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EFFECT OF SOCIO-ECONOMIC FACTORS INFLUENCING HOUSEHOLDS, WILLINGNESS TO PAY FOR WATER TARRIF IN MAIDUGURI, BORNO STATE, NIGERIA

JOSEPH AJAMU¹, FUNMILOLA FAUSAT AHMED² AND ADEDEJI ABDULKABIR NIRAN³

¹²³*Fauctly of Social Sciences' Department of Economic, University of Maiduguri, Maiduguri,
Borno State, Nigeria*

¹ajamujoe@gmail.com

ABSTRACT

This study examined water pricing policy in selected areas of Maiduguri, Borno State Nigeria. The objective of the study was to examine the socio-economic factors influencing households' willingness to pay for water in Maiduguri Borno State, Nigeria. Two stage sampling procedures were employed in selecting 588 respondents from whom data were collected for the study. Data for this study were collected through the use of well structured questionnaire, the questionnaires were administered to 588 respondents but 474 questionnaires were employed for the study due to their completeness and consistency. The respondents were selected through systematic sampling technique for household heads and purposive sampling for staff/officials of Borno state water corporation. The probit regression was used to test the hypothesis. The result of the study revealed that some socio-economic characteristics of respondents captured in the probit regression influenced their willingness to pay for water tariff and two out of four factors are positive in explaining factors determining water tariff in the study area which are fairness of water tariff and affordability of water tariff. The researcher recommended that socio-economic status identified as influencing residential or household heads willingness to pay for water should be considered when planning water supply.

Key Words: *Water Pricing Policy, Socio-economic Factors, willingness to pay, water tariff, households.*

1.1 INTRODUCTION

Water is a natural resource that sustains life and the environments. Access to portable water supply has been one of the priorities in developing countries and according to United Nations Environment Program (2000) predicts that by 2025, two-thirds of the world's population will live in water-stressed regions with per capita water less than 1,700 m³ per year. Historically, domestic water use plays crucial role in people's daily life and it is directly related to social welfare and public health issues. Although domestic water use is not a major part of water consumption, but water it is also used for irrigation farming in agriculture, for hydro-power electric generation and for industrial used. Therefore, the efficient use of limited domestic water use is one of the central concerns of policy makers.

Globally, water supply has been on the decrease, while the demand for water and the various end-users have been on the increase. This therefore has created a gap between the demand and supply of water. This also has necessitated the thinking of conceptualizing water as an economic or social good for effective of water resources. The general agreement in economics thinking is that, when the supply of a commodity is scarce relative to demand, the commodity is considered as an economic good. This therefore calls for the use of economic techniques for water demand management.

Tamkinat and Wasif (2008), show that through pricing policies, existing demand patterns are modified to achieve various objectives such as cost recovery, conservation, and equitable allocation of water among different income groups. To implement this policy successfully, the value of water is reflected by the price elasticity of water demand such that if the demand is inelastic, the price has little or no effect on the quantity consumed. On the other hand, if elasticity is high, consumers indicate willingness to reduce/increase the use of water with changes in price. Clearly, this information is fundamental in deciding the manner in which tariffs should be structured.

Water pricing policy is seen as an effective mechanism to manage water use. Developing countries, which usually suffer from inadequate water supply facilities and comprehensive water pricing systems, are in need of more practical and effective water pricing methods. In Nigeria, potable water supply is a public service, controlled by the government through states water boards, corporations or authorities and generally known as State Water Agency (SWA). As the services rendered by these SWAs are historically considered a social welfare service, their charges are usually at low rates which constitute only a fraction of the operational costs. This

situation shown that the water produced in these utilities is not priced in accordance with the requirements of the law or edict establishing them (Johnson, 2003).

Indeed, Maiduguri area presents water issues with specific characteristics such as: water scarcity and expanding urbanization. According to Borno State Ministry of Water Resource, (BSMWR) report (2015) out of the 716,973 (projected people living in urban and semi-urban areas of Maiduguri) less than half have access to water supply. Many households purchased water from private vendors, which was more expensively than from public supply. Thus, this call for study focused on domestic use and how it is affected by the current water pricing policy in the state.

1.2 STATEMENT OF THE PROBLEM

Borno State Government subsidized water supply to the community by charging low water rate to maximize economic welfares of the people and also installed boreholes in areas where treated or surface water supply cannot reach, without clear financial obligation and then bearing the annual losses. However, water demand was on the increase than the supply and technique or approach toward water charges called water pricing policies have being introduced due to obvious gap between urban demand and water supply as consequent on high population growth rate coupled with increasing urbanization and rising living condition. Hence, it is necessary to assess water pricing policies adopted in the study area in other to know how sustainable it is in address water deficiency.

Reviews of literatures have shown that a number of studies have been carried out on the analysis of water demand, supply and causes of water shortage in Maiduguri. These include Adamu (1993); Yahaya (1998); Hafsatisa (2009); and Ibrahim (2009). Their studies determined how socio-economic variables affected water demand and deficiency of the state water board services causing inefficient water supply using multiple regression approaches. However, they ignored to study household willingness to pay for water. Thus, it is not clear the degree at which the households are willing to pay for water which is the main concern of this present study.

It is obvious that one of the challenges to the provision of water services in Borno state is that water tariff is below the cost of supply and over years, the cost of water supply is subsidized which is not in accordance to the requirement of the law establishing water pricing policies. Besides, for Borno Water Corporation to adopt and implement water price policies fully, the need to examine the factor determining water pricing policies is

necessary. This will enable the agency to recover all or part of the capital and promote an efficient use of the water supply.

1.3 OBJECTIVES OF THE STUDY

- i. To examine socio-economic determinant of households' willingness to pay for water for consumption

1.4 RESEARCH QUESTIONS

The following research questions were developed to guide the study:

- i. What are the socio-economic determinants of households' willingness to pay for water consumption in selected Area of Maiduguri Borno State, Nigeria. Borno State ?

