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Abstract- The paper examines willingness to pay (WTP) at the level of household in Ilorin, Nigeria. Ilorin was divided into four residential zones namely: Government Reservation Area (GRA), Modern Area, Housing Estates, and Traditional Area. 50 questionnaires were administered in each of these zones; making a total of 200 questionnaires administered in the whole of the study area. Also, 37 socio-economic variables were generated from the questionnaire. Due to multicolinearity problem, factor analysis method was used to reduce the 37 variables to orthogonal factor defining variables. Multiple regression analysis was used to associate willingness to pay (WTP) and the social economic variables. The result of factor analysis showed that 3 factor defining variables (fdvs): income, demography and educational level, are the most dominant factors having 98% explanation. Further analysis through stepwise multiple regression suggests that household income is the best predictor of WTP in Ilorin with 83% explanation. The paper posits that any policy towards pricing water in Ilorin should consider household income as an important variant.

I. Introduction

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 in-exhaustible 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. 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.

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 (1987) 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 project fail because the needs and requirement of the community have not been met and their willingness to pay is not clearly signalled. Kessler (1997) 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 (1996) 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 a World Bank (1992) 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 (Brookshire, et. al., 1993). 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 (Howe and Dixon, 1993, Roger et. al. 1993). Also, several studies such as Whittington, et. al (1990; 1991), Atlaf, et.al. (1993, 1994), Briscoe, et. al. (1990), WBWDRT (1993) 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 (WBWDRT, 1993). 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 (Asthana, 1999; Calkins; 2002).

There are several approaches for studying willingness to pay but some of these methods have not yielded the expected results particularly in the developing countries. Therefore, Merret (2002) had criticized these previous methodologies because they do not take into account the multiple uses of water and their relationship to multiple sourcing. He suggested that behavioural studies into the domestic demand for water and waste water services in low income countries which should be based on semi structured interviews. This will be attempted in this study.

II. Water Supply and Sustainable Development

Sustainable development with reference to man's environment is the ability to continue to support progressive social and economic development with a view to providing many types of ecosystems services.

The need for water sustainability has been stressed extensively but has not been seriously examined (Kimoon, 2008). The problem of climate change, groundwater stress, extreme weather events and migration coupled with demographics and increasing consumption due to rising per capital income has brought about global water crises. As income increase, people consumed more; water demand for producing goods also increases. In addition, as people move from one meal a day to two and people include meat in their diet the demand for water is also increased. Changes in lifestyles, rural urban migration complicated by political conflict and environmental crises will further stress water demand. Furthermore, pricing policies, subsidies on water, trade patterns, and developments in science and technology patterns, evolution of policies and laws, social movements, global and natural politics will affect water supply. Meanwhile, there is need to balance all these variants for sustainable development of water resources. More importantly, the impact of lack of sustainable development will be mostly felt in countries with low income levels per capita, widespread absolute poverty, high population growth and rapid urbanization such as Nigeria.

Sustainable development is not complete without discussing sustainable financing. According to WHO estimates returns of 3 to4 dollars is expected in form of economic growth depending on the level of technology and region for each 2 dollar invested in drinking water and sanitation. For example, expanding safe drinking water and sanitation services would drastically cut the loss of life from water related illnesses. Also, upgrading of water supply and sanitation will improve education and in turn allow girls and young children to attend schools rather than fetching water. Further, in industrial countries lots of cost redeemed from ecosystem restoration efforts over 60 billions may be required for this purpose.

Indeed, WHO and UNICEF (2006) rightly conclude that without higher commitment the world may not achieve ½ of the MDGs target by 2015, this call for greater commitment in sustainable water resource management in Nigeria. This paper will examine sustainable water resources management as it relates to water pricing in Nigeria growing city.

III. The Study Area

Ilorin the Kwara state capital is located on latitude 80321N and longitude 40351 east. It covers about 1000km2. The landscape ranges in elevation in the western part from 273m to 333m and in the eastern part from 273m to 364m. Sobi hill is the dominant landform, it is an inselberg, and it is the highest point in the city (394 m above seal level.)

