

Household Willingness to Pay for Improved Solid Waste Management in Akinyele Local Government Area

Olojede Mary Adeoye Adelayo

Department of Agricultural Technology, Oyo State College of Agriculture, Igboora

*maryoluyinka@yahoo.com, adelayooyeh@yahoo.com

Abstract

Solid waste management is important in our society because it has direct effect on households' health and society at large and the dangers that are associated with dirty environment are very serious. Solid waste problem is perhaps the most important environmental difficulty being faced with in Ibadan area, both from the generation and management points of view. Therefore, the study examines household willingness to pay for improved solid waste management in Akinyele Local Government Area. Data were collected from random selection of one hundred and twenty households with the aid of a well structured questionnaire. These data were analyzed using descriptive statistics and logit regression model. The study revealed that the average age of household heads in the study is 38.7 years and that 59.2 percent and 40.8 percent of the household respondents were female and male respectively. 51.7 percent were engaged in monthly paid job while the rest 48.3 percent were engaged in informal employment like artisan, trading and other daily earning jobs. The mean household size is 4.64. 53.3 percent of the respondents have tertiary education, 20 percent have secondary education, and 13.3 percent have primary education while only 5.8 percent have no formal education. Four methods of household's solid waste collection with different price levels were used to determine households' willingness to pay in the study area; these are; low cost system – ₦500 (Communal container), low cost system – ₦700 (Vehicle in the neighborhood), medium cost system – ₦900 (Communal container with a door to door collection), higher cost system – ₦1000 (Only door to door collection). The mean willingness to pay of households for the improved service is ₦686.07. The multivariate binary logistic regression revealed that the households' willingness to pay was increased as price of the service decreased, reduced as age of the respondents increased, increased as level of education increased and reduced as household size increased. It was recommended that households should thereby attach a great value to their environment and demand and pay for whatever improved service introduced to them that will make their environment clean because environmental quality will greatly influence their general wellbeing and benefit them.

Keywords : Solid waste management, Willingness to pay, Environment, Logit Regression Model.

1. Introduction

Anthropogenic activities have always imposed threats to the environment. Among the most evident products of human activities are wastes. Daily global generation of municipal solid waste in 2006 was reported as 2.02 billion tonnes (UNEP, 2009). The rapid increase of waste generation has exceeded the earth's carrying capacity by 30% in catering the pollution intensity (Odum and Odum, 2006). As a consequence, the environment undergoes degradation as reported in various parts of the world, particularly in developing and under-developed countries (Rahji and Olorunfoba, 2009; Ngoc and Schnitzer, 2009). Since waste materials become more and more complex with the advancement in technology and human civilization, the environment needs to deal with chemical wastes, hazardous wastes, electronic-waste and many more.

Therefore, this calls for an urgent need for an appropriate waste management system. Apt waste management system is essential in order to cater for the vast transformations of human civilization, as well as, developing the environment in the most sustainable approach (Odum and Odum, 2006). Sustainable development becomes the target of modern society where economic progress is in tandem with environmental preservation. In order not to jeopardize the environment, various technologies approaches have been introduced. The necessity of proper mechanism in managing waste becomes more crucial in urban areas where dense population results in more complex composition and rapid waste generation.

In many developing countries, due to lack of appropriate planning, inadequate governance, resource constraint and ineffective management, solid waste is a major source of concern. According to UNEP (2004), solid waste generation has become an increasing environmental and public health problem everywhere in the world, particularly in developing countries. The fast expansion of urban agricultural and industrial activities stimulated by rapid population growth has produced vast amounts of solid and liquid wastes that pollute the environment and destroy resources. The changing economic trends and rapid urbanization also complicate solid waste management (SWM) in developing countries. Consequently, solid waste is not only increasing in quantity but also changing in composition from less organic to more paper, packing wastes, plastics, glass, metal wastes among other types, a fact leading to the low collection rates (Bartone & Bernstein, 1993).

In order to cope with these challenges and due to its crucial role for public health and protecting the environment, accomplishing effective municipal solid waste management should be a priority for emerging cities. However, in the past most attempts to improve solid waste management in cities have focused on the technical aspects of the different means of collection and disposal (World Bank, 1992). It is recently that more attention has been paid to enhancing institutional arrangements for solid waste service delivery, with a special emphasis on privatization.

