



## WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE COLLECTION AMONGST DIFFERENT INCOME GROUP IN MAIDUGURI

Abdullahi Shittu Ibrahim<sup>1</sup>, Shehu Usman Adam<sup>2</sup>, Yakaka Bukar Maina<sup>3</sup>, Musa Talba Jibir<sup>4</sup>,  
Abbas Ahmadu Tsala<sup>5</sup> and Hamid Mamud Kwairanga<sup>6</sup>

<sup>1,2,3,4,6</sup>Department of Economics, Faculty of Social Sciences, University of Maiduguri

<sup>5</sup>National Open University of Nigeria, Maiduguri Study Centre

### Abstract

*This study analyzed households' willingness to pay for improved solid waste collection amongst different income groups in Maiduguri metropolis Borno state, Nigeria. Data were obtained through the use of structured questionnaires (Kobo Toolbox). Stratified sampling was used in a Multistage fashion whereby in the first stage, the wards in Maiduguri were grouped into low income, middle and high income. Furthermore, 6 wards were randomly selected from a total of 15 wards in the study area. Finally, 1,206 households' heads were randomly selected with 402 questionnaires administered to each income group. Open-ended contingent valuation method (CVM) and descriptive statistics were used. It was found out on average that households from the high income areas are willing to pay ₦2478.4, ₦1565.55 in middle income areas and ₦1,263.2 Low income neighborhood accordingly. Although, as observed, households in the study areas practiced improper waste management but their opinion on environmental concern is positive. The study recommends that the municipality should formerly partner with private wastes collectors to ensure wider coverage and efficiency in the wastes services value chain as it provide a foundation for the setting up of solid waste collection fees by the municipal and some well-equipped wastes collection firms given the fact that households' heads have willingness to pay for improved waste collection.*

### Keywords:

Willingness to pay  
Solid waste  
Contingent valuation  
Income groups  
Households

### JEL Classification:

### Corresponding author

Abdullahi Shittu Ibrahim  
Phone NO: 08034043781



## 1. Introduction

One fundamental problem facing cities worldwide is how to come up with a viable and visible waste management system (Julius, Charles & Shylet, 2017). Although, most developing countries are battling with the

menace, the developed countries are still improving on their existing strategy as the problems increases with increasing population, industrialization and urbanization which in turn influences rural-urban influx (Oyedotun, Kasim,

Famewo, Oyedotun, Moonsammy, Ally & Renn-Moonsammy, 2020).

Developing countries have been facing a great deal of problems in managing municipal solid waste (Alhassan, Asante, Oteng-Ababio, & Bawakyillenuo, 2017). It is indeed one of the developmental challenges facing city authorities worldwide, especially in most developing countries (United Nations Environment Programme, & International Resource Panel, 2013). In Africa for example, there has been deficit in organized waste collectors, huge waste generation, poor waste treatment and lack of safe waste disposal. It is currently estimated that solid waste generation is growing faster in urban areas than the rate urbanization (Ayenew *et al.*, 2019). These challenges, if not addressed may lead to serious health hazard, environmental problem and poor societal outlook.

In sub-Saharan Africa, waste generation is about 62 million tons per year ranging from 0.09 to 3.0 kg per person per day, with an average of 0.65 kg/capita/day (Hoorweg & Bhada-Tata, 2012; Mombo & Bigirwa, 2017). Thus, waste management requires a large expenditure of about 20–50 percent of municipal operational budgets (World Bank 2022). However, cities collect only half of the wastes generated (Gedefaw, 2015). Nigeria as the most populous nation in Africa with over 170 million people (National Population Commission, 2016), There is no doubt that this large population will generate a huge amount of waste which mostly come from the urban areas (Adam, Shamsudin, Sidique, Rahim, & Radam, 2015). Furthermore, many metropolises are faced with the tribulations of rapid expansion as a result of population increase. This has brought about increase in the stretch of urban infrastructural facilities (Adam *et al.*, 2015). Hence this development has also affected the existing facilities because they could not meet the current predicament (Ayenew, Tilahun, Erifo & Tesfaye, 2019). Moreover, the country has not been particularly apprehensive about waste

management. Solid waste is not managed properly; due to inefficient collection, inappropriate disposal of the waste and no enough coverage of the collection amongst others (Buba, 2016). In fact, open dumping as well as open burning in unapproved location has been a norm (Dhungana, 2017).

