
Empirical Assessment of the Willingness to Pay for Waste Collection and Disposal Services in Kano Metropolis, Nigeria

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Abstract: Contingent valuation (CV) method was used to estimate households' willingness to pay (WTP) for waste collection and disposal services in Kano Metropolis, Nigeria. A multistage sampling technique was employed to randomly select a sample of 326 respondents for the study. Using logit model, the study revealed that 86.5% of the respondents are willing to pay for waste collection and disposal services in Kano Metropolis and the major determinants of the households' WTP are education, income and utility derived by households from service delivery which are positive and statistically significant at level of 1%; age, gender and occupation are negative and statistically significant at level of 1%, and family size is positive and statistically significant on households' willingness to pay at level of 10%. The result of the study also found out that mean willingness to pay for improved waste collection and disposal was N1228.00. Following this, the paper advocates the need to regulate and incorporate private sector into waste management in Kano Metropolis, thereby privatizing waste collection and disposal services. Since the stated WTP amounts were found to vary significantly, the paper also suggests that the amount of money to be charged for the waste management services should not exceed the mean willingness to pay amount found in this study. It is also recommended that government and other stakeholders should further educate the public on proper method of waste disposal in Kano Metropolis.

Keywords: Logit, Contingent Valuation, willingness to pay, Waste collection, Waste disposal and Binary choice

1. Introduction

One of the major reasons for valuing waste collection and disposal is the assumption that a well designed survey aimed at determining the willingness and capacity of household to pay is a key factor in addressing challenges of improving the efficiency of waste management system in urban areas. This study explored the possibilities of applying contingent valuation method to estimate households' willingness to pay (WTP) for waste collection and disposal in Kano Metropolis. The study area was particularly chosen in this context because it is one major area in Nigeria that is battling with management of a large volume of household waste and there is a move recently to involve the private sector in providing the waste collection and disposal services, a policy that is a clear departure from the notion that local authorities must be responsible for providing waste management services free of charge in the area. The rationale for this new policy is based on the fact that public waste collection is not efficient and that involvement of private sector is expected to bring about efficiency as has been noted in other sectors of the economy. This study will assist to improve understanding of the households willingness to pay and can provide policy makers with a useful information for effective and efficient waste management policy so that if willingness of people is known the amount to be charged will be within their ability and the collection exercise is likely to be successful. The study is organised into five parts, introduction, a review of empirical literature and theoretical framework, materials and methods, results and discussion and conclusion and recommendations.

2. Literature Review

There are several contingent valuation (CV) studies conducted particularly in developing countries to investigate households' willingness to pay for waste collection and disposal services. Although, as Wang et al., (2011) rightly observed most of the studies conducted prior to 2000 are for waste management schemes in developed countries, the period after 2000 marked watershed for most CV studies in developing countries as more papers are found on the scheme. The major differences between the CV studies undertaken in these places is that, while most of the contingent valuation studies in developing countries are more concerned with the benefits of introducing new waste management approaches such as curbside recycling, composting and incineration which aim to reduce landfill, on the contrary most

developing country-based CV studies are focused on the benefits of providing improved waste collection and disposal services away from conventional methods.

In another study, Yusuf, Salimonu and Ojo (2007) investigated the determinants of willingness to pay for improved household solid waste management in Oyo State, Nigeria using contingent valuation method. From logit regression estimates, the result of the study found that price of the service, age; educational level, household size, and households' monthly expenditure affect willingness to pay for waste management. Because majority of the household have considerable large family size and dependents, it is recommended in the study that an acceptable family planning programme should be adopted to control their population. In addition, household should improve their income and purchasing power by establishing more small scale businesses.

Similarly, Rahji and Oloruntoba (2009) conducted a study using contingent valuation method to examine determinants of willingness to pay for private solid waste disposal systems by urban households in Ibadan, Nigeria. A multistage random sampling technique was used to select 552 households for the study. Evidence from their logit model indicated that income and asset owned were positive and significant at 1% level, but amount of willingness to pay and firm services were negative and significant at 1% level at the same time age was negative and significant at 10% while education and occupation were positive and significant at 5% level. The study recommends government intervention in a variety of forms such as encouraging public-private partnership in solid waste disposal, an aggressive environmental clean campaign, and decentralization of waste management boards and privatization of some aspects of waste management to ameliorate solid waste problems and improve health.

Khattak, Khan and Ahmad (2009) examined willingness to pay for better solid waste management services in urban areas of the District of Peshawar, Pakistan using contingent valuation technique. Their findings obtained using logit model of estimation revealed that 53 percent of the households were satisfied with the existing solid waste management, and only 49 percent of them showed their willingness to pay for better solid waste management services. The results further show household size, income of household and higher education are determinants of households' willingness to pay while awareness and disease history of the household are statistically not significant. They went ahead to recommend that government should tap from the household's willingness to pay to provide improved solid waste management service.