In most countries of the world, especially developing and transition countries and European social democracies, the management of waste has been considered to be the responsibility of the government, financed by general revenues. In Nigeria, the problem of solid waste management (SWM) has been a concern which has existed for long in Lagos metropolis and in other big Nigerian cities (Ojeshina and Longe, 1996, Ayotomuno and Gobo, 2004). The management of solid waste is today one of the important obligatory functions of the Local Government Areas (LGAs) in the entire country. However, this very important service had in the past gulped a lot of money out of the local authorities, that the state governments' intervention became necessary. The reason being that, the Local Government Areas were not properly, technically and financially equipped to perform this statutory function well. Apart from the problem of lack of financial resources, weak institutional and legal framework, others are inappropriate choice of technology, inadequate collection and transportation systems as well as unsafe final disposal options. The public confidence on the ability of the LGAs to play this statutory role diminished in the face of mounting heaps of refuse on major roads and highways. This is not without the ensuing environmental pollution that made the entire system unsatisfactory (Ojeshina and Longe, 1996; Longe and Kehinde, 2005).

Even though the fundamental objective of any solid waste management programme is to minimize environmental pollution, this goal become unachievable in the absence of sustained funding, affordable local technological option and lack of participatory approach to integrated solid waste management. Willingness to pay for waste management services or facilities is very important to the success of the private sectors' participation (PSP) in (SWM) program. The willingness to or not to pay of households could have direct impact (positive or negative) on the reliability and success of any solid waste management strategy (Rahman *et al.*, 2005).

1.1 Objectives of the Study

The major objective of this study is to analyze the willingness to pay for improved solid waste management of households in Akinyele local government area. The specific objectives of this study are to determine their mean WTP for improved solid waste management and examine the determinants of households' willingness to pay for improved solid waste management service.

Solid waste management has always been evaluated based on the role and performance of the service provider, the supply side, with little or no attention is given to the demand side. This in turn, has put limit to the achievement of the improved municipal solid waste management in the city. The involvement of the service recipients or clients especially households who are the primary producers/generators of significant proportion of solid waste and perhaps main victim of the effect of uncollected solid waste, should be allowed to determine their outlet or providers and participate in making of sound policy decisions including designing of effective joint solutions of solid waste management. This would help the service providers, i.e., the municipality, to understand households' willingness to participate and pay, hence, the need for this research. Therefore, this study is different with the fact that it addresses the demand side aspect of solid waste management. The key questions here are whether or not the households are willing to pay for the improved solid waste management services and how much if it is to be delivered particularly to residential area. And whatever the responses of households are, what determines the response and how do we address the factors that determine the success of the improved municipal solid waste management.

The study will analyze the willingness to pay of household for improved solid waste with use of a qualitative choice model (logit model). Although there have been studies on this but not in Akinyele local government using the four collection methods used and only few used Logit model. Also, such willingness to pay study would help in finding out sustainable means of funding for solid waste management service in areas that are yet to be benefiting from the service but are still engaged in burning of refuse and piling of heaps of refuse at the back of their houses and strategic places on the streets.

2. Material and Methods

Ibadan is the largest indigenous city in West Africa and is located in the South Western part of Oyo State of Nigeria. It is Nigeria's second-largest urban agglomeration with the population of about 3.3million people. (Brinkhoff, 2010). It is the capital city of Oyo State and is located about 145 km north-east of Lagos having eleven local government areas.

The overall population density of Ibadan metropolitan area is 586 persons per km². The administrative and commercial importance of Ibadan has resulted in land, being a key investment asset and a status symbol for

the population.

2.1 Source of data and Sampling Procedure.

The study was carried out in Akinyele LGA using primary data. Akinyele LGA is made up of 12 wards with 149 unit counts. Data were collected with the use of structured questionnaires. A stratified sampling technique was used to select four wards (strata) to represent different classes of people in the study area. From each stratum a representative sample of 30 households were randomly selected to give a sample size of 120 households using the following price levels for each of the collection methods respectively; Low cost system – 500, Low cost system – 700, Medium cost system – 900, Higher cost system – 1000.

- Low cost system (₦500) – A large communal container probably of 5 to 8 cubic meters capacity would be placed in the neighborhood at a central location and each household and establishment would be expected to carry its container of refuse to empty it into the container. The container would have an attendant to sweep the area and keep it tidy. A vehicle would pick up the container and take it away to be emptied before it is completely full.
- Low cost system (₦700) – A vehicle would come to the neighborhood on a scheduled basis and park for a few minutes at each block or road junction to collect solid waste. When the vehicle parks, it would ring a bell, sound its horn or play a musical jingle to summon residents to bring their containers out to be emptied. All waste in the neighborhood would be kept inside until the vehicle comes.
- Medium cost system (₦900) - As with the first service option, a large communal container would be placed in the neighborhood. However, instead of households being required to carry their waste to the communal container, door to door collection would be arranged for an added fee. The door to door collection would be done by a worker using a push cart or donkey.
- Higher cost system (₦1000) – A vehicle would come to the neighborhood on a scheduled basis and provide a door to door service. At each building, containers of waste, which have been left at the curbside, would be emptied into the vehicle. The emptied containers would be placed neatly at the curb.

