

Assessing Households' Willingness to Pay for Improved Municipal Waste Management in Three Selected Cities of Northeastern Nigeria

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Abstract

Waste is a major economic drain, especially on city budgets. The inefficient use of scarce resources reflected in materials discarded and abandoned as waste represents a huge economic and environmental cost borne by society as a whole. Socially, waste has a disproportionate impact on the poor and marginalized in cities, towns and villages, as solid waste in most cities is disorganized, haphazard and under-resourced. In order to improve upon the present approach to waste management, this study aims to establish a clear rationale for making waste management a priority, by providing socially optimal amount for solid waste management and estimate the total economic benefit of improved solid waste in the selected states in Northeast Nigeria. The study used structurally design take-it-or-leave-it "TIOLI" questionnaire in eliciting households' willingness to pay for improved waste management and apply the multi-stage probability sampling techniques to reach out to the randomly selected 422 target respondents from the three (3) state capitals and retrieved as follows; Adamawa state (Yola, 414 households), Bauchi state (Bauchi, 418 households) and Yobe state (Damaturu, 409 households) using face-to-face method of questionnaire administration. The data collected was analyzed using the aid of computer software package of SPSS version 22 whereby about 94 % of the respondents indicates "YES" they are willing to pay for improve door-to-door solid waste collection services for cleaner neighborhood and health environment. Finally, the study result indicates that at all the three (3) selected northeast states state capitals of Adamawa, Bauchi and Yobe are willing to pay for improve door-to-door solid waste collection services. The mean willingness to pay is N1,556.75 and the total aggregate WTP for improve door-to-door solid waste collection and management is estimated as N2,160,659,975. And the result is aimed at providing policy guide for sustainable waste management in northeastern Nigeria by provide the households willing to pay for solid waste management and lastly, it will provide the best policy option for effective solid waste management that will be socially acceptable, economically viable and environmentally friendly.

Keywords: Door-to-door, Waste, Waste Management, Willingness to Pay, Sustainable Waste Management, Solid Waste.

Introduction

Waste generation is a natural product of urbanization, economic development, and population growth (Kaza, Yao, Bhada-Tata, & Woerden, 2018). Solid waste management is a daily routine that is continuous and never finished. As each day passes, it brings new task of streets to sweep, waste to collect, waste loads to haul and safely to dispose. Urbanization and solid waste generation are closely interrelated. In Africa, it is estimated that currently,

the rate at which solid waste is growing in urban areas is much faster than the urbanization itself (Hoornweg & Bhada-Tata, 2012). As evidence have shown that the global populations of urban residence continue to grow significantly within the last decades, it was reported that with the about 30% of world population living in urban areas in 1950s, the figure is projected to reach 66% by year 2050 (United Nations, 2015).

According to (OECD, 2008), municipal solid waste is defined as that type of waste collected and treated by, or for municipalities. This includes waste from households, bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, yard and garden, street sweepings, contents of litter containers, and market cleansing. Waste from municipal sewage networks and treatment, as well as municipal construction and demolition is excluded. Again, Magutu et al., (2010), defined Municipal Solid Waste (MSW) as solid waste that includes all domestic refuse and non-hazardous wastes from commercial, institutional, street sweepings and construction debris.

According to world bank report, it was estimated that in year 2002, urban residents who were about 2.9 billion, produces 0.64 kg of waste per person per day) and by the year 2012, this quantity increases to 1.2 kg per person per day by the urban population of about 3 billion. At present, it is anticipated that by year 2025 the total population of urban residents will rise to about 4.3 billion, who on average will generate 1.42 kg of waste per day (Hoornweg & Bhada-Tata, 2012). The UN-HABITAT, (2008) postulated that the growth of urban areas in most of the African countries has not been in concomitant with expansion of economic activities and social amenities. Many cities in the continent were struggling to provide basic services such as shelter and water as well as maintaining a cleaner environment in the face of rapidly growing urban population (UN-HABITAT, 2008).

As local economies develop, per capita waste generation also intensify in proportion to increase in production as well as consumption. Unfortunately, until recently many people in African countries including Nigeria, regard the concern for effective strategies for managing urban solid waste as a less important issue which may distract attention from the most urgent and serious problem of achieving a fast rate of economic growth. This attitude stems in part from the belief that environmental degradation with urban solid waste generation is an inevitable price of development (Uwadiogwu & Chukwu, 2013).