Ekere, Mugisha and Drake (2010) used contingent valuation to assess the determinants of waste generation and willingness by household to pay for sound waste management in urban and peri-urban areas of the Lake Victoria crescent region Uganda. The research work used a random sample of 577 selected households. In order to analyse the result of the study using econometric models, both ordinary Least Square (OLS) and Logit regression models were used. The result of ordinary least square regression shows that income, age and household size influenced waste generation. The result from the logit analysis revealed that income of the household head, location of the household, gender of the household head, level of environmental concern, age of the household head and quantity of crop waste generated by the households were significant and explained the household's willingness to pay for waste management. Since the study indicated that households were willing to pay for sound waste management, the authors suggest it should provide the basis for fixing of waste disposal fees by government but in fixing waste collection fees, authorities should pay attention to location and income of residents.

Mahanta and Das (2011) used both contingent valuation method and logit model to analyze the problems of solid waste management and households' willingness to pay for improvement in waste management (collection and disposal) in Guwahati, India. Two stage sampling techniques were applied to collect information from 360 randomly selected households. The findings revealed an average household in the city was willing to pay Rs. 60.22, though, a meagre percentage of low income groups are showing a zero willingness to pay. The authors believed zero willingness to pay can be handled by other means like pursuing low income earners to pay, introducing lower charges or making them to work instead of paying money. Based on the research findings, they suggest door to door waste collection service should be implemented as households have shown willingness to pay. They further added due to failure of local authorities to manage waste collection and disposal, the concept of Public-Private Partnership should be introduced.

Hagos, and Gebreegziabher (2012) assessed the current sanitary service fees and willingness to pay (WTP) of residents for improved urban waste management using a cross-sectional survey of 226 randomly selected households in Mekelle city, Ethiopia. They used age, sex, education, awareness, family size, income, marriage status, perception, house ownership, household waste, type of solid waste service and starting price as explanatory variables. The results of Tobit and Probit models revealed that willingness to pay is significantly related to income and awareness of environmental quality among other factors. The mean willingness to pay for improved solid waste management per month per household is ETB 11.89, while the open-ended (maximum WTP) is ETB 7.88 per month per household. But the actual WTP of the households in the city may fall between the total monthly aggregated WTP of the city estimated as ESTB 430,566 and the monthly city WTP estimated at 532,536 using dichotomous single-bounded question. This suggests as shown by the authors that citizens are eager for improved solid waste management, thus there is more room to increase the fee and acquire sufficient funds to substantially improve and modernize waste management services in the city.

Roy and Deb (2013) used a contingent valuation technique to establish the determinants of households' willingness to pay for improved waste management in Silchar Municipal area, Cachar District, Assam, India. Their multiple regression study revealed an average of 63% of the households are willing to pay for improved waste management. Using the multiple regressions, they revealed willingness to pay was significantly affected by monthly average expenditure, household size, average education, environmental awareness and number of working women. Since most of the household waste is covered by biodegradable wastes and non-biodegradable like plastic, paper, metals and others, the authors suggest composting of biodegradable waste and increased waste recycling and recovery as area of further development.

Even though, from the empirical literature reviewed contingent valuation has emerge as frequently employed methodology of valuing a proposed scheme for improving waste collection and disposal in developing countries, it is also evident that there exist few contingent valuation research effort in relation to improved waste management services in Nigeria. This concern provides the rationale for this study and therefore adds to scant literature on contingent valuation in Nigeria and Kano in particular.

3. Research Methodology

3.1 Study Area

Kano Metropolis, where the study area is located, is situated in the North-western part of Nigeria. The area consists of about eight (8) local government areas (LGAs) namely Kano Municipal, Dala, Nassarawa, Gwale, Fagge, Tarauni, and some parts of Kumbotso and Ungoggo. Additionally, a total projected population of the combined eight local government areas in 2012 is estimated at 318,738 (Bayero University Kano Consultancy Unit, 2012). This study selected and studied 326 households for the survey. In order to ensure the sample households were representative of the population, the study area was stratified into three sampling units each representing different income group (High, Middle and Low income areas) as a first stage. Thereafter, a sample was proportionately allocated into each sampling unit (strata) according to each share of total households or residential population density. For this, in each sampling unit or strata, the sampled households were chosen through multi-stage sampling. That is, since each sampling unit (strata) is composed of different residential areas, a number of residential areas were selected at random as second stage of the sampling process. The third stage involved the selection of residential structures.

