*Full Length Research*

# Household Willingness to Pay for Improved Solid Waste Management in Osun State, Nigeria

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Environmental quality value can be estimated from what people are willing to pay (WTP) to improve or to restore their environment, using valuation techniques which measure peoples 'preferences. The study examined the general features of the existing solid waste management, household willingness potential for improved waste disposal, identified the socio economic variables and other factors influencing WTP for improved waste disposal services. Primary data collected from 120 households in Osogbo metropolis, was analysed using descriptive statistics and logit regression model. The result reveals that 65 percent of the respondents are male while 67 percent are married with an average household size of 4 members. Majority of the respondents are in their active age with mean age of 42 years. Most of the respondents have formal education, the average years of education is 5 years. Fifty-three percent of the respondents are engaged in the civil service as their primary occupation. About 37 percent of the households dispose their solid waste through burning, while 60 percent claim to dispose off their waste on a weekly basis. Irrespective of non-reliability of waste vendors, 52.5 percent of the respondents paid between ₦400- ₦600 monthly to dispose waste. Majority of the households (87 percent) are willing to pay for improved waste services while most of the respondents will be willing to pay less than 5 percent of their monthly income on waste management services. The logit result reveals that sex, household expenditure and years of education are statistically significant at 10, 5 and 1 percents respectively while other factors are insignificant statistically. It was recommended that programmes that will facilitate investors (private sector) in waste disposing be initiated while payment for this service should be made affordable to encourage those households that are willing to pay.

Key words: willingness to pay, solid waste, improved service, Osogbo metropolis

## INTRODUCTION

Solid wastes by definition include refuse from households, non-hazardous solid waste from industrial and commercial establishments, refuse from institutions market waste, yard waste, and street sweepings [7 and 4]. Broadly, Household wastes otherwise known as residential or domestic wastes are made up of wastes that are consequences of household activities. These according to [6] include food preparation, sweeping, cleaning, fuel burning and gardening wastes old clothing, old furnishings retired appliances, packaging and reading materials, and where diapers or bucket latrines are used, household waste include faecal material.

In Nigeria, many metropolises are faced with the problems of rapid expansion due to population increase and this, no doubt, brought increasing strain on urban infrastructure facilities. One area in which this strain has become obvious is in waste management where the existing system appears to be incapable of coping with the heap of waste generated on daily basis. The urban centers are experiencing an increased rate of environmental deterioration, with refuse dumped along drainage channels. Most cities in Nigeria are faced with waste management problems, and Osogbo is not exempted.

Attempts have been made by scholars, researchers, consultants and government to determine the actual amount of waste being generated in Nigeria in general [3]. In a survey carried out by [6] on waste generation in Nigeria. The study shows that the volume of wastes generated by all the states increased over the period between 1994 and 1996. It was estimated that by the year 2010, Nigeria will generate about 3.53 million tonnes of solid waste, based on a per capita solid waste generation of 20kg per year [3].

Nigerian cities have been described as some of the dirtiest, the most unsanitary and the least aesthetically pleasing in the world [4].   This is because some individuals are dirty, this evidence can be seen everyday by way of indiscriminate discharge of garbage into drains and the highways. About 75 percent of solid waste collected in most Nigerian cities is disposed in open dumpsites. This method which is rampant is improper as it is not aligned to the sanitary landfill recommended. It marginalizes the urban environment as a result of the negative externalities it generates [17 and 2].     In corroborating this assertion, [6], stated that the decomposition of wastes on dumping grounds emit intolerable smells and attract potential diseases.   The dumpsites, which are poorly maintained, are also a source of pollution and a cause of poor urban aesthetic [6].