1.5 HYPOTHESIS

The following hypothesis was formulated to guide the study

H₀₁: There is no significance effect of socio-economic factors on households' willingness to pay for water for consumption.

2.1 REVIEW OF RELATED LITERATURE

2.1.1 Socio economic characteristic of Household Heads water demand

Gender

Ifabiyi (2011) in a study on willingness to pay for water (WTP) at the level of household in Ilorin, Nigeria. Showed from the findings that majority (68%) of respondents were female, while 32% were males. Deborah (2012) studied the determinants of household water consumption in Jos metropolis of plateaus state . According to the findings revealed that 60.1% of the respondents are male. Also, Akpen and Ivue (2016) studied shows the determinant of residential per capital water demand in Makurdi Metropolis. Results findings revealed that majority of the respondent were (53.4%) male. According to Abaje, Ati and Ishaya (2009) studied the potable water supply and demand in Jema'a area of Kaduna state, Nigeria. The findings showed that 78% of the respondents were male which constitute the majority.

Age

Ifabiyi (2011) in a study on willingness to pay for water (WTP) at the level of household in Ilorin, Nigeria. Findings from the study showed that majority (66%) of the respondents were within the age bracket of 31 – 50 years. Ubagida (2012) studied the effectiveness of pricing policy in households' water demand management in Kaduna state: A case study of Sobon Gari Local Government. The findings showed that majority (43.6%) of the respondents were within the age bracket of 31 – 43 years. Chineke, emereole and Adogu (2014) studied the socio – economic status of households sources of water supply and associated water diseases of communities in Njaba, Imo state of Nigeria. Result from the findings showed that 43.3% of the respondent were within the age bracket of 50 – 59 years and were the majority.

Marital status

Coster and Otufale (2014) studied the households water use demand and willingness to pay for improved water services in Ijebu Ode, Ogun state of nigeria. Results from the findings reported that majority of respondents were married (67%). Aho, Akpan and Ivue (2016) studied show the determinants of residential per capital water demand of Makurdi Metropolis. The findings showed that majority of respondents 59% were single. Chineke, Emereole and Adogu (2014) studied the socio – economic status of households, sources of water supply and associated water related diseases of communities in Njaba, Imo state of Nigeria. Result from the studies reported that majority of the respondents were married 50%. Deborah (2012) assessed the determinant of household water consumption in plateaus state: A case study of Jos metropolis. The fundings of the study whowed that majority of the respondents were single 52.4%.

Educational level

Ubagida (2012) studied the efffectiveness of pricing policy in households' water demand management in kaduna state: a case study of sabon gari. The findings revealed that majority (48.3%) ownned higher institutions certificates. Ifabiyi (2011) studied the willingness tp pay for water in kwara state of Nigeria. Findings revealed that majority of the respondents (42%) have higher institutions certificates.

According to Alo, Akpon and Ivue (2016) studied shows the determinants of residential per capital water demand in Markurdi Metropolis. Results from the findings showed that majority of respondents own tertiary undergraduate certificate (40.7%).

Household size

Ifabiyi (2011) studied the willingness to pay for water by household in Ilorin, kwara state of Nigeria. From the results of the study, the family size distribution of household water consumers showed that most of the respondents had family size of about 6 – 10 persons. This indicated that there were enough persons in each household consuming water. Alo, Akpen and Ivue (2016) studied the determinants of residential per capital water demand in makurdi metropolis. The results of the findings revealed 61.1% were the majority with highest household size of less than (<) 5 persons. Deboral (2012) studied the determinants of household water consumption in Plateaus state: a case study of Jos Metropolis. According to the findings, 23.6% of respondents represent the majority with two (2) persons household size.

Income level

Ifabiyi (2011) studied the willingness to pay for water by household in Ilorin, kwara state of Nigeria. The results of the findings revealed that 48% of respondents emerged the majority which earned less than 50,000 naira. Ubagida (2012) studied the effectiveness of pricing policy in households' water demand management in sabon gari of kaduna state. Findings revealed that majority of the respondents (40%) were persons of higher income level. Deborah (2012) studied the determinants of household water consumption in Jos Metropolis of Plateaus state, Nigeria. The results of the findings revealed 24.5% were the majority earning income between 5,000 – 35,000 naira monthly.

Occupation

Coster and Otufale (2014) studied the households' water – use demand and willingness to pay for improved water services in Ijebu Ode of Ogun state. Results from the findings reported 60.6% were the majority of the respondents engaged in trading. Ubagida (2012) studied the effectiveness of pricing policy in households' water demand management in Sabon gari local government of Kaduna state. The findings revealed that majority of respondents, 49.6% were civil/public servant. Deborah (2012) studied the determinants of household water consumption in Jos Metropolis of Plateaus state, Nigeria. The results of the findings showed that 45.2% were student and the majority of the respondents.

2.1.2 Household Willingness to Pay for Water

Choe et al. (1995) in Dauoa Philippines employed a Contingent Valuation Method (CVM) to examine household demand for surface water quality improvement. A total of 581 persons were interviewed a referendum

kind of question about a citywide plan for an improvement in water quality. The result show that the support for the water quality improvement plan fell sharply as the monthly fee increases. The result from the estimation of mean WTP of different households from socio-economic characteristics show that household WTP for water quality improvement is low both in absolute and percentage of income and 15% of the respondents refused to pay anything at all. Several results from the research suggest that these low estimates of WTP for surface water quality improvement are likely to reflect respondents' true preferences.

Bayrou (2002) research work out in Nazareth town in Ethiopia, examine the determinants of willingness to pay water tariff. Used probit model to see the effect of the explanatory variables on the choice of the household to the improved water service. The Censored Least Absolute Deviation (CLAD) estimation result showed gender, income, monthly expenditure for water consumption, quality and time taken to fetch water from existing source significantly affects the respondent's willingness to pay. While the probit estimate result showed that income, education level, source of water, quality and time taken to fetch water from the existing source affect the choice of the respondents to the improved water service. The descriptive analyses result revealed that the mean WTP for improved water service is higher than the existing tariff. The affordability analyses also indicated that consumers are able to pay if they are provided the improved water service at a price equal to the average incremental cost of providing the improved water supply service.