3.2 Model Specification

To analyse whether households` are willing to pay for waste collection and disposal services in Kano Metropolis, a model that could predict discrete outcomes is used. For this, a binary model that allowed for two possible outcomes-yes or no type answer is needed. The type of model is adopted by Khattak, Khan and Ahmad (2009) to examine willingness to pay (WTP) for better solid waste management services in urban areas of District Peshawar, Pakistan. In their model households` willingness to pay (HH` s WTP) was treated as dependent variable and was regressed on some socioeconomic variables that include education level, income, household size, awareness and disease history respectively as shown below:

$$WTP_i = \beta_0 + \beta_1E + \beta_2I + \beta_3HH + \beta_4A + \beta_5DH + u_i \quad (i)$$

For the purpose of this study, the adopted valuation function is modified and specified as a binary choice model in form of.

$$Y^* = \beta_0 + \sum \beta_i X_{ij} + \mu_i \quad (ii)$$

Where Y^* is a dichotomous dependent variable which can either assume the value of 1 or 0. It measures the household willingness to pay (HWTP) which is an unobserved implicit variable. But in this study, HWTP is conceptualized as an actually observed dependent binary variable defined by:

HWTP = { 1 if the sampled household is willing to pay or 0 if otherwise.

The assumption is that households are faced with a choice between two alternatives; i.e. they are willing to pay or they are not. It is also assumed in this model, willingness to pay for a proposed improved waste collection and disposal among households in Kano Metropolis is endogenously determined and is a function of the following independent variables as shown in the following explicit form of the model to be estimated:

$$HWTP = \beta_0 + \beta_1AGE + \beta_2GED + \beta_3EDU + \beta_4OCUP + \beta_5INC + \beta_6FMS + \beta_7UFS + u_i$$

Where:

HWTP = Household willingness to pay for waste collection and disposal

AGE = Age of the Household

GED = Gender

EDU = Educational level

OCUP = Occupation

INC = Income

FMS = Family Size

UFS = Utility from service delivery

u = Error term or random variable

The parameters β_1 reflect the impact of changes in the regressors on the probability of the regressand. The model was modified because of theoretical expectations that the variables added also influence willingness to pay.

4. Results and Discussions

The study was conducted between February and June, 2014 in Kano Metropolis

Table 1: Descriptive Statistics of respondents` Socioeconomic Characteristics

Variables	Mean	Standard Deviation
Age in years	43.53	9.597
Years of schooling	12.68	3.91
Family size	5.309	3.157
Monthly income	85219.33	1.03824

Source: Field Work, (2014)

The basic socioeconomic characteristic of respondents is presented in Table 1. From the result, the average years of the sampled household was 43.53, signifying that most of them are at their active productive age. The result also shows that most of respondents (34.05%) had at least more than 12 years of education. Theoretically, those with some higher level of education should be more willing to pay than those without.

Table 2: Willingness to pay (WTP)

WTP	Frequency	Percentage
Yes	282	86.50
No	44	13.50
Total	326	100

Sources: Field Work, (2014)

In Table 2, the responses to the willingness to pay questions showed that the proportion of `yes` answers obtained from the respondents are 86.50%. This suggests that the percentages of those who are willing to pay are higher than that of sampled households not willing. When further asked to state reason for their answer `yes` to the WTP questions, most of them agreed to the fact that the payment would motivate responsible waste management agencies to ensure efficient waste collection and disposal services. A total of 44 respondents representing about 13.5% are not willing to pay.

Table 3: Amounts Respondents are willing to Pay

Amounts (in Naira)	Frequency	Percentage
500	39	13.83
1000	106	37.59
1200	3	12.41
1400	2	1.06
1500	60	21.28
1700	3	1.06
1800	2	0.71
2000	18	6.38
2300	2	0.71
2500	13	4.61
3000	1	0.35
Total	282	100

Mean = 1228.00
Minimum = 500
Maximum = 3000

Sources: Field Work, (2014)

The respondents were also asked to state the amount of money they would be willing to pay per month in order to address the challenges of waste management in the study area. As shown in Table 3, the lowest amount the sampled households are willing to pay is N500 (Five Hundred Naira), the highest is N3000 (Three Thousand Naira), and mean willingness to pay is approximately N1228.00 (One thousand two hundred, twenty eight Naira).