The economic importance of waste management on the quality of life cannot be over- emphasised. Wastes that are not well managed can affect the environment in terms of the contamination of the atmosphere, soil and water. This can cause severe problems for humans and animals population. It can also affect human health in particular by causing convulsion, dermatitis, irritation of nose/throat, anaemia, skin burns, chest pains, blood disorders, stomach aches, vomiting diarrhoea and lung cancer which may lead to death [4]. It is worthy to note that it breed flies (which carry germs on their bodies), mosquitoes, and rats which aids salmonella, leptospirosis and other diseases they cause by biting and spoiling millions of tons of food. Lastly, is the social effect where flood may occur as a result of dumping of refuse in drainage especially during the raining season; an example of this is the recent flood which happened in late July 2010 in Osogbo metropolis. Lives and properties worth millions of naira were lost in this July flood [10].

## PROBLEM STATEMENT

Collection of waste used to be the responsibility of municipal authorities in the past [9], hence, waste collection is a service for which local government is responsible [7]. In short, waste collection is the constitutional responsibility of the local government. This responsibility is not mutually exclusive, because, there is no local government area in Nigeria that can afford the huge financial, technical, administrative and human resource requirements to effectively carry out this constitutional responsibility [4]. The collection of solid wastes in many Nigerian cities has always until very recently, been dominated by government agencies; it has been concluded that it is the responsibility of government to solve the waste collection problems, as part of government obligations to the citizens.

An explanation for the inability of the government to manage solid waste collection effectively arose perhaps from the misconception of this task as a public good. Irrespective of the fact that government gave waste collection a priority in their development objectives, their ability to curtail the problems of waste collection deteriorates with time, due to rising capital costs for plant and equipment, increasing operation and maintenance  costs. Considering the rapid spatial and population growth of most urban areas with decreasing coverage levels, and with increase in level of waste generated, confronted by increasing public demand for improved services [12 and 13], the need arises for the involvement of the private sector and the civil society in the provision of municipal solids waste service.    It should be noted, however, that it is only in the large urban centres of Nigeria e.g.  Lagos, Ibadan, Warri, Suleja amongst others that the activities of formal private sector are recorded [4].    In majority of the secondary cities such as Osogbo, they are neither totally absent or being substituted with the informal refuse collectors such as cart pushers. This therefore gives rise  to  the

need to evaluate the household willingness to pay for improved solid waste disposal services in the study area. Specifically the study examined the general features of the existing solid waste management, household willingness potential to pay for improved waste disposal, identified the socio economic variables and determine the factors influencing WTP for improved waste disposal services.

## METHODOLOGY

***Data collection and sampling technique:*** The study was carried out in Osogbo metropolis.

Osogbo is the capital city of Osun State, Nigeria. It is therefore a centre of administration. Two major local government areas (LGAs) are located in Osogbo namely Olorunda LGA and Osogbo LGA. The third, however, is Egbedore LGA having about two-fifth of its land coverage within the Osogbo metropolis. Osogbo metropolis has a population of approximately 350,000 people according to the 2006 National population census. It lies on the tropical rainforest with both favourable rainfall and adequate soil. It has an annual rainfall of about 1130mm covering a period of 200-220 days each year. The study area was selected because it is the centre of administration of Osun state and by this status has experienced expansion due to population increase.

The study used primary data. The data were collected with the use of structured questionnaires. A two stage sampling technique was used to select households used for the study. The first stage involves stratifying the entire study area into new and old areas. The study covers three locations in each of the two areas. The locations covered in the new area include Agunbelewo, Odekale and Ataoja Estate while locations covered in the old area are Oke-onitea, Jaleyemi and Dada Estate. Twenty households were randomly selected from each of the locations and this forms the second stage.   A total of 120 households were sampled from both areas, i.e. sixty households from the old area and sixty households from the newly developed area.

Descriptive statistics such as frequency distribution tables, mean and standard deviation were used to analyze the socioeconomic characteristics of the respondents. The logit model was used to determine the mean willingness to pay for improved waste disposal service by households. The logit model which is based on the cumulative probability function was adopted because of its ability to deal with a dichotomous dependent variable on a well-established theoretical background. Logistic regression, according to [11] 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. The model specified by [8 and 15] was adopted for this study as used by [5] in a study on willingness to pay for improved conservation of environmental species in the USA and [17] on willingness to pay for improved household solid waste management in Ibadan North Local Government Area, Oyo State.