In a study conducted by Rananga *et al* (2015) on "Willingness to Pay for Water Services in Two Communities of Mutale Local Municipality, South Africa: A Case Study", the study was accomplished through open-ended questionnaire interviews with selected respondents. The study showed that respondents were dissatisfied with the unreliable water services (89.9%) but were willing to pay for water services to secure reliable water services (95.5%). The respondents with tertiary level education were willing to pay R 150 per month per 6 kilolitres. The maximum 6 kilolitres is the free basic water services that the municipality can provide without collecting water revenues. The following variables: literacy levels; household size of 3 to 6 members; the age of 40; and monthly incomes, had a significant effect ($p = 0.005$) on the monetary amount and the willingness to pay.

Omonona and Fajimi (2011) examined the factors that influence the willingness to pay for improved water supply services in Ibadan metropolis, Oyo State Nigeria. Data were collected using multistage sampling technique from 102 households that are currently and not currently connected to the public water services. Data obtained from the survey were analyzed using a Logit model-based contingent valuation. Evidence from the Logit model indicated that the mean willingness to pay of households for improved water supply is N1,080.80. The result also shows that price that a household 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 and correlates in predictable ways with households' willingness to pay for improved water supply services. The implication is that the households have certain socioeconomic characteristics that influence their willingness-to-pay for improved water supply services and they can afford to pay higher than the existing tariff if they are provided the improved water service.

Mamudu (2016) examined the factors that influenced willingness to pay for improved portable water supply services in Kano metropolis. Data were collected using multistage random sampling technique from households that are currently and not currently connected to the public water services such that every 40th household in the study area was selected based on the systematic random sampling procedure which brought the sample size to 3735 households. Data obtained from survey were analyzed using a Logit model-based contingent valuation. Evidence from the Logit model indicated that the mean willingness to pay of households for improved portable water supply is N1, 358.60. The result also showed that household monthly expenditure, age, vendor price, educational qualification, household size and percentage households are willing to pay from income are significant factors that influence the households' willingness to pay for improved portable water supply services and correlates in predictable ways with household's willingness to pay for improved portable water supply services. Finally, the study recommends that Government and policy makers in water supply agencies should ensure the provision of up to date water infrastructures. This will help to transform the old rudimentary system of transporting, filtering and distributing the resource to a more efficient form. Making regular payments of water tariff and ensuring maintenance culture were equally recommended.

Ayanshola *et al.* (2013), focused their study on the evaluation of willingness-to-pay (WTP) for sustainable household water use in Ilorin, Nigeria. The study involved assessment of the existing water supply situation particularly considering water use indicators such as demography, adequacy of existing water supply system and WTP for reliable supply. Field work involved the use of structured questionnaire to obtain data on household water use and WTP for a reliable water supply of the sampled houses consisting three land use patterns. Descriptive statistic was employed to evaluate the variables that affect WTP for improved household water use while Contingency Valuation Method was adopted to evaluate the WTP for reliable and sustainable service delivery. The findings of the study revealed that: approximately 70% of total sampled households were connected to municipal supply out of which 13% indicated satisfaction in terms of sufficiency and 87% used alternative sources to augment water supply; consumers are willing to pay an average sum of N737.22 per month for

improved water supply services and; gender, water quality and household income level have significant impact on WTP at 5% level of significance.

Ifabiyi (2011) examined 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. Fifty (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 multicollinearity problem, factor analysis 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 socio 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 suggested 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 variable.

Ma'ruf (2005) in a study on prospects and implication of commercializing urban water supply, revealed that 76% of the populace in Kaduna State were willing to pay more for water supply, 18% indicated otherwise and 3% were undecided. For full water household connections the average monthly water bill willing to pay per household in the state was N1230.20. Inclusion of community based water service enterprise was based on the conviction that a substantial capacity exists for internal revenue generation from full user charge if only there is a favourable disposition towards its exploitation.

Kim (1998) carried out research work on Willingness to Pay for Water at the Household Level: individual financial responsibility for water consumption in Akulam Village of Kerala state, India. It was found that the local government's responses to the increasing demand for potable water and expand the existing limited system beyond sustainable capacity. The infrastructural development is weak with water policy, charges for water have not been reviewed for decades and state subsidies for the public water utility remain high. Consequently, the existing flat rate tariff did not relate either to the cost of the service nor to the consumer's ability to pay: it is therefore socially inequitable in its distribution and, economically, it does not generate sufficient revenue to meet even the recurring costs of water.

Wang (2010) carried out a research on water pricing with household surveys: A study of acceptability and Willingness to pay in Chongqing, China. A multiple bounded discrete choice (MBDC) survey model was used to

collect information about acceptability of different water prices by different types of households and estimating households' willingness to pay for water service improvement with a survey of 1500 households in five sub urban districts in Chongqing Municipality, this study showed that a significant increase in water price is economically feasible as long as the poorest households are properly subsidized. The analysis also indicated that the order in which hypothetical prices are presented to the respondents with the MBDC method can systematically affect the answers and should be taken into account when designing such survey instruments.

Sidrat *et al* (2014) examines Households' Willingness to Pay for Improved Tap Water Services in Karachi and its determinants by using single and double bound dichotomous choice elicitation questions. Three models, namely, probit model, interval data model and bivariate probit model, were used to analyze the data. The results show that the average WTP is in the range of Rs. 604 – 734 per month by households whose income is less Rs. 20,000 per month. The results showed that the average WTP increases as the income level increases. The overall average WTP from all income classes is in the range of Rs. 1,922 – 2,126 per month whereas the current average bill paid is Rs.703 per month. These results showed that the households are willing to pay much more than what they currently pay for a safe and regular water supply service. The study presented the evidence that cost recovery is possible by increasing tariffs for higher income households. A major implication of this study is imposition of cross subsidization. This study showed that a significant increase in water price is economically feasible as long as the poor households are properly subsidized.

