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Households' Willingness to Pay for Improved Solid Waste Management in Uyo Metropolis, Akwa Ibom State, Nigeria

Ini-mfon Vincent Patrick[1], Ubokudom Etim Okon[1], Ubong Udo Solomon[2,*]

[1]Department of Agricultural Economics and Extension Akwa Ibom State University, Obio Akpa Campus, P.M.B. 1167, Uyo, Akwa Ibom State, Nigeria
[2]Robert W. Plaster Graduate School of Business, Williamsburg, KY, USA
*Corresponding author: usolomon@3795@ucumberlands.edu

Abstract Municipal solid waste if not properly disposed could cause pollution to the environment or even harm to human health. This study examined household's willingness to pay for improved solid waste management in Uyo metropolis, Akwa Ibom State. Primary data were randomly collected from 160 respondents' households and analyzed using descriptive statistics and Tobit regression model. The results show that the mean household monthly expenditure was ₦ 52, 173 ($ 144.93), and they were willing to pay ₦ 618.28 ($ 1.72) monthly for an improved solid waste management. Also, some variables including number of years of formal schooling, household's monthly expenditure and awareness of negative health implications of indiscriminate waste disposal, had positive and significant influenced on willingness to pay (WTP) for improved solid waste management, while age had negative and significant influence on WTP. Incorporating these findings and adoption of house to house collection of solid waste with a monthly service charge is recommended for efficient solid waste management in the study area.

Keywords: *household, solid waste management, urbanization, willingness to pay, Tobit*

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1. Introduction

The last two decades have witnessed a rapid increase in the volume and complexity of solid waste generated in large cities of the developing economies. This could be attributed to rapid increase in urban population, rising standard of living and/or heavy consumption pattern among urban dwellers, construction boom and poor environmental management policies [1]. According to United Nation Habitat, cities in developing countries will absorb ninety five percent of urban growth in the next two decades [2]. However, urbanization rate in Africa will be growing 1.8 times faster than the global population between 2015 and 2020. Consequently, managing the urban waste, especially in developing countries is a big challenge.

The term solid waste management is generally used to describe non-liquid materials arising from various consumption and production activities of people. Similarly, Municipal solid waste management (MSWM) could be referred to the collection, transfer, treatment, recycling, resources recovery and disposal of solid waste in urban areas. The goals of municipal solid waste management are to promote the quality of the urban environment, generate employment and income, and protect environmental health and support the efficiency and productivity of the economy. A report from United Nations Environmental Protection Agency [3] suggest that the quantity and type of waste generated in a city depends upon its functions, the economic status of its residents as well as the level of technological development. Also, the composition and volumes of waste generated differ between low and high-income locations. As cities continue to develop, substantial quantities of solid waste are also generated, this could continue in such a way that the volume of solid waste being generated increases at a faster rate than the ability of the agencies to improve on the financial and technical resources needed to parallel this growth. Ogwueleka [4] observed that solid waste is wetter, heavier and more corrosive in developing nations, making its management a major concern.

In Nigeria, solid waste management is characterized by inefficient collection methods, insufficient coverage of the collection system as well as improper disposal of solid waste [4]. In collaboration, Bakare [5] noted that Nigeria generates more than 32 million tons of solid waste annually, out of which only 20-30% is collected, most of which could not be disposed properly. Despite a host of policies and regulations, solid waste management in the country is assuming alarming proportions with each passing day. Reckless disposal of solid waste in urban centers could lead to blockage of drainage networks, and choking of water bodies. Also, improper collection and disposal of municipal wastes could cause serious health and environmental damage [6]. This necessitates the improvement of current waste management system in

the city, as inefficient waste management system could constitute a serious health hazard.

Uyo, the capital of Akwa Ibom State (one of the oil producing States in the country), has experienced a great influx of people from rural areas and investors accompanied by a high demand for both residential and commercial accommodation. These have resulted in urban environmental problems of which the management of solid waste is clearly the most serious. Many areas of the city have become health risk owing to the accumulation of solid waste. A close examination of municipal solid waste management in many developing cities including Nigeria shows that the present strategies are deficient and need to be re-addressed. The rate of solid waste collection and evacuation perpetually lag behind the rate of generation. One fundamental issue is the delayed collection of solid waste from waste bins. In some cases, the wastes are not collected until after a week or two, consequently, the waste bin overflows and litters the surroundings. This makes solid waste accumulation a major source of environmental nuisance. However, efficient waste management is vital for health and improvement of the well being of human beings. If the ongoing waste management by municipality does not continuously offer efficient waste collection and disposal facility, concerned and private individuals might interfere.