In Nigeria, solid waste management (SWM) is primarily the responsibility of local authorities (Oguntoyinbo, 2012). Usually, the collection is often from the source or temporary dumping sites and disposes off finally in an open dumping site outside the city (Ziraba, Haregu, & Mberu, 2016). The ever increase in solid waste generation leads to increase in demand on existing solid waste management services which in many countries in Africa, happens to be the single largest item that consume higher share of the budgetary allocation of the local authorities (Dangulla et. al., 2016: Hoornweg & Bhada-Tata, 2012). In relation to this, the budgetary requirement for solid waste management in municipalities of developing countries is considerably higher. These commonly range between 20 to 50% of total municipal recurrent expenditures (Cointreau, 2005). With the increase in contracting private sector to manage the municipal waste, the recurrent cost of managing

the MSW goes up, because of the need for reimbursement of the contracting companies for the capital investment they made.

Objective(s) of the Study

The aim of the present study is to develop economic model for improved municipal solid waste management in three selected cities in North-eastern Nigeria through the following objectives;

1. To estimate the households' socially optimal amount for solid waste management in the selected states in Northeast
2. To estimate the total economic benefit of improved solid waste in the selected states in Northeast

Review of Literature

Around the world, waste generation rates are rising. In 2016, the worlds' cities generated 2.01 billion tons of solid waste, amounting to a footprint of about 0.74 kilograms per person per day. With rapid population growth and urbanization, annual waste generation is expected to increase by 70% from 2016 levels to 3.40 billion tons in 2050. Residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste. In low-income countries, over 90% of waste is often disposed in unregulated dumps or openly burned which create serious health, safety, and environmental consequences, contributes to global climate change through methane generation, and can even promote urban violence (UNEP, 2013).

Municipal Solid Waste Management and the Use of Economic Tools

Economic tools for solid waste management ensure the financial sustainability of SWM services. The basic objective of economic instrument as a tool for effective solid waste management is that, it helps to cover logistics as well as other management costs that will ensure improved and effective service delivery (Hamisu et. al., 2017: Fujiwara & Campbell, 2011).

This approach influence behavior by the pricing mechanism, which usually leads to waste minimization, and strengthen resource recovery and recycling. Some of the characteristics of economic instrument include; instruments to create revenue for public authorities (Hamisu et. al., 2017: Ezebilo 2013). Typical revenue-creating instruments are user charges or taxes that serve to cover the costs of public environmental services, create revenues, and at the same time serve to create incentives for changing behavior (for example, to produce less waste). Also, economic instruments help to provide incentives to private companies in form of subsidies or tax exemptions for companies providing environmental services or products.

The need for economic tools to be part of solid waste management is necessary, as it create revenue for public authorities. SWM costs are rarely covered by local authorities in low and middle-income countries such as Nigeria. Investment costs tend to overshadow operation

and maintenance (O&M) costs in such a way that they ultimately seem insignificant. The need to upgrade SW collection, treatment and disposal infrastructure is widespread, but this will generate additional (capital and O&M) costs that will need to be met. Cost recovery is insufficient to really tackle the waste hierarchy, so the means for incentivizing waste management need to be found. Compared to other policy options, such as command-and-control measures or communication tools for behavioral change, economic incentives are usually the most efficient means for achieving sustainable waste management goal (Hamisu, *et. al.*, 2017: Gunsilius, 2012).

The study by Stretz, (2012), showed that economic instruments play an important role in the efforts of the Municipality of Maputo to improve service delivery and quality in Solid Waste Management. Without the significantly increased revenues the municipality would not have been able to sustain the improvements to service delivery that have been achieved in the last years. The experience shows that the goal of adequate waste service provision can only be accomplished when the three main components are developed together. These are suitably locally apt technical solutions, the economic instruments to sustain the services and the capacity of the institution to implement and sustain both.

The principle of economic instrument such as the cost benefit analysis requires that the economic cost is determined as the consumer surpluses or producer surpluses which are anticipated to happen at the long run for the baseline case or the 'without' situation, but are prevented under the 'with' policy option. On the other hand, consumer surpluses and/or producer derived from the 'with' options are refer to as 'economic benefit', which can be achieved by means of cost-benefit analysis (M. S. Ibrahim, *et. al.*, 2017: Hanley, Barbier, & Barbier, 2009). As obtained in the literature, so long as the economic gains from a planned policy surpass the economic costs, then that planned policy is expected to provide a welfare gain or net benefit to the society as well as overall enhancement in the economic efficiency of natural resource management in relation to the status quo (Hamisu, *et. al.*, 2017: James & Predo, 2015).

It is believed that the economic value of environmental goods and services when incorporated in policy analysis, it would aid in making a very sound policy decisions that would be in favor of sustainable environmental and resource management (Ghosh & Mondal, 2013). Thus, the economic valuation can often support wise solid waste development decisions, especially as a practice that provides the quantitative values of various environmental goods and their services, which do not have market value. Economic valuation can also help in making wise decisions concerning the use, allocation and management of solid waste. It also identifies the numerous benefits from efficient waste management options that improve human welfare (Do & Bennett, 2009).