Although there is no formal arrangement with the private sector in waste management in most cities of Nigeria; as a result, managing solid waste has been the responsibility of government agencies but, it is a popular opinion that only a minimal fraction of the waste are collected (Mukhtar & Akan, 2018). This has left a big junk of waste in residential environment, making it looks unattractive and unhealthy. These challenges include cities like Lagos, Port Harcourt, Abuja, Kano, and Kaduna amongst others, in spite the fact that, there are some presences of formal private waste collectors (Saleh & Marzuki 2022).

In Maiduguri, the agency saddled with the responsibility of managing solid waste is Borno State Environmental Protection Agency (BOSEPA) (Mukhtar & Akan, 2018). Basically, BOSEPA as government agency is established to manage solid waste generated within Borno state with much emphasis on Maiduguri Metropolis. This agency faces several challenges including inadequate funding, corruption and bureaucratic red-tapeism among others (Mukhtar & Akan, 2018).

Maiduguri metropolis has over the year witness an increase in population size and there is no doubt that this will lead to increase in waste generated by Households. Households are considered as the major contributors of solid waste and by far the most affected (Amoah, 2018). Conducive environment is no doubt a major factor in estimating the standard of living; as such societies may strive to pursuit a friendlier environment (Gedefaw, 2015). The economic value of non-market environmental goods and services are measured in terms of “willingness to pay” (WTP), although, non-market

environmental goods and services are not traded in a real market (Usman, 2014). WTP is often attributed to environmental economists to describe the value of environmental goods and services, when they actually make any payment or not (Barbier, Acreman & Knowler, 1997). Since WTP involves market valuation of environmental good therefore, it may be attributed to income. The National Bureau of Statistics in its publication; Snapshot of inequality in Nigeria, has identified three income groups; low, middle and upper income (NBS, 2018).

However, this research is necessary because of the level of unsafe and unhealthy waste disposal practice adopted by residents and for the fact that, Private formal waste collection service is still at the infancy level within Maiduguri Metropolis. Muktar and Akan (2018) highlighted the challenges faced by residents and BOSEPA with respect to waste management in Maisansandari neighborhood of Maiduguri metropolis, Borno state. But, to further mitigate the menace of waste management, it is also important to know households willingness to pay for improved waste collection service with the intention of showing how different income groups determine households' willingness to have a clean and serene environment, forecasting how much could be generated from waste management value chain and to motivate the spring up of private waste collectors in Maiduguri metropolis. The aim of this study is to estimate the mean willingness to pay for improved solid waste collection amongst different households in Maiduguri Metropolis.

## 2. Methodology

At first a Multi stage sample techniques was used to group the wards into income groups out of which we have two high income wards and two wards were selected from respective middle and low income groups at random. Taking the respective sample of cumulative households across income group using the Mitchell and

Carson (1989) formula for sample size determination and adding the suggested 10%, a sample size of 399 was obtained in high income areas, 390 in middle income areas and 390 in low income areas accordingly. In other to have an equal amount of response to each version of questionnaire, knowing well that questionnaire for each income groups has three versions and since the calculated sample sizes for each groups appears not to have varied too much, the sample size that would have been approximated for 400 was approximated for 402 so that each version will have equal amount of questionnaires (134 questionnaires for each version). To select respondents at random, the Yarwa Primary Health Care Clinic Immunization register for houses within Maiduguri metropolis was used after which, excel random number generator was used to select 1206 house numbers of respondent for the selected wards making a total of 402 respondents for each income group.