2.2 THEORETICAL FRAMEWORK

2.2.1 Theory of Pricing Public Utilities

In case of public service that is considered pure public good, free services might lead to wastage of resources. Dalton quoted in Jhingan (2003) advocated the compulsory cost of service principle whereby the government should charge a price for the service provided to people and leave a gap between revenues and costs since they are public utilities. However, Dalton favours the voluntary price principle for public utilities. According to this principle the consumers of these services are required to pay the price fixed by the Public Sector Enterprises (PSEs). The PSEs may have a monopoly in a particular service such as water or power supply and may fix a price lower than its cost of production for it so that the welfare of the community is not adversely affected.

The general principle for pricing such public service is to recover cost without distorting the allocation of resources done by making price equal to short run marginal cost while keeping productive capacity constant. But

water periodically requires large investments. In such cases, average cost falls as production expands and the actual charge is below the average cost.

Charging that price will lead to a loss and the public price has to be revised to cover the cost of providing the service. The major theories of pricing public undertakings are presented below:

a. Marginal Cost Pricing Rule

One of the aims of PSEs is to be economically efficient or to maximize social welfare. If PSE is a monopoly, it will not be economically efficient because it will produce where $MC=MR$.

However, for more efficient resource allocation, it is essential to find out whether it is operating under decreasing or increasing returns. If price equals MC under decreasing returns, the PSE will earn profit and if it is operating under increasing returns, it incurs loss. Thus, the application of this principle has an implication for the financial position of the PSE and the output will not be of optimum size because the PSE will be earning either super normal profit or incurring losses.

However, to secure optimum allocation, the output should be increased and this is only possible when the marginal cost pricing principle is followed. This is the most efficient pricing method because consumers are charged for any additional unit of water used and therefore, can lead to efficient use of water. Although having a lot of appealing from efficiency grounds, using the “marginal cost principle” to price water service provision may have a limited scope. Different reasons explain the limitations of this alternative. First, choosing price that equals marginal cost may not allow meeting revenue requirement to guarantee operation of the provider. Second, in cases in which it is possible to anticipate divergences between short run marginal cost and long-run marginal costs, it is not clear to which one the price should be tied. Third, considering that, at least in the short-run, capacity of operation is fixed, and in some cases demand varies over time (for example, by season) then the “marginal cost principle” does not have a straight forward way of implementation. Pricing the provision of water services under the marginal cost principle may involve a trade-off between efficiency and raising enough revenue. There are others limitations like conceptual and practical difficulties in the calculation of marginal cost and administrative and managerial difficulties.

b. No-Profit No-Loss Policy

Jhingan (2003), advocated no-profit no-loss policy or the principle of break even for PSEs. He argued that PSEs are meant to serve public interest and not to make profits. According to Lewis (1956), PSEs should neither make profit nor loss after meeting all capital charges. He further stated that what the Economic principle support is not the MC pricing but a system that consumer contributes to fixed cost according to their capacity to pay. This policy means that prices should cover total costs. These include all types of expenses like short and long period fixed and variable costs, current and replacement costs, depreciation charges, interest on capital and advertisement, selling and distribution expenses. These costs may be covered by making the prices equal to the average costs or by two-part/multi-part policy.

The full cost or average cost pricing policy is advocated on the ground that full cost prices are based on average total cost which can be easily estimated. This policy leads to profit which compensate for losses, so that there is neither loss nor profit. However, this policy may lead to mal-allocation of resources when consumers do not buy additional units at the marginal cost. Also, if the demand curve (AR) lies below the AC throughout the length, the AC pricing will not give any output and total cost will not be covered at all. There is a difficulty in distributing appropriate depreciation over a period of time. To overcome these limitations, Lewis, Coase and Henderson (1956) advocate two-part/multi-part tariff policy.

c. Profit Price Policy

Some Economists such as Rao (1959), quoted in Jhingan (2003), categorically rejected the theory of break even and argued for the adoption of profit price policy. Such a policy according to him will make the state utilize its own resources rather than taxing citizens. He stated that PSE must be carried on a profit-making basis not only in the sense that the PSE must yield an economic price but also get the community sufficient resources for financing a part of investment and maintenance expenditure of the government. This theory is based on the following arguments:

- a. When a State invests in PSE, it expects profits to augment resources for development.
- b. PSEs should not be dependent on government for finance.
- c. Even in case of monopoly, the best course is to charge a price that could give a minimum profit which ultimately goes to the State for capital formation.
- d. This policy will contribute to the general revenues of the State.
- e. The surpluses from profit will provide adequate funds for expansion and modernization.

The theory also shows that the price policy of the PSE producing public good or service should not be different from the one that the private entrepreneur follows. However, the price should be determined by the Board of Directors or the government but it should be noted that PSEs should aim at a reasonable rate of profit. It is also difficult to earn a particular rate of profit for all PSEs because of the following reasons:

- a. The PSEs which have not broken even cannot earn profit because their overhead costs will be high.
- b. If the gestation period is long it takes it a very long period to break even and start earning profit.
- c. For public utilities, welfare and not profitability is the principal objective. They try to equate MC with price.

Finally, from the above review of all pricing rules of public utilities, Marginal Cost Pricing Rule best explain the effective pricing policy on households water demand. This method is useful in accordance to specific situation in the study area, whereby State Water Agency can earn additional profits from using up excess production capacity. It is not a method to be used for normal pricing activities, since it sets a minimum price from which water board will earn only minimal (if any) profit.

This study, therefore adopted Marginal Cost Pricing Rule considering its ability to allocate water resource efficiently or maximize economic welfare to the general public because it promotes very low water rate or tariff that is affordable by all.

2.3 MATERIALS AND METHODS

For this research, primary source of data collection through administration of questionnaire was used. Data were collected relating to the socio-economic characteristics of the households and Borno State Water Agency.