Ilorin has a tropical wet and dry climate. Wet season is experienced from May to November and dry season from November to March. Days are hot during the dry season from November to January when temperature ranges from 330 to 34.60. Between February and April, temperature values are frequently between 34.60C to 370C. Mean monthly temperature is high in the city in dry season. Mean temperature is 140C in dry season and 80C in the wet season. Rainfall condition in Ilorin exhibits greater variability both temporarily and spatial. Relative humidity varies seasonally with an average of 79.7%. The vegetation in Ilorin falls within the derived Savannah. The city is underlain by Precambrian Basement complex; comprising mostly gneiss, granite, schist, undifferentiated metasediments rocks and overburden that are composed mainly of clay, sand and silt soils. The drainage system of Ilorin is dendritic in nature, and is dominated by Asa River, which flows from south to north and divides the city into two parts, the western and eastern parts. The western part represents the indigenous area. The eastern part coincides with the

modern layout. Major rivers draining the city are: Asa, Agba, Alalubosa, Okun, Osere, Aluko. Aluko.

Ilorin is one of the fastest growing urban centers in Nigeria. There has been a colossal increase in the population of Ilorin since it became the state capital in 1976. The population growth rate is much higher than other cities at 2.5 percent of the national growth. The 1991 census put the population of Ilorin city of about 572,172 (NPC, 1991 provisional results).

IV. Methodology

Willingness to pay is a behavioural attribute of water consumers, and the data required include: information on the socio-economic characteristics of respondents such as level of education, employment status, income level, size of household, uses of water, and quality of water demand e.t.c. Information is also required on the pricing options employed by government, and consumer's willingness to pay, ability to pay for water of household level e.t.c. A list of this is presented in Table 1.

These information and others were obtained through primary sources with the use of structured questionnaire and interviews. Ilorin city was categorized into four major zones, namely GRA, modern layouts, traditional layout, and housing estates. In each of these, 50 questionnaires were administered each: Demarcation into these four zones is to allow the sampling of the different patterns of water resource characteristics among the various segments of the city such as the elite, uneducated etc.

V. Analytical Procedure

In view of the nature and the number of socioeconomic variables employed multico-llineraity is expected in the data set. Hence, factor analytical approach was used to re-write the 37 variables to a few orthogonal ones which best explained the variance multiple regression and stepwise analyses were also used to establish relationships between willingness to pay and the orthogonal factors.

VI. Results and Discussion

1) *Primary attributes of households*

a) *Size of Household*

According to Table 1 large family size is common in the traditional area as much as 19 people and least in the modern area sometimes as low as 2 persons.

b) *Educational Status*

The modern area has the highest number of educated people at primary and tertiary level. High percentage of people within the modern area has tertiary education. Hence, overall literacy level is highest in the modern area.

c) *Monthly Income of Respondents*

Income level is generally low. Income is least in the traditional area as 42% earn less than 5000 per month. A high percentage of the highest paid workers are found in the GRA 20% earns #17,000 and above.

2) *Water Supply Characteristics*

a) *Accessibility to Water*

32% of residents in GRA are connected to improved water system (pipe borne water). This is followed closely by the traditional area (25%), while a high percentage of residents of modern area have higher asses to hand dug wells.

b) *Quantity of water Demanded*

The amount of water demanded has no bearing on the house hold sizes as the residents of modern areas uses more water than GRA and residents of traditional area despite their higher family sizes and even the higher level of education in the GRA.

c) *Water Pricing*

Majority of the respondents want to control usage of water mainly due to economic reasons and are not really bothered about environment problems.

d) *Individual attitude towards improved services*

All categories of respondents with the exception of residents of Housing Estates are willing to pay for improved services with a large majority in the GRA willing to pay more for improved services. Residents of housing estates appeared to have lost confidence in the public supply service system.

e) *Response to Privatization*

Majority of residents of modern layout wants privatization of water supply, while most residents in GRA do not want water services to be privatized. This is expected in view of the irregular supply in the modern area, as privatization is envisaged to bring improved services.

3) *Factors controlling willingness to pay*

After vari-max rotation only 3 factors dominated the explanation of the variance. Variables with loadings greater than 0.80 were selected as defining variables.

a. Factor 1

Factor 1 has the highest number of loadings, with high loadings on about 50% of the variables. The

strongest loadings were recorded on income levels and water use control variables. This factor contributed 64.5% explanation to the variance. It is tagged House Hold Income Factor.