Economic values of benefits are estimated in terms of the amount that people are willing to pay for the best policy options that improve their utility and wellbeing. Thus, use of economic instruments in municipal solid waste management in particular provides a guide for policymakers in making sound policies that reveal the relative importance of effective solid waste management (Hamisu *et. al.*, 2017: Do & Bennett, 2009). In situations where

economic instrument as tool for achieving sustainable solid waste management program is considered appropriate and important, the information provision supporting policy usually relies on benefits valuation method, or sometimes the benefit transfer (BT). In BT, the non-market values are transferred from particular studies that was conducted somewhere in a similar policy context. The aim is to inform environmental policy and decision-makers with a cost-effective alternative and inexpensive valuation technique, whose success depends on the availability of appropriate studies and values that the transfer process can performed (Hamisu, et. al., 2017: Brouwer, 2009).

Economic Valuation Technique for Non-Market Goods and Services

Valuation Technique is just a branch of environmental economics, which is aimed at allocating values for non-market goods and services which have no market prices. It is considered a difficult task; most economics have frequently been compelled for attempting to put a "price tag" on environmental resources. However, organisations responsible for resources protection and management most often make difficult decision that involve trade-off in allocating resources. These kinds of decision are economic decisions and are based to either be directly or indirectly on the general public values (Hamisu, et. al., 2017: Samdin, et. al., 2008).

The principal challenge associated with the application of standard economic technique to the provision of environmental goods, whether directly through public provision or indirectly through regulations, is the issue of assigning monetary value on the resources. Due to the fact that these goods are not usually bought and sold in the market, the real prices and sales information is not obtained more often. As such, economist developed several methods to value non-marketed goods and services consistent with the valuation of marketed goods (Hamisu et. al., 2017: Hanley and Splash, 1993).

The Contingent Valuation Method

Cooper 1993, describe applying dichotomous choice contingent valuation as a simple technique of data collection and having standard empirical models of estimating the economic values of natural environmental goods and services. WTP value of a hypothetical change of the environment resources can best be obtained through the questionnaire survey. Responses of WTP questionnaire survey can be used to estimate the net benefit of natural resources to the

DC-CVM is divided to single bounded and double bounded methods. Bishop and Heberlein 1979 was the first to apply the single bounded CVM. The method involves the determining of a range of bidding price of just a single bid indicating his/her maximum WTP for a particular good or service. This method only asked the respondents to state their "Yes or No" response to an offered bid amount (Shamsudin et. al., 2011; and Venkatachalam, 2003). Rollins et. al., (1997) in Henenman 1984 and Lee et al., (2009) in Carson 1985 introduce the modified version of DC-CVM called the double bounded dichotomous choice method. In

this method, one more bid is added to single bounded depending on the "Yes or No" response to the initial bid. Double bounded DC-CVM was first been applied by Carson and Steinberg (1990), Rollins et. al., (1997) and Amirnejad, et. al., (2006).

Single bounded DC-CVM in comparison with double bonded DC-CVM is easier to implement especially in data collection and estimation. However, Carlsson (2005) in hanenmann et. al., (1991) compare single bounded and the double bounded DC-CVM statistical efficiency and found that the single bounded is more efficient. But Monte Carlo studied (Marre et. al., 2015) argued that there is no any relevant difference between them. According to Yacob et. al., (2009) a single bounded DC-CVM is a 'take it or leave it (TIOLI) bid offer which is offered to respondents with only "Yes or No" option'. DC-CVM questions are easy to be answered by respondents than open-ended questions because the respondents are mostly familiar with discrete choices in their market transactions (Walker & Mondello 2007; Hanenmann et. al., 1994). Therefore, for the purpose of this study, the single bounded DC-CVM 'take it or leave it (TIOLI) bid offer option' was used to elicit respondent willingness to pay for an improve conservation of Yankari Game reserve, Bauchi Nigeria.

CVM is a method that provides individuals with the opportunity to purchase public goods under hypothetical situations, especially in the absence of real market or existing information concerning the real market scenario. It plays a significant role in the establishment of environmental policy (Adamu et. al., 2015). The CVM technique is applied in many fields including the protected areas (Majumdar et. al., 2011), endangered species conservation (Kotchen and Reiling, 2000), ecosystem services (Turner et. al., 1995), and also biodiversity conservation (Wang et. al., 2012). Other areas where CVM is gaining popularity include the improvement of water quality, energy systems, human health, land conservation and many of its applications in the field of outdoor recreation or ecotourism (Herath & Kennedy, 2004).

Logit Equation Model Derivation

Bateman et al., (2002) define cumulative density function as the observing probability of a special value of WTP or less in a sample population. The logistic curve is presented as non-linear with a WTP ranging from $B=0$ to $B=+\infty$. As the logistic function approaches one, the independent variable increases.