***Willingness to pay(WTP) of the households for improved waste disposal services***

The logit regression model specified below was used to obtain the willingness to pay of the households for an improved water supply. The coefficient estimates obtained were then used to calculate the mean willingness to pay of the households as used by [1].

$$P_i = E\left(Y = \frac{1}{X_i}\right) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1)}} \qquad \text{... 1}$$

Where $P_i$ is a probability that $Y_i = 1$

$X_i$ is a set of independent variables

$Y$ is dependent variable

$\beta_0$ is the intercept which is constant

$\beta_1$ is the coefficient of the price that the households are willing to pay for improved water supply Mean willingness to pay for improved waste disposal by households was calculated using the formula derived by [3] and given as:

$$MeanWTP = 1 * In \frac{(1 + exp^{\beta_0})}{/\beta_1/} \quad ...2$$

where $\beta_0$ and $\beta_1$ are absolute coefficient estimates from the logistic regression and the *Mean WTP* is the mean for the improved waste disposal by households.

***Factors influencing willingness to pay by household:*** To identify the factors influencing willingness to pay for improved waste disposal by households, the household responses to the WTP question was regressed against the households WTP potential and other socioeconomic characteristics of the household. The regression logit model is specified as:

$$Y = \frac{1}{1 + exp^z} \quad ...3$$

Where Y = responses of household WTP which is either 1 for Yes and 0 for No

$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots + \beta_7 X_7$
$X_1$ = Sex (Dummy: Male=1, Female= 0)
$X_2$ = Age (yrs)
$X_3$ = Educational level (number of years spent in the school)
$X_4$ = Marital status. Dummy variable (married =1, single=0)
$X_5$ = Household size (number)
$X_6$ = Percentage WTP from income (number)
$X_7$ = Household expenditure (N)

The pseudo-$R$ square and the chi-square were used to measure the goodness of fit of the model and the significance of the model used.

## DISCUSSION OF THE RESULTS

The socio economic characteristics of the respondents are presented in table 1. The male accounted for 65 percent while 35 percent were female. The high percentage of the male is as a result of sampling of the household heads. The proportion of the married in the study area is 67 percent which may therefore encourage the willingness to pay for improved solid waste considering the volume of waste from members of the household. The household size distribution showed that 70 percent of the respondents have between 1-5 household members while only 5 percent represent those that have above 10 members. The mean household size of the respondents is 4 members. The age range with the highest frequency is 41 – 50 years which accounted for 35 percent of the respondents while those above 60 years accounted for 3.3 percent. The average age in the study area is 42 years. This implies that respondents are in their active age and therefore can work to earn, more income which can affect their decision to pay for improved waste services.

About 10 percent of the respondents represent those without formal education while only 5.8 percent of the respondents had post graduate education. The mean years of education in the study area is 5years. This revealed that a typical household in the study area had at least 5 years of formal education. Education helps to enlighten the respondents on the need to keep our environment clean, free from germs and healthy for all. The primary occupation of the respondents revealed that 54.2 and 20 percents engaged in civil service and trading respectively while only about 7.5 percent were involved in other income activities such as transportation, attendants in eatery, fuel stations etc .

Household expenditure on food and non-food was used as a proxy for income s most respondents would otherwise not divulge the real value of their monthly income [1]. The level of household expenditure is generally low, about 51.7 percent of the respondents spent on a monthly basis about N20,000 or less as household monthly expenditure while about 12.5 percent spent over N60,000 as monthly expenditure. The average household expenditure was about N26, 655, with the lowest and the highest being N6,800 and N108,500/month/household respectively. The result reveals the level of earnings of respondents as they are not likely to spend above their income. As the level of income increases, the probability that households would adopt improved waste disposal services will also increase.