The role of income is clearly shown in willingness to pay. Most residents of high income area are willing to pay for improved water services. Asante et.al. (2002) established a relationship between household income and willingness to pay for water in Ghana. Briscoe and de Ferranti (1988) has also established that an increase of 10% in household income increase water consumption by 4% in Zimbabwe. In a similar survey of household willingness to pay for water in Mali, Calkins et.al (2002) also reported that purchasing power of daily food expenditure turned out to be significant at a level of significance of 6% which is slightly higher than the usual 5%. They concluded that, purchasing power has a positive effect on the probability of adoption.

b. Factor II

Factor II contributed 22.4% explanation to the variance in the equation. This factor loaded highly on all the demographic variables of age and sex variables. This factor is tagged demographic factor.

The role of age and sex are very significant in willingness to pay. Young respondents are likely to pay more for water compared to the elderly ones, while females may wish to pay more for water than male depending on the culture and tradition of the respondents. The WBWDRT (1993) in a survey of different parts of the world observed that demographic variables of age and sex play important role in willingness to pay. For example, they concluded that increasing the numbers of children by one from the mean increase the probability of purchase from 74 to 85% on gender. They also concluded that gender was statistically significant in the determination of willingness to pay for improved water. In the some vein, Briscoe and de-Ferranti (1988) in a study in Zimbabwe observed that women are willing to pay 40% more for access to public taps than their husband in order to free themselves for more fulfilling and remunerative handicraft or small commercial activity. In terms of the social characteristics of the household, while the number of women of all ages increases the likelihood of using a more distant or less reliable sources will also increase, also a higher dependency ratio for example age, infirm, student or infant members of the household to fulfilling active members reduces the likelihood of using an inconvenient source.

c. Factor III

Factor three contributed 11.3% to the variance. It has the highest loadings on educational variables. This shows that the higher the level of education the higher the willingness to pay for water. This popular observation agrees with several reports on willingness to pay for water in the less developed countries. For example, WBWDRT (1993), showed that more educated households are willing to pay for improved water supplies

The role of these three factors has been stressed in literature. Another study conducted in India clearly linked gender and education. For example, in Zimbabwe Briscoe and de-Ferranti observed that the higher the level of education of women, the greater the demand for clean water. Similarly, female literacy and perception of benefit were also found to be relevant. In a similar study, Asthana (1991) (in India) and Jayasundra et.al. (1999) (in Bangladesh) reported the importance of gender and education in willingness to pay. This is simply because the level of education will affect identification of water sources, perception of water quality and reliability of sources of water.

4) Predicting Willingness to Pay In Ilorin

The 3 factors were related to willingness to pay using multiple regression, the result is presented in Table 3. The 3 factors contributed 98% of the explanation to willingness to pay for improved services in Ilorin.

Based on this association, willingness to pay in Ilorin can be predicted using equation 1.

$$WTP = 36.800 + 28.239HINC + 7.123DEMO + 10.773EDU$$

C…….. (eq. 1)

(R=98%; SE=2.79)

In a further analysis using stepwise regression, it was observed that income is the dominant factor affecting household willingness to pay for improved water services in Ilorin.

Conclusively therefore, willingness to pay for improved water services in Ilorin can also be defined with equation 2.

$$WTP = 36.80 + 28.24\ HINC$$……. (eq. 2)

(R2 = 83.0%; SE=15)

The above shows that income of respondents contributed 83.0% explanation to the discussion of household willingness to for improved water services in Ilorin. The result is expected in view of the nature of the study area. The levels of respondent income are generally low. This factor is clearly supported with Table 1 which shows that in the modern layout and the government reserved areas where levels of education are highest respondents are willing to pay more improved water .

This agrees with the findings of Asante (2002), WBWRT (1993) and several others. In the study area, the

areas of high income also doubles as areas where level of education and awareness are also higher or need for improved and hygienic water. Hence, this again explained reasons for the expected results.

The results obtained in this work, agree with popular opinion on studies of WTP but rather the report WBWRT (1993) Briscoe and de Ferranti (1988) where demographic variables dominant. It also disagrees with the work of Calkins, et. al. (2002) in Mali, where distance to the planned new sources of water was dominant in the determination of willingness pay. The paper also agreed with Engel, et.al. (2005) where he reported that quality perception, relative distance to improved and unimproved sources, prices and income level are important to the explanation of willingness to pay for improved services.