Maiduguri Metropolitan Area was purposively chosen being the state capital and most densely populated of all the local government. The study area was stratified into wards and respondents were selected from each ward in proportion to the size of its population. Systematic random sampling was then employed to select household heads in each ward based on the sample frame.

The population of the study area consists of households (water users) whose houses have public water run pipes connection in Maiduguri Metropolitan Area. The households with effective water connection were

estimated to a total of 2891 which is 9% out of 29,676 of total residential water connections with a ratio of 1:10 to the non-effective water connections.

Besides, water provider comprises of officials of the Borno State Ministry of Water Resource and Borno State Water Boards working in Maiduguri. The population was stratified into departments and sample size was drawn from each department's proportion to the size of its personnel. Purposive sampling was then used to collect data from staff in each department.

The sample size was obtained in accordance with the measuring table of determining sample size for research activities of Krejcie and Mongan (1970). The first stage involved stratifying the population of the effective water connection from public water supply into 15 electorate wards in Maiduguri Metropolitan Area and sample size was drawn from each ward in proportion to the size of its population. Second stage involved the use of systematic random sampling; this was employed to select households in each ward at regular intervals based on the percent share of individual ward. A total of 341 respondents (water users) were employed for the study.

The sample size of water officials of Borno State Water Corporation is 43% out of 511 total staff members employed in the study area in accordance with the measuring table of determining sample size for research activities of Krejcie and Mongan position of 1970, this represented the number of respondents to the second set of questionnaires. The samples size was drawn proportional to the actual number of staff in each department and simple random sampling method was employed to select staff in each department and 217 respondents were employed among the total water providers.

Data for the study were obtained through structured questionnaire adopted from Ayanshola *et al.* (2013) and Ubangida (2012) research work and was filled by various sampled water users (households) and water supply service provider within Maiduguri Metropolitan. The questionnaires were structured using two response style questionnaires and five-point Likert scale, ranging from strongly agree having a score of 5, agree having a score of 4, undecided having a score of 3, disagree having a score of 2, strongly disagree having a score of 1 and open ended questions which allow free responses from the respondents. Five hundred and seventy-five (558) copies of questionnaire were distributed to the two categories of respondents in the study area but 474 questionnaires were employed for the study due to their completeness and consistency.

Probit Regression model was employed for data analysis. Probit analysis is designed to fit a regression model in which the dependent variable Y characterizes an event with only two possible outcomes. The probit

model was used for the binary response (0, 1), that is, whether the household is willing to pay or not for the offered bid. Following Cameron and Pravin (2005), the probit model takes the following form below.

$$Y_i^* = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \dots + \beta_k x_{ki} + \varepsilon_i \text{-----} -1$$

and that:

$$Y_i = 1 \text{ if } y_i^* > 0$$

$$Y_i = 0 \text{ otherwise.}$$

Where x_1, x_2, \dots, x_k represent vectors of random variables, and ε_i represents a random disturbance term. While the explicit function is,

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \text{-----} -2$$

Where the probability that $Y_i = 1$ (WTP for water tariff)

X_i is a set of independent variables

Y is dependent variable (Responses of household to willingness to pay question which is either 1 if Yes or 0 if No)

β_0 is the intercept which is constant

β_1 is the coefficient of the price that the households are willingness to pay for water tariff.

β_0 and β_1 are absolute coefficient estimates from the probit regression willingness to pay water tariff by households.

β_1, \dots, β_8 = Coefficient of the explanatory variables X_1, \dots, X_8

ε_i = Error term

The explanatory variables can be expressed as described by Raheem (2006) and was modified to suit this study.

The explanatory variables are:

X_1 = Age of Household Head (AGE) in years

X₂= Educational Qualification of the Household Head (EDUCQ) in level, Primary school = 1, Secondary school = 2 and Higher Institution = 3

X₃= Household Size (HHS) in number

X₄= Household heads' Income Level (HHINCL) in Naira

X₅= Household awareness of shortage in water supply (HHAWP) Yes = 1 or No = 0

X₆= Time of water availability daily (TWA) 1 – 6 hours = 1, 7 –12 hours = 2, 13 – 18 hours = 3 and 19 – 24 hours = 4

X₇= Perception on the amount pay for water supply (PAPWS) Yes = 1 or No = 0

X₈ = Perception on the need to improve water supply (PIWS) Yes = 1 or No = 0

$$\text{Willingness to Pay for water} = \text{AGE} + \text{EDUCQ} + \text{HHS} + \text{HHINCL} + \text{HHAWP} + \text{TWA} + \text{PAPWS} + \text{PIWS} - \dots - 3$$

Table 2.1: Estimated Probit Regression Model of Households' Willingness to Pay for Water Tariff

n = 293				
Parameter	Estimate Coefficient	Standard Error	t-value	P-value
CONSTANT	1.931116	0.709782	2.721**	0.0401
Age	0.622553	0.131159	4.747**	0.0102
Education Qualification	1.955758	0.265853	7.357***	0.0023
Household Size	1.500696	0.277045	5.417***	0.0095
Household Head Income Level	3.944736	0.416034	9.482***	0.0002
Household awareness of water supply deficiency	-0.479088	0.182727	-2.622**	0.0423
Time of water availability	-1.247023	0.303417	-4.110**	0.0192
Perception of respondents on the amount paid for water supply	0.680963	0.307746	2.213**	0.0496
Perception of respondents on the need to improve water supply	0.515091	0.201534	2.556**	0.0414
Sigma	0.865679	0.383061	2.260**	
Log likelihood = 95.168696				
LR chi ² = 211.90				
Prob>chi ² = 0.0000				
Pseudo R ² = 0.895853				

** Significant at 5 percent, *** Significant at 1 percent

Source: Field Survey, 2018

Age (AGE)

The coefficient of age (0.62) is statistically significant at 5% and positively related to willingness to pay water tariff. This implies that the likelihood of paying for water supply services rise as respondents' age increases and this agrees with the apriori expectation. This may be due to the fact that the old people who have adapted themselves to the water supply service have high preference and more willing to pay for water tariff as compared to their younger counterparts coupled with lack of physical strength to fetch water far from home. This agrees with Omonona *et al.* (2011) and Mamudu (2016), who recognized that the older the respondent, the higher is the preference and willing to pay for the water service.