One way to achieve efficiency in waste management could be to adopt the house- to- house collection method, in which the authorities collect solid waste from residents on specified days of the week. The foregoing raises the following questions to be answered by this investigation. Are residents of Uyo metropolis, willing to pay for house - to - house collection of solid waste in order to increase efficiency, regularity and improved waste collection and disposal system? This study aimed to investigate domestic waste management practices in Uyo metropolis, Nigeria, with a view to determining the socio-economic characteristics that influence household's willingness to pay for house to house collection of municipal solid waste.

2. Materials and Methods

2.1. Study Area

The study was conducted in Akwa Ibom State in Nigeria, with a population of about 3,920,208 million [7] The State is a major oil-producing area and is located in the South-South geo-political zone of the country, lying between latitudes 4°32' and 5°33' N and longitude 7°25' and 8°25' E. It shares its southern boundary with the Atlantic Ocean. The State capital has experience great influx of people and/ or investors from within and outside the country. The State has a very rich potential for agriculture, and is suitable for food and tree crops, fish and livestock farming. Crops widely grown in the area are leafy vegetables such as waterleaf, fluted pumpkin and garden egg. Others include cassava, maize, yam, pepper, plantain, garden egg and cucumber.

2.2. Sampling Techniques/Data Collection

This study adopted simple random sampling technique in selecting of respondents from the four clans in Uyo metropolis, namely Offot, Oku, Ikono and Ifa clans. Through the assistance of the Uyo Capital City Development Authority (UCCDA), a list of households in each clan was obtained, from which 40 households were then randomly selected, from each clan to make a total of 160 households for the study. Data for the study were obtained mainly from primary sources using a structured questionnaire. The data focused on the following: Socio-economic characteristics of the household heads such as gender, age, educational status, marital status, household size, monthly household expenditure (a proxy for income), as well as house ownership status. In addition, awareness of the negative health implication of indiscriminate waste disposal system and the period or length of time in which each household spent in the environment were also considered.

2.3. Data Analysis

The data collected was analyzed using descriptive statistics such as mean, and standard deviation and inferential statistics such a tobit regression model. In determining the socio-economic factors influencing the respondents' willingness to pay (WTP) for improved solid waste management the maximum likelihood Tobit regression model was used. The Ordinary Least Square (OLS) would be inefficient and inconsistent as it does not tolerate the present of zeros in its error term.

Table 1. The description measurement and *a priori* expectation of the variables used in the Tobit regression model

Variable	Description	Measurement	a priori expectation
GEND (X1)	Gender of the respondents	Dummy: 1 if male; 0 if otherwise	+/-
AGE (X2)	Age of respondents	Years	+/-
MSTAT (X3)	Marital status	Dummy: 1 if couple; 0 otherwise	+/-
EDUC (X4)	Number of years spent in formal schooling	Years	+
LENGSTAY (X5)	Number of years spent in the environment	Years	+/-
EXPEND (X6)	Monthly household expenditure (proxy for income)	Naira	+
HOWNSTAT (X7)	House ownership status (weather respondent as a tenant or landlord)	Dummy: 1 is he/she is the landlord; 0 otherwise	+/-
HEALTHAWARE (X8)	Awareness of the health implication of indiscriminate waste disposal system	Dummy: 1 if aware; 0 otherwise	+/-
HHSIZE (X9)	Number of persons living in the household	Number	+/-

Source: field survey, 2016.

