided if the service is improved. The study also discovered that time of water availability, income, gender, education and age were the important factors that influences WTP for public water supply services in Owo local government area of Ondo State Nigeria.

The study therefore concluded that the present water supply in the study area is grossly unreliable and people are not satisfied with it. The study recommended that government should upgrade, repair and where possible replace most of the obsolete and non-functioning equipments so as to ensure regular, accessible and uninterrupted water supply to residents' in the study area. Government should also create enabling policy for public-private partnership in water supply to secure the much needed fund for improvement for reliable service delivery since residents' are willing to pay for improved water supply service.

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