Educational Qualification (EDUCQ)

As indicated in Table 2.1, the coefficient of household heads level of education (1.95) is significant at 1% and positively influenced willingness to pay water tariff. This implies that the education level of respondents is an additional factor which is ought to influence willingness to pay for water supply services. The awareness of the source of water and the importance of good water hygiene ultimately influenced their decision on payment of water tariff. Similar result was obtained by Omonona *et al* (2011), Ifabiyi (2011), Mamudu (2016) in their study on estimating the willingness to pay for water services.

Household Size (HHS)

The coefficient of household size was also significant at 1% level and positively influenced willingness to pay water tariff. Increasing household size could exert more pressure on households need on portable water since this need tend to increase with the number of persons in the households. This implies that as households size increases, the probability of positive impact on households' willingness to pay for water tariff also increases. This is in line with the studies of Mamudu (2016), he found that when household size increases the probability of the household saying yes to willingness to pay for water tariff is also high.

Household Heads' Income Level (HHINCL)

The coefficient of income level as presented in Table 2.1 is significant at 1% and this implies that for every 1 unit increase in households' income level, willingness to pay for water tariff also increases by 3.944736. The income variable has a positive influence on willingness to pay. According to economic theory, the level of consumption of an individual depends largely on his level of current income as propounded by John Maynard Keynes, the absolute income hypothesis. He stated that, the current real income is the most important determinant

of consumption in the short run. This result also confirms with another economic theory, Income Effect Theory of Consumer Choice, which states that an individual/household demand for a particular commodity depends on his/her income, and that income is positively related, except in the case of inferior goods (Bayrou, 2002). Therefore, an increase in respondents' income will increase the likelihood of paying for water supply services. This agreed with Ayanshola et al. (2013), in a research in Ilorin that household income level have significant impact on willingness to pay (WTP) at 5% level of significance. Ifabiyi (2011) also reported that household income is the best predictor of willingness to pay in Ilorin with 83%.

Household Awareness of Water Supply Deficiency (HHAWSD)

Table 2.1 indicated that coefficient for households' awareness of water supply deficiency is statistically significant at 5% and negatively influenced household willingness to pay for water services. The result implies that the respondents are relatively less satisfied with the existing water services, but they are still willingness to pay for the service with the hope that the service will be improved. This is in support to the study conducted by Rananga *et al* (2015), showed that respondents were dissatisfied with the unreliable water services (89.9%) but they are willing to pay for secure reliable water services (95.5%).

Time of Water Availability (TWA)

The coefficient availability of water (in terms of the number of hours water is available per week received) is statistically significant at 5% level and showed a negative relationship with household's willingness to pay for water tariff. This implies that the household, though, willing to pay water tariff are relatively less satisfied with the existing time of water availability. This is in support to the research conducted by Omonona *et al* (2011).

Perception of respondents on the Amount Paid for Water Supply (PAPWS)

The coefficient of the perception of household on the amount paid for water supply is statistically significant at 5% and it's showed a positive relationship. The result implies that households are satisfied with the amount paid for water supply and they are willing to pay for it. This is also in line with the finding by Omonona *et al* (2011), revealed that household public water consumers are satisfied with the water delivery service level and tariff at price that deem to be value for money.

Perception of respondents on the need to Improve Water Supply (PIWS)

The results in Table 2.1 showed the coefficient of perception of respondents on the need to improve water supply is and statistically significant at 5%. The value indicated that respondents have positive perception on the need to improve water supply system in the study area. This implies that despite challenges in the delivery of adequate portable water, household are still willing to pay the water pricing tariff. This is in line with Bayrou (2002) research work, the result revealed that the mean willingness to pay for improved water service is higher than the existing tariff. The affordability analyses result also indicated that consumers are willing to pay if they are provided the improved water service at a price equal to the average incremental cost of providing the improved water supply service.

Probit regression analysis revealed that education and household size were significant at 1% and positively influenced willingness to pay for water tariff while age, income level, perception of respondents on the amount paid for water supply and perception of respondents on the need to improve water supply exert positive influence on willingness to pay but significant at 5%. This implies that a unit increase in the coefficient of these variables would increase the possibility of households' willingness to pay for water tariff in the study area. On the contrary, the result revealed that time of water availability (at 1%) and household awareness of water problems (at 5%) were significant but negatively relate to willingness to pay.

Descriptive statistic results showed factors determining water tariff in the study area were full-cost recovery, affordability, fairness, and economic efficiency. Two out of four factors are positive in explaining factors determining water tariff in the study area which are fairness of water tariff and affordability of water tariff.

2.4 CONCLUSION

The study examined water pricing policy in selected areas of Maiduguri Borno State, Nigeira. The study concluded that male dominated the household heads and staff/officials of Borno state water corporation and most of them were married. The respondents attended higher institutions and were in their active age. The result of the study revealed that majority (56%) of respondents sourced their water from Borno state water corporation (surface water). The study revealed that Domestic Water Flat rate was the only adopted water pricing policy by the Borno state water corporation because it uniformly charged household a very low water rate or tariff that is affordable by all based on a single connection from the public water to suit social and political situation of the study area.

The study established that some socio-economic characteristics of respondents captured in the probit regression influenced their willingness to pay for water tariff. Based on the assessment of water officials (water provider), the two most important determinant of water tariff are full-cost recovery of water tariff and economic efficiency are statistically insignificant in explaining water tariff. This is because the water tariff does not cover operation and maintenance costs let alone capital charges. The studies therefore conclude that the pricing policy is not effective in water demand management.