The data coefficients of the questionnaire variables would be derived through the analysis. Version 22.0 SPSS computer software will be used for the logistic analysis. Cameron, (1988) used the below formulae to estimate mean WTP;

$$\text{Mean WTP} = [\beta_0 + \sum \beta_k X_k] / (\beta_1)$$

B_0 = the estimated constant,

B_k as the coefficient estimated parameters,

X_k as the explanatory variable mean value, and,

B_1 as the estimated bid coefficient.

Methodology

Study Area and Population

The study area of the present study comprised of the states in the northeastern sub-region. The states include; Adamawa (4,902,100), Bauchi (8,649,800), Borno (6,111,500), Gombe (3,960,100), Taraba (3,609,800) and Yobe (3,649,600) state (NBS, 2022). These have an estimated population. Fig.1, is a map of Nigeria showing, the states in the northeastern sub-region.

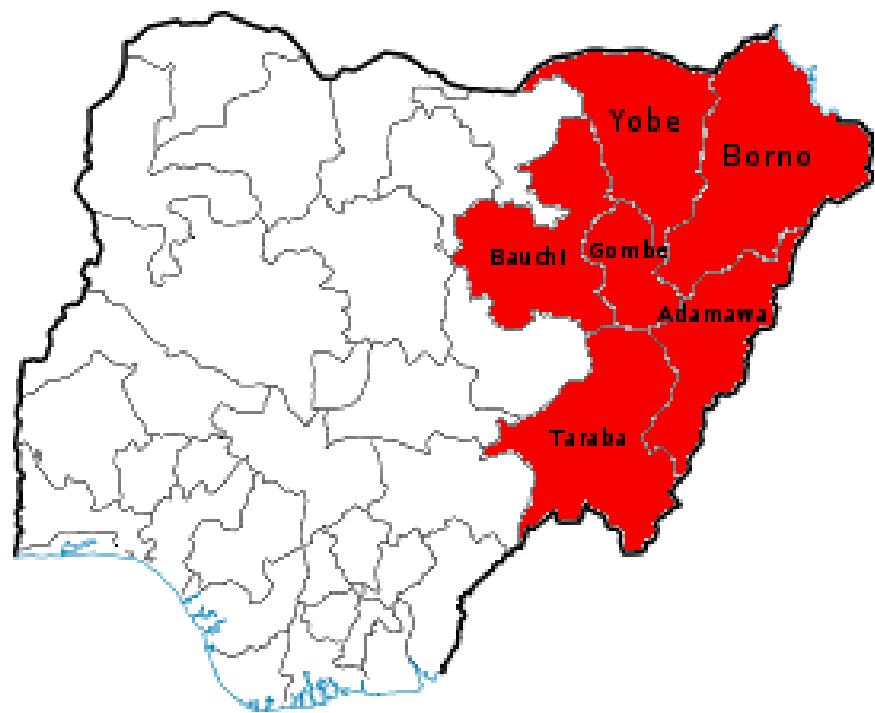


Fig.1 Map of the Study Area.

Population and Sampling

The population of this study comprised of residents of three (3) randomly selected states in the northeast, which include; Adamawa state (Yola, 414 households), Bauchi sate (Bauchi, 417 households) and Yobe state (Damaturu, 398 households) (NBS, 2016). From each state, the state capital is selected for the study. The sample size of the study would be determined using Krejcie and Morgan (1970), table of sampling at 95% confidence level, based on the total population of the selected states in the region. Table 3.1 shows the population of the state capital of each of the selected state. The total population of the study based on the projected population of the selected cities stand at 1,393,300. Furthermore, this study would employ multi-stage sampling techniques which involve the use of different probability sampling techniques (Teddlie & Yu, 2007). The essence of this method is to help minimize sampling bias (Sekaran, 2006).

Table 1. Population of the Study NBS 2022 Projection

State	State Capital	Sample +10%	Returned Questionnaires
Adamawa	Yola		
4,902,100	610,400	384+38= 422	414
Bauchi	Bauchi		
8,649,800	645,000	384+38= 422	418
Yobe	Damaturu		
3,649,600	137,900	384+38= 422	409
Total		1,266	1,241

NBS, 2022

Adamawa (4,902,100), Bauchi (8,649,800), Borno (6,111,500), Gombe (3,960,100), Taraba (3,609,800) and Yobe (3,649,600) state (NBS, 2022). Whereas the state capital population of Yola is 610,400, Bauchi is 645,000 and Damaturu is 137,900 (NBS, 2022).

Data Source and Instrument Design

Data collection will be majorly from primary source, notably a structured questionnaire. Secondary data would also be sourced inform of images for the GIS/Remote sensing analyses.