Given the fact that solid waste management service is being introduced afresh to the areas, then the prices used are ones, being used by private refuse management companies in other areas based on our findings and the service is twice per month. This would be an improvement on the personal burning of refuse and other self employed methods used by the households to manage their solid wastes.

2.3 Method of Data Analysis

The logit regression was employed for this study to explain the log-likelihood of willingness to pay, because of its comparative mathematical simplicity and asymptotic characteristics, which constrained the predicted probabilities to a range of zero to one. The logit linear model which is based on the cumulative probability function was adopted because of its ability to deal with a dichotomous dependent variable and a well established theoretical background. Logistic regression, according to Roopa, K.S., 2000 is a uni/multivariate technique which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables. Logit model was used for this study as specified by Hanemann (1989), Whittington, et al (1990), Branka and Kelly (2001), Yusuf et al, (2005) , Adepoju and Omonona (2009).

$$(1) P_i = E (Y = 1 / X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_i)}}$$

Where P_i is a probability that $Y_i = 1$

X_i is a set of independent variables

Y is dependent variable

β_0 is the intercept which is constant

β_1 is the coefficient of the price that the households are willing to pay for improved waste management. The coefficient estimates obtained from the identification of factors influencing households' WTP for improved SWM were then used to calculate the mean willingness to pay for solid waste management. Mean willingness to pay for improved solid waste management by households was used as given by Hanemann (1989).

$$\text{Mean WTP} = 1 * \ln (1 + \exp \beta_0)$$

$$/ \beta_1 /$$

Where β_0 and β_1 are absolute coefficient estimates from the logistic regression and the Mean WTP is the mean amount the households are willing to pay for improved solid waste management. To identify the factors that influence households' willingness to pay for improved solid waste management, the respondents' responses to the WTP question was regressed against the prices the respondents are willing to pay and other socio economic

characteristics of the respondents. The regression logit model is specified as:

$$Y = \frac{1}{1 + \exp^z}$$
$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_8 X_8 + E_i \quad (7)$$

Y = Households' response to the willingness to pay

(Yes = 1, No = 0)

Z = Summation of the explanatory variables multiplied by their coefficient

β_0 = Constant

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

E_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 (years)

X_2 = Educational level of household head (years)

X_3 = Marital status (dummy variable; Married = 1, Otherwise = 0)

X_4 = Household size

X_5 = Sex of the household head (Male = 1, Female = 0)

X_6 = Household monthly expenditure

X_7 = Weight of accumulated waste (Kg)

X_8 = Price the household is willing to pay monthly (₦)

3. Result and Discussion

Table 1 presents some selected socio economics characteristics. The study shows that majority of the respondents are in their active working age with the mean age of 38.6 which implies that they may know and appreciate the value of solid waste management. And may also know and dread the consequence of solid waste mishandling and are familiar with the cost sharing in its management. This study has more female respondents than males and this could mean that female are more concern about their environment than males because they are responsible to general hygiene of the house i.e house cleaning, refuse disposal, washing and cooking and this would tell more on the outcome of their effort. Therefore, female might be more willing to pay for solid waste management than males. A little above average number of the respondents interviewed is engaged in formal employment i.e civil servant, government work, private work or any other monthly paid job while the rest are informally employed. i.e trading, artisan and other daily earning job. This means that the respondents are at least earning a living no matter how small, to cater for their welfare of which solid waste management is one. Therefore should be willing to pay to keep their environment clean. The mean household size is 4.64 which is approximately 5 members per household and this is in line with the fact that the lesser the household size the more their willingness to pay to keep their environment clean. Average number of the respondents is educated to tertiary level meanwhile there is little or none of the remaining that did not attend school at all. This implies that almost all of them can read and write and would have read and heard about the consequence of unclean environment. In other word, the higher the level of education the more the respondent would appreciate the value of clean environment and would dread the consequence of unclean one.