2.5 RECOMMENDATIONS

In the light of the above findings, the following recommendations are made:

1. The variables and socio-economic characteristic identified influencing residential or household heads willingness to pay for water should be considered when planning water supply. Also, other studies on agricultural, industrial and commercial water demand should be done to estimate the total per capita water demand of Maiduguri

REFERENCES

1. Abaje, I.B., Ati, O.F., & Ishaya S., (2009). Nature of Potable Water Supply and Demand in Jema'a Local Government Area of Kaduna State, Nigeria. *Journal of Environmental and Earth Sciences* 1(1): 16-21, 2009. ISSN: 2041-0492.
2. Abba, K., (2010). Water Vendors "MOYA" in Maiduguri Metropolitan Area. *Journal of Management and Social Sciences*, University of Maiduguri, Borno State. Pp. 2 – 7.
3. Adamu, I. M., (1993). Causes of water shortage in Maiduguri Metropolis: A Case Study of Mairi Village Research Work Submitted to the Department of Civil and Water Resources Engineering, University of Maiduguri. Pp: 35 - 61.
4. Aho M. I., Akpen G. D., & Ivue P., (2016). Determinants of Residential Per Capita Water Demand of Makurdi Metropolis, Nigerian Journal of Technology (NIJOTECH) Vol. 35, No. 2, April 2016, pp. 424 – 431
5. Ajibola, M. A., (2013). Evaluating Service Delivery Performance of Water Utilities in Kaduna State Water Board, Nigeria. A Dissertation in Partial Fulfillment for the Award of Doctor of Philosophy in Department of Water Resources and Environmental Engineering Submitted to the School of Postgraduate Studies, Ahmadu Bello University, Zaria, Nigeria. Pp: 15-36.

6. Ayanshola, A.M., Sule, B.F., & Salami, A.W., (2013). Evaluation of Willingness to Pay for Reliable and Sustainable Household Water use in Ilorin, Nigeria
<http://dx.doi.org/10.4314/ejesm.v6i6.6s> *Ethiopian Journal of Environmental Studies and Management* Vol. 6 Supplement 2013 Pp:9-18.
7. Bayrou, A., (2002). Analyses of Affordability and Determinants of Willingness to Pay for Improved Water Service in Urban Areas, Strategy for Cost Recovery: Case Study of Nazareth Town, Ethiopia. Faculty of Business and Economics, School of Graduate Studies, Addis Ababa University. Pp: 339-361.
8. Bithas, K., & Stoforos, C. (2006). Estimating Urban Residential Water Demand Determinants and Forecasting Water Demand for Athens Metropolitan Area, 2000-2010. Pp: 3 - 6.
9. Boland, J. & Dale, W., (1997). The Political Economy of Water Tariff Design in Developing Countries in Ariel Dinai (ed.) *The Political Economy of Water Pricing Reforms*. Oxford University Press. New York Pp.215 – 236. Borno State Diary (2011). Borno State Government Printing Press Maiduguri. Pp. 1 – 4.
10. Borno State Government (BSG), (2007). In Tijjani, B.A., Abubakar, M., Benisheik, K.M., & Mustapha, A.B. (2010). Resource use efficacy in rice production in Jere Local Government Area of Borno State, Nigeria. *Journal of Basic and Applied Science* (2010), 18(1):27-34
11. Borno State Ministry of Water Resources (BSMWR) (2015). Report Extract on the Activities Performance of the Ministry. Pp: 3 - 25.
12. Briscoe, J., (1997). Managing Water as an Economic Good in M. Kay, T. Franks and L. Smith (eds.), *Water: Economics of Management and Demand*. London, Pp: 339-361.
13. Borno State Ministry of Water Resources (BSMWR) (2015). Handling over Notes by the Honorable Commissioner (officer handing over duties) i.e Mustapha Hassan Aminami to new officer taking over duties i.e Dr. Zainab Gimba. Pp: 16-32.
14. Borno State Ministry of Water Resources (BSMWR) (2015). Filed Survey on Households effective and non – effective water connections. CBDA (2015). Chad Basin Development Authority Annual Report 2015. Pp: 39-75.
15. Cameron A., Colin & Pravin K., Trivedi (2005). *Micro-econometrics: Method and Applications*, Cambridge University Press. Chapter 14
16. Chineke H. N., Emereole C. O., & Adogu P. U., (2014). The Socio-economic Status of Households, Sources of Water Supply and Associated Water related diseases of Communities in Ngaba Local Government Area of Imo State. *Nigerian Journal of General Practice*. Vol. 12.

17. Choe K., Whittington K. & Lauria D. (1995). "Household Demand for Surface Water Quality Improvement in the Philippines: A Case Study of Davaco City." The Environment World Bank, Washington D.C.
18. Coster, A.S., & Otufale, G. A.,(2014). Households' Water-Use Demand and Willingness to Pay for Improved Water Services in Ijebu Ode Local Government Area, Ogun State, Nigeria Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria. *Journal of Environment and Earth Science*, www.iiste.org ISSN 2225-0948 Vol.4, No.17.
19. Deborah Bitrus Juryilla (2012). The Determinants of Household Water Consumption in Plateaus state: A case study of Jos Metropolis. A thesis submitted to the School of Postgraduate Studies Ahmadu Bello University Zaria, Nigeria.
20. Dessalegn, C., (2012), factors determining residential water demand in north western Ethiopia. The Case of Merawi Cornell University Master's Thesis
21. Douglass, N., (1993). The Role of Institutions. London Press, U.K. (ERSA)
22. Egwakhide, C. I., & Nyor T., (2012). Effectiveness of Pricing Policy in Nigerian Public Sector
23. Enterprises: A Theoretic Approach. Department of Economics and Management sciences, Nigerian Defence Academy Kaduna, Nigeria. *International Journal of Business and Social Sciences*, Vol. 3 No. 8.
24. Griffin, G., (2008). Water Resources Economics: The Analysis of Scarcity Policies and projects. MIT Press, Cambridge, Massachusetts
25. Hafsatisa, M., (2009). Analysis of effective water supply in Maiduguri. Effective water supply in Maiduguri Metropolis. A Research Work Submitted to the Department of Civil and Water Resources Engineering, University of Maiduguri.
26. Hikma, A., (2012). Determinants of Household Water Demand: A Case Study of Makelle- Ethiopia.
27. Ibrahim, M., (2009). Simple Regression Analysis on Water Supply and Demand: A Case Study of Maiduguri Metropolitan Council. Research Project Submitted to the Department of Civil and Water Resources University of Maiduguri.
28. Ifabiyi, I. P., (2011). Willingness to Pay for Water at Household Level in Ilorin, University of Ilorin, Kwara State, Nigeria. *Global Journal of Human Social Sciences*, Volume 11 Issue 2 Version March 2011, Type: Double Blind Peer Reviewed International Research Journal, ISSN: 0975-587 (USA).
29. Jhingan, M.L., (2003). Advance Economic theory (micro and macro-economic). Vrinda Publications Limited, India.
30. Johnson, A. O., (2003). Issues and Implications of Water Pricing in Urban Nigeria, towards the Millennium Development Goals, 29th WEDC *International Conference Abuja*. Vol.3, No.12