Sample Size

The NOAA panel recommended face-to-face interview mode was used in the elicitation of the 422 samples at each of the three (3) state capitals. The Krejcie and Morgan (1979) sample size table was applied in determining the sample size. However, 38 (10%) additional questionnaires were added to the 384 drawn samples of each state capital to curtail questionnaire rejection or poor return rate (Ismail, 1992). Therefore, the total sample of each state capital is 422 while the grand total is 1,266 and the total number of returned questionnaires is 1,241 (Adamawa 414, Bauchi 418 and Yobe 409).

Sampling Technique

The study deploys multi-stage sampling techniques which involve the use of different probability sampling techniques (Teddle & Yu, 2007). The essence of this method is to help minimize sampling bias (Sekaran, 2006).

Data Collection

The face-to-face questionnaire interview was used in eliciting the study data and 1,266 respondents were interviewed, but only **1,241** valid responses were obtained after treatment of outliers, missing cases of vital information on vital questions.

Instrument Design

The structured Questionnaire survey method of data elicitation has been declared to be the

foremost tool used in quantitative studies (Wang et al., 2015; Ware et al., 2000) that elicit responds from respondents either by writing their views or by selecting from a given alternatives (Coombe & Davidson, 2015; Kerr & Churchill, 2001). And the “take it or leave it (TIOLI)” Yes or No option were given to the respondents to indicate their WTP and is adjudge to be easier to answer (Yacob et. al., 2009).

Results and Discussion

Socio-Demographic Profile of the Respondents

The respondent's socio demographic characteristics result is presented in table 1, with Male respondents constituting of Yola 331 (79.9%), Bauchi 342 (81.9%) and Damaturu 321 (78.5%) while that of female is Yola 83 (20.1%), Bauchi 76 (18.1%) and Damaturu 88 (21.5%) respondents. Which can be linked to the socio cultural and religious belief of Muslims of northeastern Nigeria that mostly prevent their wives and female associate from staying outdoors and taking part on social activities.

The age mean score of the respondents is 35 years, respondents age ranging from 18-25 years constitute of Yola 40 (9.7%), Bauchi 34 (8.1%) and Damaturu 103 (25.2%), respondents that fall within the age range of 26-35 years are Yola 143 (34.5%), Bauchi 126 (30.9%) and Damaturu 119 (28.1%), while respondents fall within the range of 36-45 years Yola 106 (25.6%), Bauchi 151 (37.5%) and Damaturu 114 (27.9%), whereas Yola 106 (25.6%), Bauchi 151 (37.5%) and Damaturu 114 (27.9%) and Yola 60 (14.4%), Bauchi 47 (11.2%) and Damaturu 20 (4.9%) fall within the range of 46-55 years and 56 and above years respectively.

From result shows that the respondent's marital status are married respondents constitute of Yola 331 (79.9%), Bauchi 343 (82.1%) and Damaturu 363 (88.8%) while the non-married (singles) are Yola 83 (9.4%), Bauchi 75 (17.9%) and Damaturu 46 (11.2%).

The respondent level of education indicates that Yola 43 (10.3%), Bauchi 35 (8.4%) and Damaturu 43 (10.3%) attended a non-formal type of education, those with primary qualification were Yola 81 (19.6%), Bauchi 87 (20.8%) and Damaturu 83 (20.3%), Yola 156 (37.7%), Bauchi 98 (23.4%) and Damaturu 137 (33.5%) respondents have secondary school qualification which constitute majority of the research respondents. Those that attended colleges, polytechnics and university (tertiary education) constitute only Yola 134 (67.6%), Bauchi 198 (47.4%) and Damaturu 147 (35.9%) of the respondents which may likely positively influence their consciousness based on awareness and knowledge on choosing “YES”.

The result of the occupational status of the respondents shows that Yola 138 (33.3%), Bauchi 172 (41.1%) and Damaturu 143 (39.9%) are been employed by government while those that are self-employed were Yola 121 (29.2%), Bauchi 118 (28.2%) and Damaturu 139 (33.9%). Yola 55 (13.2%), Bauchi 9 (2.2%) and Damaturu 68 (16.6%) of the respondents are farmers while unemployed and retirees constitute of Yola 51 (12.3%), Bauchi 41 (12.2%) and Damaturu 41 (10%) and Yola 49 (11.8%), Bauchi 78 (11.7%) and Damaturu 18 (4.4%) of the total survey respondents respectively.

The respondents gross monthly income indicates that Yola 8 (1.9%), Bauchi 7 (1.6%) and Damaturu 4 (0.9%) earn between N10,000-N20,000 monthly, those that earn between N21,000-N30,000 were Yola 28 (6.7%), Bauchi 56 (13.4%) and Damaturu 9 (2.2%) while those within the range of N31,000-N40,000 were Yola 94 (22.7%), Bauchi 67 (16%) and Damaturu 77 (18.8%) respondents and N41,000-N50,000 were Yola 121 (29.2%), Bauchi 116 (27.7%) and Damaturu 153 (37.4%) of the respondents. Respondents with the highest monthly income of N51,000 above constitute only Yola 157 (37.9%), Bauchi 172 (41.1%) and Damaturu 166 (40.5%) of the survey respondents. The mean score of gross monthly income of the respondents from the result analysis is N35,255.