Table 4 shows the results for all the 326 respondents from the logit model. In the result, the coefficient are interpreted as the change in the probability of a respondent's willingness to pay for improved waste collection and disposal services given a unit change in the independent variables calculated at mean values. The empirical result revealed that all the coefficients; age, gender, education, occupation, income, and family size are statistically significant at level of 1% except utility derived from service delivery which is significant at level of 10%. Therefore, the result of the major factors that influence households' willingness to pay for waste collection and disposal services is interpreted as follows:

4.1 Empirical Result

Table 4: Result of logit Model and Marginal Effect

Variables	Logit	Marginal Effect
Age (AGE)	-.0764841*** (.0325805)	-.0045548*** (.00203)
Gender (GED)	-2.856227*** (.762727)	-.4404584*** (.16936)
Education (EDU)	.9143031*** (.2743453)	.0544485*** (.01861)
Occupation (OCUP)	-1.05145*** (.2158984)	-.0626158*** (.01584)
Income (INC)	.0000169*** (5.40e-06)	1.01e-06*** (.00000)
Family size (FMS)	.161628* (.0863902)	.0096253* (.00541)
Utility from Service Delivery ((UFS)	1.225534*** (.4098844)	.0729829*** (.03103)
Constant	3.600043*** (1.513904)	
	No of Obs. = 326	

Source: Authors computation from survey data (2014) using STATA 11. The figures in parenthesis are p-values. They implied ***significant at 1% and *significant at 10%.

4.2 Major Findings

From the estimated result, the relationship between the probability of household's willingness to pay and the age of the households is negative and significant at level of 1%. In particular, the marginal effect suggests a year decrease in household age is likely to increase probability of households' willingness to pay by 0.45%. Therefore, the result implies old people are less willing to pay than young respondents for an improved waste collection and disposal service in Kano Metropolis. This may be explained by the fact old people tend to consider environmental issues less important.

The result also revealed that all things being equal, there is an inverse and significant relationship between respondents' willingness to pay and gender of the household at level of 1%. By implication, since in this study male respondents carried the weight of 1 and female respondents 0, it suggests that the females respondents are more willing to pay for improved waste collection and disposal service in the study area than their male counterpart. The result of marginal effect also suggest decrease in probability of one being male increases the likelihood of households' willingness to pay by 44%.

The estimated result also revealed that coefficient of the respondents' occupation carried a wrong sign but statistically significant at level of 1%. This suggests households who have an occupation are less likely to pay for waste collection and disposal services. This finding is not consistent with reality but the wrong sign may be due to misspecification of the mathematical model or the measurement error.

The coefficient of respondents' level of education was found to be statistically significant in explaining households' willingness to pay at 1% level. It has a positive sign and therefore, consistent with previous studies that found education to have positive and statistical effect on willingness to pay for improved waste collection and disposal services. The result of its marginal effect suggests a year additional qualification of the respondents is more likely to increase the probability of households' willingness to pay by at least 54%.

The respondents' monthly level of income was also found to be positive and significant in raising the ability of households' willingness to pay for waste collection and disposal services. The coefficient of the income from its marginal effect also suggests any additional increase in monthly income would increase the probability of households' willingness to pay by 100%. This confirms our a priori expectation because ability of a household to pay largely depends on the income.

The coefficient of family size also has positive and significant influence on willingness to pay at 10% level. Therefore, the marginal effect of variable implies that 1% increase in a respondent family size would probably increase households' willingness to pay by 0.9%. This is probably true because as the size of family increases, the tendency to generate more waste also increases, and ultimately induces households' willingness to pay.

The study also found relationship between utility derived from service delivery and households' willingness to pay was positive and significantly at 1%. The estimated marginal effect of this result suggests that as utility derived from service delivery increased, the probability of households' willing to pay also increased by 72%.

5. Conclusion and Recommendations

In this study, contingent valuation method was applied to identify households' willingness to pay for waste collection and disposal services in Kano Metropolis, Nigeria. The information provided by the study can help to get a better understanding of households' preference for improved waste management services. The survey suggests that majority of the respondents feel that people's willingness to pay can exert a significant positive effect on improved waste collection and disposal services. This assertion was further confirmed through an empirical evidence which found a strong relationship between household's socio-economic and demographic characteristics and willingness to pay for an improved waste management scheme.

It is recommended that government should franchise waste management services in Kano Metropolis especially in high and middle income areas, since residents are willing to pay to compensate for the higher cost of providing improved waste collection and disposal services in the area. A direct collection fees method may be one of the feasible ways to collect money for supporting improved waste management services but there is need for comprehensive policy measures for making the method to be more realistic and practicable. Since we can also link the satisfaction derived from services delivery to the knowledge of health and environmental implication of improper waste collection and indiscriminate waste disposal practice, government and other stakeholders must further educate the public on proper method of waste disposal in Kano Metropolis.

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