The Tobit model is specified thus:

$$Y^* = \beta^1 X + \varepsilon$$

$$Y = \begin{cases} 0, \& \ Y^* \le 0, Y^* < T \\ 1, Y^* > 0, Y^* \ge T \\ Y = Y^*, otherwise \end{cases} \quad (1)$$

$$Z^* = \alpha 1 V + u$$

$$Z = \begin{cases} 1, Z^* > 0 \\ Z, Z^* \le 0 \end{cases}. \quad (2)$$

Where Y is a vector of WTP that is censored at 0;T is the offered start price; X is matrix of explanatory variables that are hypothesized to influence WTP; Z is a vector of a dummy variable which is 1 when a respondent is willing to pay and 0 otherwise; is a matrix of explanatory variables that may influence the probability that a respondent is willing to pay; α and β are vectors of unknown parameters to be estimated corresponding to the matrix of explanatory variables V and X, respectively; ε and u are error terms that could be correlated with correlation coefficient P; and Y* and Z* are unobserved or latent variables corresponding to Y and Z, respectively. Y values are observed when z equals 1.

3. Results and Discussion

Table 2 shows that the mean educational level was about 11 years. Household head's educational level may determine the household level of income as well as their willingness to pay for improved solid waste management services. About 91% of the respondents were married, with majority (92%) of the households headed by men. Most (59%) of the respondents were tenants, while about 41% of them were landlords. Majority (68%) of the respondents were aged 50 years and below, with a mean age of about 47 years. This implies that they were in their economically active and productive age. The mean household size in the area was approximately 8 persons. Thus, a typical urban household in the area is large, which could indicate greater volume of waste generation. Larger household size could generate more solid waste especially when there are more adults in the household. Also, majority (62.5%) of the respondents were aware of the negative health implications of indiscriminate waste disposal, while 37.5% of them were not aware. The mean household monthly expenditure (a proxy for income) was ₦ 52, 173, suggesting that majority of the respondents had monthly income greater than the national minimum wage of ₦ 18,000 in the country. However, a cursory look at Table 2 shows that on the average, the respondents spent 8 years in their environment, an indication that they are familiar with the waste management problems in the area.

Socio-economic characteristics influencing household's willingness to pay for solid waste management in Uyo metropolis, Akwa Ibom State, Nigeria

Table 2. Socio-economic characteristics of the respondents

Variables		Frequency	Percentage
Education			
	Primary	17	10.62
	Secondary	44	27.5
	OND	38	23.75
	B.Sc.	51	31.88
	Postgraduate	10	6.25
	Total	**160**	**100**
Gender			
	Male	148	92.50
	Female	12	7.50
	Total	**160**	**100**
Marital status			
	Couple	145	90.63
	Single	15	9.37
	Total	**160**	**100**
House ownership Status			
	Tenant	94	58.75
	Landlord	66	41.25
	Total	**160**	**100**
Age			
	≤ 40	43	26.88
	41-50	66	41.25
	51-60	34	21.25
	Above 60	17	10.62
	Total	**160**	**100 mean = 47.36**
Household size			
	1-5	38	23.75
	6-10	103	64.38
	Above 10	19	11.87
	Total	**160**	**100 mean = 7.55**
Awareness of Health			
	Not aware	60	37.50
	Aware	100	62.50
	Total	**160**	**100**
Monthly expenditure			
	≤ 30,000	30	18.75
	30,001 -60,000	82	51.25
	60,001 -90,000	37	23.12
	90,001 -120,000	8	5
	Above 120,000	3	1.88
	Total	**160**	**100 mean = ₦ 52,173**
Length of Stay in the environment			
	≤ 5 years	66	41.25
	6-10	55	34.38
	11- 15	28	17.5
	16-20	6	3.75
	Above 20	5	3.12
	Total	**160**	**100 Mean = 8 years**
Bid			
	0	79	49.38
	500	22	13.75
	1000	29	18.13
	1500	11	6.88
	2000	11	6.88
	2500	7	4.38
	3000	1	0.63
	Total	**160**	**100**

Source: field survey, 2016.