Table 2. Socio-Economic Background of the Respondents

Element	Yola		Bauchi		Damaturu	
	Freq.	%	Freq.	%	Freq.	%
Gender						
Male	331	79.9	342	81.9	321	78.5
Female	83	20.1	76	18.1	88	21.5
Age						
18-25	40	9.7	34	8.1	103	25.2
26-35	143	34.5	129	30.9	119	28.1
36-45	106	25.6	151	37.5	114	27.9
46-55	75	18.1	57	13.6	53	12.9
56 and above	60	14.4	47	11.2	20	4.9
Marital status						
Single	331	79.9	343	82.1	363	88.8
Married	83	9.4	75	17.9	46	11.2
Educational level						
Non formal	43	10.3	35	8.4	42	10.3
Primary	81	19.6	87	20.8	83	20.3
Secondary	156	37.7	98	23.4	137	33.5
Tertiary	134	67.6	198	47.4	147	35.9
Occupation						
Government	138	33.3	172	41.1	143	39.9
Self-employed	121	29.2	118	28.2	139	33.9
Farmers	55	13.2	9	2.2	68	16.6
Unemployed	51	12.3	41	12.2	41	10
Retiree	49	11.8	78	11.7	18	4.4
Level of Income						
N10,000-N20,000	8	1.9	7	1.6	4	0.9
N21,000-N30,000	28	6.7	56	13.4	9	2.2

N 31,000- N 40,000	94	22.7	67	16	77	18.8
N 41,000- N 50,000	121	29.2	116	27.7	153	37.4
N 51,000 and above	157	37.9	172	41.1	166	40.5

Field Survey, 2023

Respondents Willingness to Pay

Among the total number of 1,266 questionnaires were distributed to the respondents and interviewed during the study, 1,241 (Adamawa 414, Bauchi 418 and Yobe 409) were retrieved back fully answered. 1,241(98%) respondents indicates that they are willing to pay by choosing "Yes" that they are willing to pay for improved solid waste collection based on the reasons offered to them and the remaining 25(2%) responded protested "No" that they are not willing to pay. The result summary of the respondent's willingness to pay section is presented in table 3.

Table 3. Willingness To Pay Response

State	Yes		No		Total	
	Freq.	(%)	Freq.	(%)	Freq.	(%)
Adamawa	367	88.7	47	11.3	414	98.3
Bauchi	359	85.9	58	14.1	418	99.2
Yobe	376	91.8	33	8.2	409	97

Field Survey, 2023

Reasons for the Respondent's Willingness to Pay

Existence value was the major reason that the respondents gave for their willingness to pay with about 437 (39.7) (Yola 147, Bauchi 139 and Damaturu 151) saying that they are willing to pay for cleaner neighborhood and, 287 (26.2%) (Yola 79, Bauchi 112 and Damaturu 96) respondents stated that they are willing to pay because the amount is minor, they can afford it. Other reasons offered for willingness to pay are, for sustainable Solid waste management is everybody's business, I don't want waste in my area and waste has health effect to us 180 (16.3%) (Yola 70, Bauchi 56 and Damaturu 54), 122 (11%) (Yola 48, Bauchi 32 and Damaturu 42) and 68 (6.1%) (Yola 25, Bauchi 20 and Damaturu 23) respondents accordingly.

Reasons for the Respondent's Not Willingness to Pay

However, from the "No" responses of 54 (39.1%) (Yola 19, Bauchi 22 and Damaturu 13) that are not willing to pay for the improved solid waste management they said is Government is responsible for waste management, 37 (26.8%) (Yola 13, Bauchi 15 and Damaturu 9) said this will not solve the problem of solid waste in my area, while 25 (18.1%) (Yola 8, Bauchi 11 and Damaturu 6) states that they the programme will add economic burden to households. I already pay enough through taxes is another reason that the respondent gave for not

willing to pay with 15 (10.9%) (Yola 4, Bauchi 7 and Damaturu 4) respondents. Having no interest in solid waste management is the less response given for not willing to pay for improves conservation of the reserve with about 6 (4.3%) (Yola 2, Bauchi 3 and Damaturu 1) respondents.