31. Kaika, M. (2003). The Water Framework Directive: A New Directive for a Changing Social, Political and Economic European Framework. *European Planning Studies* 11 (3). Pp: 5 - 12
32. Kim, L. (1998). Willingness to Pay for Water at the Household Level: Individual Financial Responsibility for Water Consumption, MEWEREW Occasional paper No. 26, Water Issues Study Group. School of Oriental and African Studies (SOAS) University of London.
33. Krejcie, R.V., & Morgan, D., (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, Vol.3 pp: 607-619.
34. Laudia T. O., Wasiu A. S., & Ayinde A. E., (2004). Determinants of rural household willingness to pay for safe water in Kwara State, Nigeria. *Aquaculture, Aquarium, Conservation and Legislation International Journal of the Bioflux Society*.
35. Lauger, L. (1982). Tariff structures in water supply, WHO, ETS/8,. 2.
36. Lin C., Nicholas P., & Bethany C., (2015). *Water Pricing in Australia: Unbundled Politics, Accounting and Water Pricing*. Centre for Water Policy and Management, La Trobe University, Australia. Springer International Switzerland.
37. Lipsey, R. & Chrystal A. (2010). *Economics Twentieth Edition*. United Kingdom: Oxford university press.
38. Mamudu, A. (2016). Analysis of the Determinants of Willingness to Pay for Improved Portable Water Supply in Kano Metropolis. Department of Economics, Faculty of Social Sciences, Ahmadu Bello University Zaria. Nigeria
39. Ma'ruf, S. (2005). Prospects and Implication of Commercializing Urban Water Supply. Ph.D Thesis, Department of Urban and Regional Planning. Faculty of Environmental Design, Ahmadu Bello University, Zaria.
40. National Population Commission (NPC) (2006). *Official Census Gazette*. Federal Republic of Nigeria. The Federal Government Printer, Lagos.
41. Omonona, B. T., & Fajimi, F. O., (2011). Households Willingness to Pay for Improved Water Supply Services in Ibadan Metropolis of Oyo State, Nigeria. Department of Agricultural Economics, University of Ibadan, Ibadan, Nigeria. *New York Science Journal*, 2011;4(4)
42. Rabi, P.K., & Nebin, L.S. (2010). Housing and Household Characteristic and Family Structure.
43. Raheem, A.A. (2006). Food Safety Label Analysis among Salt Consumers in Oluyole Local Government Area in Ibadan. Department of Agric-Economics, University of Ibadan, Ibadan.
44. Rananga, H. T., & Gumbo, J. R. (2015). Willingness to Pay for Water Services in Two Communities of Mutale Local Municipality, South Africa: A Case Study. Department of Hydrology and Water Resources, University of Venda, South Africa. 49(3): 231-243.

45. Renwick, M. & Archibald, S. (1998). Demand Side Management Policies for Residential Water Use: Who Bears the Conservation Burden? *Land Economics* 74(3).
46. Shao, L. (2000). Water pricing towards sustainability of Water Resources: A Case Study In Beijing Master's Thesis, Lund University Master's Programme in Environmental Science, Sweden
47. Shella, L. (2007). Managing Water Demand Price Vs Non-Price Programmes. *A Pioneer Institute White Paper No. 39*.
48. Sidrat, A., & Heman, D. L., (2014). Households' Willingness to Pay for Improved Tap Water Services in Karachi, Pakistan.
49. Simona, F. (2012). Issues on the Role of Efficient Water Pricing for Sustainable Water Management. Institute of National Economy Romanian Academy.
50. Tamkinat, R., and Wassif, M., (2008), Price Setting for Residential Water: Estimation of Water Demand in Lahore. *Pakistan Development Review*.
51. Ubangida, S., (2012). Effectiveness of Pricing Policy in Households' Water Demand Management in Kaduna State: A Case Study of Sabon Gari Local Government Area. A Master Degree (M.Sc) Thesis Submitted to the Department of Economics, Ahmadu Bello University Zaria, Kaduna State Nigeria. Pp: 33-49.
52. United Nations High Commission for Refugee (2017). Multi-Sector Market Assessment: Charcoal, water, low-income rental housing and core-relief items in Maiduguri, Jere and Konduga, Borno State, Nigeria. Published by European Union Humanitarian Aid, October.
53. United Nations Environment Program (UNEP)(2000). *Global Environmental Outlook 2000*. Nairobi. UNEP.
54. Wang M. (2010). Water pricing with household surveys: A study of acceptability and Willingness to Pay in Chongqing, China. *Economic Review* 21 (2010) 136–149. China
55. Yahaya, Y. I. (1998). Assessment of Water Supply in Maiduguri Metropolis. A Research Work Submitted to the Department of Civil and Water Resources Engineering, University of Maiduguri. Pp: 39-47.