Table 1

Variables	Frequency	Percentage
Age (years)		
<30		30.0
31-40		35.5
41-50		20.8
51-60		9.2
>60		5.0
Total		100
Mean age = 38.6yrs		
Gender		
Male		59.2
Female		40.8
Total		100
Employment		
No Formal		48.3
Formal		51.7
Total		100
Household Size		
1-3		28.3
4-6		60.0
7-9		8.3
Above 9		3.3
Total		100
Education		
No formal		5.8
Primary		13.8
Secondary		20.0
Tertiary		53.3
Vocational		7.5
Total		100

Table 2 represents the logit analysis of the factors that determine the willingness of households to pay for improved solid waste management.

Table 2

Willpay	Coefficient	Standard Error	Z- Statistics	Prob
Price	-0.0343585***	0.0067443	5.09	0.000
Constant	21.85127***	4.257283	-5.13	0.000

*** indicate statistically significance at 1%

Degree of freedom = 1
 Log Likelihood = -22.174513
 Pseudo R² = 0.7168
 Chi² (LR Statistics) = 112.24
 Significance Level = 0.000
 Mean willingness to pay = ₦686.07

The result of the multivariate binary logit regression analysis revealed that the model is fit and has overall significance at 1 percent level. The chi square shows the overall goodness of fit of the model. The pseudo R² indicates that 73.14% of the variation in households' willingness to pay for improved solid waste management was explained by the independent variables.

The result also shows that only four variables are significant at 1% level. These variables are; age, educational level, household size and price of solid waste management.

The result indicates that education level has a significant effect on households' willingness to pay for solid waste management. This implies that the higher the level of education the more the respondent would appreciate the value of environmental quality and would dread the consequence of unclean environment.

Formal education has the likelihood of influencing willingness to pay for improved waste management services. A year increase in respondents' level of education will increase households' willingness to pay for improved solid waste management services by 0.1838 point. Also, age has a negative significant effect on respondents' willingness to pay for improved solid waste management. This means that a year increase in age of

the respondents reduces their willingness to pay by 0.1075. This implies that younger respondents would know and appreciate the value of solid waste management than the older ones. They may also know and dread the consequence of solid waste mishandling and would be familiar with the cost sharing in waste management. Household size has the likelihood of influencing willingness to pay for improved waste management in sense that a unit increase in household size reduces willingness to pay for improved waste management services by 0.3936. The mean household size is 4.64 which is approximately 5 members per household and this is in line with the theoretical belief that the lesser the household size, the more their willingness to pay. This is because too large household size may cause overcrowding and will affect the outlook of the environment, also there would not be agreement and individual would be dodging responsibility of paying for the waste they generate. Price has an inverse and significant effect on the willingness of respondents to pay for solid waste management. As the price of solid waste management increases the households' willingness to pay decreases. This result shows that likelihood of respondent paying the extra cost of solid waste management with respect to price is -0.0121. This means 1 naira increase in price of solid waste management would reduce households' likelihood of paying for improved solid waste management by 0.0121

Table 3

Willpay	Coefficient	Standard Error	Z- Statistics	Prob
Constant	21.85127***	4.257283	-5.13	0.000
Age	-0.1075309***	0.028265	-3.80	0.000
Eduyr	0.183801***	0.0619511	-2.97	0.003
Marst	0.2638354	0.6620834	0.40	0.690
Sex	-0.0304138	0.5372791	-0.06	0.955
Hhsize	-0.393624***	0.1433674	-2.75	0.006
Hhexp	8.63e-06	0.0000196	0.44	0.659
Price	-0.120895***	0.002383	5.07	0.000

4. Conclusion

The consequences of poor environmental quality as it has been established in the problem statement of this study should be dreaded by households because of the poor health quality that could result from it and be ready to pay for improved way of managing solid wastes; it will greatly influence their general welfare positively.

The estimated mean willingness to pay of household is low. This implies that households are willing to pay for improved solid waste management and desire it because it will improve their welfare but at an affordable price, that is why majority of them chose the low price level for the improved solid waste management. By the current solid waste collection fees and the existing system, which are discovered to be in place in other areas, the solid waste management cannot be improved and can't cover its cost with the existing level and therefore participation of households is important to improve and achieve sustainable improved solid waste management in the area.

Also, if people know or are informed about the nature of improvement in environmental quality, that is, improved solid waste management, the envisaged welfare improvement elicits people's WTP (Hartwick et al. 1998). Therefore WTP can be used to predict the level of welfare gained from improved SWM system. Households are also discovered not to have being enjoying any collection method of any kind in the study area, whereas majority of them have containers placed in strategic places into which they dump their solid wastes before they finally burn or bury them. This is a point to note for local government and private companies to buckle up and be faithful in making sure their service reach out appropriately.

5. References

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