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Table 1: socio-economic and willingness to pay attributes of respondents.

Social economic variable	Regional Pattern			
	G.R.A	Modern layout	Traditional layout	Housing estate
No people per household				
a. 1-5				
b. 6-10	25.3	34.2	19	22
c. >10	25	25	19	26
	24	5	51	19
Age of respondent				
a. 18-25	35	37	18	10.8
b. 26-30	35	39	20	6
c. 30-35	36	32	19	13
d. 36-40	27	23	29	21
e. >40	33	33	22	13
Sex				
a. Male	23	19	24	33
b. female	18	20	18	44
Education				
a. primary	14	83	5.4	0
b. secondary	15	18	48	33
c. tertiary	26	27	21	26
d. others	46	22	13	20
Income				
a. <50,000	19	23	42	16
b. 5000-8000	2	24	38	18
c. 8000-12,000	27	31	15	31
d. 12,000-17,000	20	16	9	27
e. >17,000	7	3		
Accessibility				
a. Boreholes	32	24	25	19
b. Hand dug well	31	9	28	31
c. Pond of stream	9	35	23	33
Quantity of water demanded				
a. 60 litres	13	41	33	13
b. 61-120 litres	28	28	48	16
c. 121-180 litres	35	21	21	23
d. >180 litres	25	19	23	33
Control of use				
a. Economics	30	28	18	25
b. environment	18	21	36	26
Willingness to pay for improved services				
a. willing to pay	29	24	25	22
b. not willing to pay	9	30	25	35
Privatization				
a. want privatization	19	31	26	13
b. don't want privatization	31	19	24	37

Table 2: Factor loadings, Eigen-values, percentage contribution of factors

Variable	Variable Description	Factor I	Factor II	Factor III
1.no of people per household (1-5)	Household size	.94	.20	.24
2.,, ,, ,, (6-10)		.91	.40	.18
3. '' '' '' >10		.71	.40	.50
4. age 18-25	age	.35	-.90	-.30
5. 25-34		-.15	-.97	-.17
6. 35-40		-.31	-.90	-.40
7. 41-45		-.86	-.43	-.12
8. >50		-.41	-.90	-.27
9.male	sex	.19	.97	-.13
10. female		.70	.70	-.05
11. First school leaving certificate.	Level of education	.70	0.07	.70
12.secodary school education		.78	.50	.40
13. tertiary institution		.93	.30	.22
14. other forms of education		-.18	-.51	-.80
15. monthly income	Monthly income	.81	.26	.51
16. 5000-8000		.84	-.30	.50
17. 8000-12,000		.94	.30	.14
18. 12000-17,000		.90	.44	.05
19. .17,000		.93	.40	-.05
20. private service	Sources of water	.94	.22	.24
21. bore hole		.85	.45	.17
22. hand dug well		.81	.40	.40
23. stream		.83	.12	.52
24. 60 litres	Volume of water use by household	.91	.18	.32
25. 61-120litres		.95	.30	.14
26. 121-180 litres		.90	.44	.19
27. >180 litres		.95	.26	.17
28. economic value	Value attached to water use	.82	.40	.42
29. environmental value		.91	.23	.35
30. willingness to pay	Indices of Willingness to pay	.90	.40	.20
31. % household not willing to pay		.89	.40	.23
32. % able to pay		.91	.09	.40
33.% not able to pay		.93	.30	.24
34.% willing to pay		.80	.45	.36
35. % not willing to pay		.90	.15	.41
36. % household in support of privatization	Desire for privatization	.90	.44	.15
37. household not in support of privatization		.71	.45	.55
Factor Description		Household income factor [HINC]	Household Demographic factor [DEMO]	Household Education factor [EDUC]
Eigen value		23.2	8.07	4.07
% Variance		64.5	22.4	11.3
% Cum. Variance		64.5	86.9	98.2

Table 3: Summary of Multiple Regressions

Constant/variable	coefficients	Standard error	t-test	Significance level	R^2
constant	36.800	1.25	29.41	.022	
1. Household income factor (HINC)	28.239	1.399	20.109	.022	
2. Demographic factor (DEMO)	7.123	1.399	5.09	.123	98
3. Education factor	10.773	1.399	7.7	.082	