Primary data was used for the study. The primary data was generated through the use of structured questionnaire, which will cover socio-demographic characteristics of households such as; age, gender, household size, household income category, house ownership, housing type, educational level, occupation, marital status, house ownership and duration of stay in present area, method of waste disposal and level of environmental concern (Usman, 2014). Each respondent stated how much he/ she was willing to pay for the improved solid waste collection after he/she most have been presented with a hypothetical solid waste market attributes (Sizya, 2015).

The structured questionnaires stored online (Kobo Toolbox) has three sections; section one contained concern about the environment, the second section contained willingness to pay question and the third section have question on socio-demographic characteristic of respondents (Adam et al., 2015).

All respondents gave verbal consent to participate in the study before administering the

questionnaire (Yoad, Chirawurah & Adongo, 2014). With the aid of trained Enumerators and immunization ad hoc staffs, selected households were administered the questionnaire. The questions were read out to the respondents in the language they were more comfortable with (Oyedotun *et al.*, 2020). The hypothetical scenario and willingness to pay questions were offered in the introductory part of section two of the questionnaire before socio-demographic questions (Adam *et al.*, 2015). A collection system, in which the households would be issued a state of the art heavy duty wheeler bin in his/her house for collection on a specified day of the week for proper disposal but with a monthly payment schedule while assuring them of a clean serene and a disease free environment was explicitly presented (Usman, 2014).

### 2.1 Willingness to Pay (WTP) using Contingent Valuation Method

WTP for solid waste collection was estimated using Contingency Valuation method while describing households' willingness to pay using area of histogram. The method is regarded as one method in measuring WTP using the Contingency Valuation approaches as such; descriptive statistics was used to analyze findings of the study.

## 3. Results

### 3.1 Socio-demographic Characteristics of Respondents

Frequencies and percentages were toiled out for meaningful interpretation of results. The various socio-demographic characteristic of respondents in High, Middle and Low income areas are presented in table 2 thus;

Table 1: Socio-demographic Characteristics of Respondents

Variables	Category	High Income Frequency(%)	Frequency(%)	Low Income Frequency(%)
Gender	Male	322 (80.1)	290 (72.9)	320 (79.6)
	Female	80 (19.9)	112 (27.1)	82 (20.4)
Age	Mean Age	45.71	44.34	33.94
Education	Never been to School	14 (3.5)	48 (11.9)	49 (12.2)
	Primary School	12 (3.0)	31 (7.7)	474 (10.9)
	Secondary School	36 (9.0)	25 (8.7)	49 (12.2)
	Diploma	93 (23.1)	107 (26.6)	122 (30.3)
	University	228 (56.7)	125 (31.1)	95 (23.6)
	Qur'an	19 (4.7)	56 (13.9)	43 (10.7)
Occupation	Government Worker	167 (41.5)	88 (21.9)	90 (22.4)
	Private Sector	66 (16.4)	59 (14.7)	63 (15.7)
	Pension	23 (5.7)	11 (2.7)	11 (2.7)
	Self Employed	118 (29.4)	210 (52.2)	181 (45.0)
	Housewife	14 (3.5)	14 (3.5)	12 (3.0)
	Unemployed	14 (3.5)	20 (5.0)	45 (11.2)
Households Size	Mean Household size	6.33	5.48	6.65
Households members age more 18	Mean Households members age more 18	0.67	0.62	0.67

Income of Households members age more 18	Mean Income of Households members age more 18	45914.18	37341.29	42705.47
Income Category	Income Category			
	₦0-₦50000	47 (11.7)	124 (30.8)	161 (40)
	₦51000-₦100000	117 (29.1)	186 (46.3)	139 (34.6)
	₦101000-₦150000	86 (21.4)	55 (13.7)	24 (6.0)
	₦151000-₦200000	84 (20.9)	15 (3.7)	53 (13.2)
	₦200000 and Above	68 (16.9)	22 (5.5)	25 (6.2)
Marital Status	Single	19 (4.7)	28 (7.0)	29 (7.2)
	Married	346 (86.1)	322 (80.1)	316 (78.6)
	Widow	25 (16.2)	26 (6.5)	33 (8.2)
	Divorced	12 (3.0)	26 (6.5)	24 (6.0)

Source: Field Survey, 2022.