Respondents Willingness to Pay for Door-to-Door Solid Waste Collection

Base on the 1,266 questionnaires distributed to the respondents and interviewed during this study, 1,241 (Adamawa 414, Bauchi 418 and Yobe 409) were fully answered and retrieved. 1,241(98%) respondents indicates that they are willing to pay by choosing "Yes" that they are willing to pay for improved solid waste collection based on the reasons offered to them and the remaining 25(2%) responded protested "No" that they are not willing to pay. The result summary of the respondent's willingness to pay section is presented in table 4. For the initial bid amount offered. N 1,000, 417 responses were obtained and those that indicate "Yes" to the bid amount are Yola 113 (27.1%), Bauchi 122 (29.2%) and Damaturu 113 (27.1%), while those that indicate "No" are only Yola 26 (6.1%), Bauchi 19 (4.5%) and Damaturu 24 (5.7%) showing their unwilling to pay the amount for improve conservation of Yankari game reserve. The second bid amount is N 2,000 and 411 questionnaires were returned and fully answered, out of which Yola 96 (23.6%), Bauchi 91 (22.1%) and Damaturu 96 (23.3%) said "Yes" they are willing to pay and Yola 41 (9.9%), Bauchi 48 (11.7%) and Damaturu 39 (9.5%) respondents said "No". for the third bid amount of N3,000, 413 answered questionnaires were retrieved out of which Yola 86 (20.8%), Bauchi 82 (19.8%) and Damaturu 87 (21.1%) were willing to pay by saying "Yes", whereas "No" respondents are Yola 52 (12.6%), Bauchi 56 (13.5%) and Damaturu 50 (12.1%).

The willingness to pay response here revealed that the more there is increase in bid amount, the lower the "Yes" response from the respondents which is in line with the economic theory of demand (Kim et al., 2007; Alberini et al., 2003; Cooper, 1993).

Table 4. Summary of Willingness to Pay for Door-to-Door Solid Waste Collection Base on Bids

	Yola				Bauchi				Damaturu					
Bid Amou nt	Yes		No		Yes		No		Yes		No		Total	
	Fre q.	(%)	Fre q.	(%)	Fre q.	(%)	Fre q.	(%)	Fre q.	(%)	Fre q.	(%)	Fre q.	(%)
N 1000	113	27.1	26	6.1	122	29.2	19	4.5	113	27.1	24	5.7	417	33.6
N 2000	96	23.6	41	9.9	91	22.1	48	11.7	96	23.3	39	9.5	411	33.1
N 3000	86	20.8	52	12.6	82	19.8	56	13.5	87	21.1	50	12.1	413	33.3

Field Survey, 2023

Logit Regression Model

Based on the model result has been present in table 5 those five (5) independent variables are found to be significant at varying levels, and all the five (5) variables have a coefficient, marginal effect and significant level (P value). The coefficient of each variable is entailing two (2) vital information of sign and weight.

In a situation where by the coefficient has a negative sign, it is entailing an inverse relationship between the said variable and the WTP. Coefficient weight on the other hand is the coefficient value that presents the level of strength of the variable in determining the WTP.

All of the five (5) variables of Age, level of Education, income per month, and Bids (1,000, 2,000 and 3,000) have positive coefficient at varying weight.

Age of respondents is an important variable that is used in determining WTP in this model. The result finding indicates that age of respondents has a positive coefficient with weight of .073392233 and found to be significant at 1% confidence level. The finding indicates that as the age of respondents increase, their WTP also increase. Therefore, older people among the respondents have higher WTP than younger once. Scholarly, positive and significant relationship between age and WTP as said by Kim t al., (2012) and Bhandari and Heshmati, (2010) with divergent views with other scholars such as Montes, Benayas and Marti, (2007) and Reynisdottir et al., (2008).

The next variable that has most effect on WTP is the years or educational of the respondents, which have a positive coefficient value with weight of .13117622 and statistically significant at 1% confidence level. The positivity of the coefficient indicates that those respondents with higher level of education are more willing to pay for door-to-door solid waste collection and management than those with lower level of education. The result output is signifying that educated people have more knowledge and awareness and are believed to have more information on the dangers of solid waste than those with lower level of education. Therefore, influence of education on WTP is been reported by researchers such as Wang and Jia (2012).

The next important variable in the WTP model is the income of the respondents, which also have a positive coefficient of 79188D-04 and significant at 1% confidence level. It is clearly depicted from the model that as the respondents' income increase, their willingness to pay also increases. This indicates that, respondents with higher level of income have higher positivity of WTP than those with lower level income. This finding is in cognizance with many related findings of determining WTP (Bailey & Aksen 2015, Wang and Jia, 2012), Bhandiri and Heshmati, 2010; Reyinisdottir et al., 2008 and Kim, Wong and Cho, 2007).