Table 4: Summary of Stepwise Regression Model

Constant/variable	Regression coefficient	Standard error	t-test	R^2 (%)
Intercept	36.80	-	5.48	83
1. income	28.24	15.00	3.76	

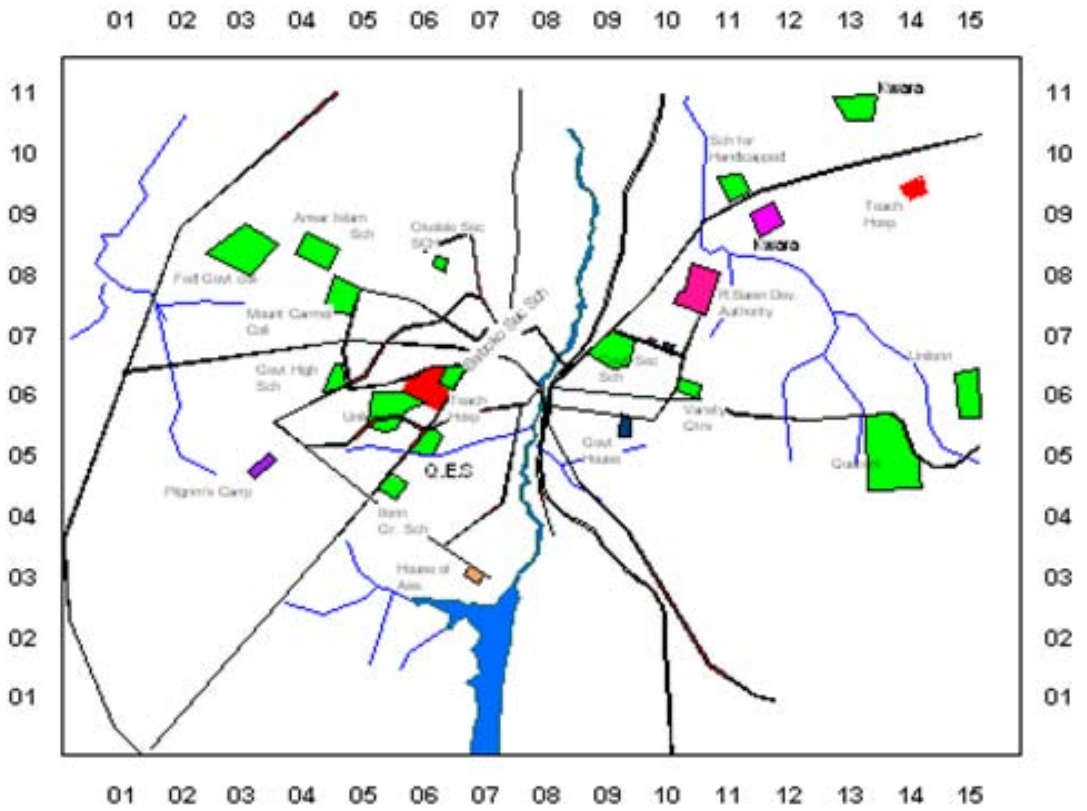

Fig.1 : A digital map showing major urban features of Ilorin metropolis

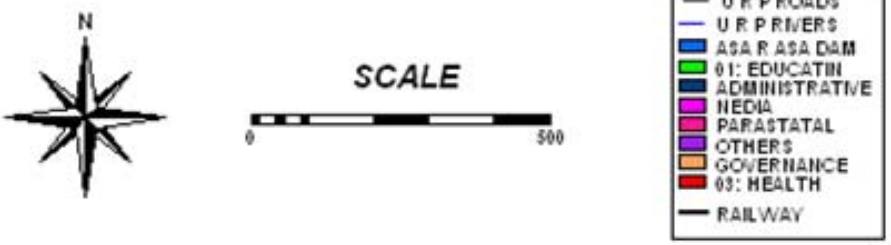

Plate 1: Waiting for water in parts of Ilorin West Local Government Area (Empty containers are used to queue-up.)

Plate 2 : At-last water came; note the struggle and chaos in fetching water by housewives and children who are culturally assingned to fetch water;also imagine the average time it may take for each of these people to fetch just a bucket of water.

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