**Table 1:** Socio economic characteristics distribution of the respondents

| Socio economic | | Frequency | Percentage | Mean value |
|---|---|---|---|---|
| **Sex** | **Male** | 78 | 65 | |
| | Female | 42 | 35 | |
| **Marital Status** | Married | 81 | 67.5 | |
| | Single | 39 | 32.5 | |
| **Household Size** | 1- 5 | 84 | 70 | |
| | 6-10 | 30 | 25 | **4** |
| | Above 10 | 6 | 5 | |
| **Age** | ≤ 30 | 24 | 20 | |
| | 31 - 40 | 40 | 33.3 | **42** |
| | 41 - 50 | 42 | 35 | |
| | 51 - 60 | 10 | 8.3 | |
| | Above 60 | 4 | 3.3 | |
| **Education (yrs)** | None | 12 | 10 | |
| | 1 .6 | 54 | 45 | |
| | 7-12 | 27 | 22.5 | **5** |
| | 13-18 | 20 | 16.7 | |
| | >18 | 7 | 5.8 | |
| **Pry Occupation** | Civil service | 65 | 54.2 | |
| | Farming | 10 | 8.3 | |
| | Trading | 24 | 20 | |
| | Artisans | 12 | 10 | |
| | Others | 9 | 7.5 | |
| **Monthly expenditure** | <20,000 | 62 | 51.7 | |
| | 20,001- 40,000 | 25 | 20.8 | |
| | 40,001- 60,000 | 18 | 15 | |
| | Above 60,000 | 15 | 12.5 | ₦26,655 |
| **Total** | | **120** | **100** | |

The general method of disposing waste, its reliability as well as the frequency of waste disposal is presented in Table 2. The result revealed that 37.5 percent of the respondents claimed to dispose their waste through burning which helps to keep the environment clean. On the reliability of use of this method, 80 percent attested that it is a reliable means of disposing their waste. On another hand, 35 percent of the respondents dispose their waste by dumping it on the roadside, at a dump site, or a nearby bush. However, 54.8 percent of this category indicated that it was not a reliable means of disposing their waste. Twenty five percent of the respondents used waste vendor (waste collector) by paying a token to dispose their refuse, but 63 percent of this category also claimed that was not a reliable means of disposing waste because of the limited number of waste vendor. Lastly, only 2.5 percent of the respondents bury their waste in the soil and they all claimed that the method is reliable to dispose their household waste.

The frequency of disposing waste showed that while 14 percent dispose waste daily, about 60 percent of the respondents dispose their waste on a weekly basis and only 2.5 disposed occasionally. With the knowledge that keeping household waste in the house for a week long has its health implication because it can harbour germs, breed rats, mosquitoes, cause air pollution amongst others. Given this result, households may be encouraged to pay for improved, prompt and regular waste disposal through the private sector.

**Table 2:** Method of Solid waste disposal, reliability of methods and frequency of disposal

| Variable | Frequency | Percentage |
|---|---|---|
| **Method**  Burning | 45 | 37.5 |
| Use Of Waste Vendor | 30 | 25 |
| Dump Nearby | 42 | 35 |
| Bury In The Soil | 3 | 2.5 |
| **Tota**l | **120** | **100** |
| **Reliability Of Method** | | |
| Burning | 36 (9) | 80 (20) |
| Use Of Waste Vendor | 11 (19) | 36.7 (63.3) |
| Refuse Dump Nearby | 19 (23) | 45.2 (54.8) |
| Bury in The Soil | 3 (0) | 100 (0) |
| **Frequency of disposal** | | |
| Daily | 17 | 14.2 |
| Weekly | 72 | 60 |
| Bi-weekly | 12 | 10 |
| Monthly | 16 | 13.3 |
| Ocassionally | 3 | 2.5 |
| **Total** | **120** | **100** |

*Figures in parenthesis represent the claim that the methods are*
*unreliable and the corresponding percentage*