Table 3. Censored Regression analysis on the Determinants of willingness to pay for solid waste management in Uyo metropolis

Explanatory Variables	Coefficient/ Std. errors	Z- values	Marginal effects (dy/dx)
Intercepts	-1529.763 (600.3554)	-2.55**	
Gender (X1)	9.6840 (282.029)	0.03	9.6839 (282.03)
Age (X2)	-19.1186 (8.8822)	-2.15**	-19.1186 (8.8822)
Marital Status (X3)	37.3594 (287.3371)	0.13	37.3594 (287.34)
Education (X4)	89.6603 (25.5122)	3.51***	89.6603 (25.512)
Length of Stay (X5)	-16.6517 (13.8735)	-1.20	16.6517 (13.874)
Expenditure (X6)	0.0249 (0.0038)	6.59***	0.0249 (0.0038)
Tenancy/ Housing arrangement (X7)	-172.9978 (167.8945)	-1.03	-172.9978 (167.89)
Health awareness (X8)	640.4932 (202.756)	3.16***	640.4939 (202.76)
Household Size (X9)	14.1692 (31.7176)	0.45	14.1692 (31.718)
Prob > Chi^2 = 0.000 Log likelihood ratio = -701.5819 LR Chi^2 = 107.68 Pseudo R^2 = 0.0713 Sigma = 843.1983 (71.9844) Number of observations = 160 *** = Significant at 1 % level of Probability ** = Significant at 5 % level of Probability (a) dy/dx is for discrete change of dummy variable from 0 to 1			

Source: field survey, 2016.

Results of the maximum likelihood Tobit regression model as presented in Table 3 shows that four out of nine variables were statistically significant. The probability chi square (0.000) shows the overall significance of the model at the one percent level. Also, a log likelihood ratio of -701.582 is an indication that the model specified model fit the data better. The pseudo R^2 of 0.0713 is not surprising, given that the conventional measure of goodness of fit of it is not particularly meaningful in binary regressed models [8].

The variable age, had a negative and statistically significant ($p<0.05$) coefficient. This could mean that elderly household heads were not willing to pay for improved solid waste management in the area. The implication is that younger household heads have higher interest in living in a better environment than their older counterparts. This finding gives a good indication of a sustainable and improved waste management demand; as younger household heads may have more years to stay in the environment, hence, increasing their willingness to pay. This result is in line with the findings of [9] who opined that older persons may consider waste collection as government responsibility, hence, not willing to pay. However, the result contradicts the findings of [10]

The coefficient of educational level was positive and statistically significant ($p<0.01$), suggesting that highly educated household heads had higher willingness to pay for improved solid waste management services. This is true because education is believed to increase individuals' ability to obtain, analyze and assimilate information that helps to make prudent decisions related to management of their environment. In this instance, educated people will have better understanding of the negative health implications of indiscriminate waste disposal, hence willing to pay for improved solid waste management services. This result lends credence to the findings of [10,11,12,13]. The coefficient of expenditure (a proxy for total household monthly income) was positive and statistically significant ($p<0.01$). This implies that willingness to pay increases with increase in household income *ceteris paribus*. A plausible explanation to this result is that when households' income increases, the expenditure of the household will also increase. So there is a positive relationship between household income and demand for improved solid waste management services, suggesting that household with more income will more likely have higher willingness to pay for improved solid waste management. This result is in line with that of [13].

The variable, awareness of health implication of indiscriminate solid waste management services was positive and statistically significant ($p<0.01$). This could mean that being aware of the negative health implication of indiscriminate waste disposal system increased the likelihood of a household willing to pay for improved solid waste management services.

4. Conclusion

The factors influencing households' willingness to pay for improved waste management services were identified using Tobit regression model. The results showed that majority (92%) of the respondents were male, married (91%) and have spent an average of 11years in formal schooling. About 58% of the respondents were tenants, with a mean age and household size of 47 years, and 8 persons, respectively. The mean household monthly expenditure was ₦ 52, 173 ($ 144.93), and they were willing to pay ₦ 618.28 ($ 1.72) monthly for an improved solid waste management. Age of the household heads, level of education, total monthly expenditure of household, and awareness of the health implication of indiscriminate waste disposal system were found to significantly influence the likelihood of the respondents' willingness to pay for improved waste management services in Uyo metropolis.

The results and conclusions drawn from this study will contribute to the body of knowledge available to policy makers for determining the socially optimal charges for solid waste services in Uyo and the southern region of Nigeria. It will also give policy makers a baseline when negotiating a fair rate of return for waste management contractors servicing the Uyo area and its surroundings. Also, enlightenment campaigns on the need to maintain a clean and safe environment is recommended. Investment in social education such as this will boost awareness and increase the percentage of people willing to pay (WTP) for improved solid waste management. Future research focusing on conversion of urban waste to organic fertilizers will be highly appreciated.

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