Finally, the fifth variable is the WTP Bid amount (1,000, 2,000 and 3,000). Bid amount carries a negative sign on its co efficient weight at -.00141143 as expected and significance at 1% confidence level. As said earlier, a negative (-) sign is entailing inverse relationship between the variable and WTP bid. This simply means that as the WTP bid amount increases, the choice of the WTP is decreasing by the respondents. Therefore, the higher the increase in

bid amount the lower the possibility response to accept by the respondents willingness to pay (Baral et. al., 2008; Loomis, et. al., 2000).

Table 5. Result of Logit Regression Model

Variable	Coefficient	Standard Error	Marginal Effect	P-Value
CONSTANT	-4.18999241	.80355890	-4.645	.0000
AGE	.073392233	.01494674	4.140	.0000
BIDS	-.00141143	.00031568	-5.923	.0000
EDU_YRS	.13117622	.03562903	3.003	.0001
INC	.79188D-04	.171504D-04	6.913	.0000
Number of observations			1,242	
Log likelihood function			-161.704	
Mcfadden Pseudo E-squared			.41762	
Percentage correct prediction			89.093	

Field Survey, 2023. Note: *Significance at 1%, **Significance at 5%, *Significance at 10%**

The Estimation of Mean Willingness to Pay for Improve Conservation of YGR

The single bounded dichotomous choice of contingent valuation method (DC-CVM) was employed for the purpose of this study, therefore the result outcome will be in dichotomous state of two (2), either the respondent is willing to pay by choosing "Yes" option for the offered bid or not willing to pay the offer bid by choosing "No" to the question. The mean willingness to pay is calculated using the logit regression result using the mean willingness to pay derived equation stated in the previous chapter. Nigerian naira (N) is the unit currency used for the monetary estimation.

The Mean Willingness to Pay for Improve Conservation

The mean WTP amount estimated using the logit regression model was calculated using the equation formulae,

$$\text{Mean WTP} = [\beta_0 + \sum \beta_2 X_2 \dots \beta_k X_k] / (\beta_1)$$

The mean Willingness to pay for the respondents for the improve door-to-door solid waste collection is estimated at about N1550.75 This amount indicates that the respondents are willing to pay higher than the highest bid amount so that solid waste can be managed appropriately in table 3 and Table 4.

Aggregate Value of Improve Conservation of YGR

Richer (1995) method of estimating aggregate value based on multiplying the mean Willingness to pay value obtained from the logit model estimation by the number of households in the area of the study. The total households in study area based on the Nigeria National Bureau of statistics (2022) is found to be 1,393,300, the estimated mean

willingness to pay is N1,556.75. The total aggregate WTP for improve door-to-door solid waste collection and management is estimated as N2,160,659,975.

Conclusion

These study employed dichotomous choice contingent valuation method in estimating the households mean willingness to pay and total aggregate benefit for improve door-to-door solid waste collection base on their income level, age, education level and the result shows that majority of the household response entails their willingness to pay towards the door-to-door solid waste collection and management. The results finding were very credible because it passes the minimal test of theoretical validity behind the reliability of CVM. Venkatachalam, (2004) stated that CVM results can be said to be theoretically valid if they are in conformity with the underlying principles of the economic theory.

The logit estimation models with socio-demographic variables shows that the "YES" probability response was significantly correlated (positively) with the household respondents age, level of education, income level and negatively correlated with the offered bid price (1,000, 2,000 and 3,000) while Mitchell and Carson (1989) confirm that the theoretical validity of CVM studies needs the assessment of willingness to pay (WTP) values by regressing them against the standard socioeconomic variables. Thus, the outcome of this study justified that the validity of the result can help in identifying the significant of the determinants of the willingness to pay.

This study finding entails that elderly respondent who have attended tertiary level of education and have higher income level constitutes the target market that would be willing to pay for door-to-door solid waste collection and management. This study finding is aim at providing a useful and important policy guide by revealing the importance of economic valuation within the context of solid waste management for the development of a sound environmental policies and strategies that would help to identify the important of household opinion in decision making both socially, economically as well as in developmental and planning purposes for sustainable community development.

Finally, this study finding will contribute to the ever growing existing literature of contingent valuation method for waste management, more especially in developing countries such as Nigeria. The amount paid by the households will serve in job creation to our teaming unemployed youths and also fill gap of poor funding created by government in management waste collection and proffer a better handling and management.

Recommendations

Based on this study and findings, there is need for expanding of horizon of such studies and also creating an improvement in the level of the general population awareness on the need for improved solid waste management from source in other to have a safer and sustainable environment. Also, there is need for comparing the result of this study with that of other valuation studies on the same subject matter so as to have a more comprehensive and optimal questionnaire instrument were an ideal WTP will be estimated.

Finally, further studies of such kind can be transferred to other cities and the result can be used to determine benefit transfer and it is recommended that other valuation techniques such as Pair Wise Comparison, Choice Modeling, Contingent Rating and Contingent Ranking could aid in comparing the result which will lead to the obtaining of a more valid and reliable result.

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