Table 3 present the distribution of the current expenditure on waste disposal and the willingness to pay potential of the household. The result revealed that 52.5 of the respondents spend  between N400- N600  on  waste  disposal  per month. While  7.5  percent  claimed  to dispose waste at no cost, only 3.3 percent spent above **N** 800 on waste disposal. This is an indication that majority of the respondents are already expending money on solid waste disposal and therefore may be WTP for improved services. A binary response to household willingness to pay for improved services showed that 87.5 percent are willing to pay. However, 71.4 percent of this category of respondents are willing to pay only less than 5 percent of their monthly income to waste collectors while only 3.8 will be WTP above 10 percent of their income if the need arise. The mean value of the percentage of income the respondents are WTP is 3 percent. Given the advantages of improved services, most households in the study are WTP a proportion of their income, to sanitise their immediate environment.

**Table 3:** Household Current and Proposed Expenditure on Waste Disposal

| Expenditure      (₦) | Frequency | Percentage |
|---|---|---|
| **Current**        None | 9 | 7.5 |
| <400 | 29 | 24.2 |
| 401-  600 | 63 | 52.5 |
| 601 – 800 | 15 | 12.5 |
| Above 800 | 4 | 3.3 |
| **Total** | **120** | **100** |
| **Household WTP**  Yes | 105 | 87.5 |
| No | 15 | 12.5 |
| **Total** | **120** | **100** |
| **WTP Potential** < 5% | 75 | 71.4 |
| 5.0 – 7.5% | 21 | 20 |
| 7.5% 10.0% | 5 | 4.8 |
| Above 10% | 4 | 3.8 |
| **Total** | **105** | **100** |

***Determinants of WTP for improved waste disposal services:*** Table 4 presents the logit analysis of the factors that determine the willingness to pay for improved waste disposal services. The results showed that respondents 'age, marital status, household size and percentage household WTP potential do not significantly influence the willingness to pay for improved waste disposal. However, sex, educational status, and monthly expenditure of households are statistically significant at P < 0.10, P < 0.1 and P <0.05 respectively. Educational level is positively related to WTP for improved waste disposal services. This indicates that as level of education increases the tendencies to adopt and pay for improved disposal services will also increase. The coefficient of household expenditure, a proxy for income is also positive, an indication that increase in income will increase the probability that households would be willing to pay for improved disposal services. This is confirmed by [14 and 16],

The result reveals that the marginal effect on probability of households paying for the service with respect to household monthly expenditure is 0.46776. This implies that for every N1 increase in household monthly expenditure, the likelihood of paying for improved refuse collection and disposal increases by 0.46776.

**Table 4:** Multivariate Logit Regression

| Variable | Marginal effect on probability of willingness to pay | | |
| --- | --- | --- | --- |
| | Coefficients | Standard Error | Z-statistics |
| Constant | 8.182 59 | 1.51 | 0.3112 |
| Sex | - | -1.827 | 0.0677* |
| Age | - | -1.159 | 0.2463 |
| Educational | 0.331 | 3.105 | 0.0019*** |
| Marital | 0.960 | 0.924 | 0.3554 |
| Household | 0.532 | 1.782 | 0.0747 |
| WTP | 0.184 | 1. 245 | 0.2133 |

| | | |
| --- | --- | --- |
| ***Statistically significant | Chi-squared (LR | 22.36494 |
| **Statistically significant at | Degree of freedom | 7 |
| *Statistically significant at | Significance level | 0.00000 |
| Log likelihood    - | Restricted Log | -32.03139 |

## CONCLUSION AND RECOMMENDATIONS

The study revealed that payment for waste disposal is not a new idea in the study area, however, majority of the respondents were willing to pay for an alternative waste disposal services, particularly when it is going to be an improvement on the existing means of services. Sex, education and household expenditure were discovered to be determinants of household WTP for improved disposal services in the study area. It is recommended that programmes facilitating investors in waste disposing be initiated while payment for this service should be made affordable to encourage those households that are willing to pay. In addition, public enlightenment campaign through mass media could also be adopted in order to properly inform the citizens on the need to patronize the solid waste disposal investors.

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