Gender as described in Table 1a shows that, 80.1% of the respondents were male in high income wards while 72.9% male was recorded in middle income wards and likewise in the low income areas the result follow suit with 79.6%. This finding is in consonance with the study of John (2015). The mean age of respondents in high income areas is 45.71 while that of middle income is 44.35 and the low income has 33.94 as the mean age. The low income areas have a

relative younger households' heads than the middle and high incomes areas. Respondents level of education in high income areas is university education at 56.7% and 31.1% of respondents in middle income areas also has education up to university level while, on the contrary 30.3% respondents has Diploma as their highest level of education in low income areas.

Table 1 Continuation of Socio-Demographic Characteristics of Respondents

Variables	Category	High Income Frequency(%)	Middle income Frequency(%)	Low Income Frequency(%)
Do Belong to any Environmental Organisation	Yes	13 (3.2)	12 (3.0)	8 (2.0)
	No	389 (96.8)	390 (97.0)	394 (98.0)
Disposal Concern	Father	251 (62.4)	222 (55.2)	258 (64.2)
	Mother	72 (17.9)	123 (30.6)	91 (22.6)
	Children	20 (5.0)	33 (8.2)	8 (2.0)
	All	59 (14.7)	24 (6.0)	45 (11.2)
House Ownership	Owners	292 (72.6)	257 (63.9)	280 (69.7)
	Rent	110 (27.4)	145 (36.1)	122 (30.3)
House Rent	Mean House Rent	53,109.45	35,283.88	21,119.40
Numbers of room	Mean Numbers of room	2.73	2.18	2.81
Hosing Type	Four bed rooms flat and above	100 (24.9)	21 (5.2)	16 (4.0)

	Three and two bed rooms flat	215 (53.5)	190 (47.3)	89 (22.1)
	One bed room	57 (14.2)	99 (24.6)	79 (19.7)
	Others	30 (7.5)	92 (22.9)	218 (54.2)
Duration of stay in current location	Mean Duration of stay in current location	12.21	11.25	12.90

Source: Field Survey, 2022.

Respondents in high income areas are government workers with 41.5%, while both respondents from the middle and low income households are self-employed with 52.2% and 45.0% with some more relatively lower government workers of 21.9% and 22.4% respectively. The high income areas has an average households size of 6.33, the middle income has an average of 5.48 households size while the low income has 6.65 households size respectively and this is slightly above the Nigerian national average of 5.0 households' sizes.

On the average both, low and high income households have at least 0.67 household members that is gainfully employed while the middle income households has 0.62 households' members who are gainfully employed and those households' members gainfully employed has an average income of ₦45,914.18, ₦37,341.29 and ₦42,705.47 in both high, middle and low income households' within the study area.

As shown on table 1a, a significant number of the respondents in both high and middle income areas fall between the income group of ₦51000-₦100000 with 29.1% and 46.3%. Meanwhile, low income Households has 40% of respondents falling between the income groups of 0-₦50000 as the households' heads income category. However, 86.1%, 80.1% and 78.6% of respondents are married across income groups and this is due to the fact that majority of households' head are between the marriageable ages also cohabiting or single household are rarely found in the study area. 96.8% do not belongs to any environmental organisation in

high income areas, 97.0% in middle income areas and 98.0% in low income areas.

All respondents across income groups got father as the major person concern with solid wastes disposal with percentage of 62.4%, 55.2% and 64.2% in that order. While mother have the second highest percentages of 17.9%, 30.6% and 22.6% in accordance to high, middle and low income groups.

Also, 72.6% of respondents in high income areas owned their apartments likewise 63.9% for middle income and low income areas at 69.7%. The average rent in high income community is 53,109.45, while the middle income area is 35,283.88 meanwhile in the low income wards is 21,119.40. The numbers of rooms on average is 2.73 in high incomes areas, 2.18 in middle incomes areas and 2.81 low income areas. The high and middle income communities have three and two bed rooms' flats at 53.5% and 47.3% while low income community has others with the highest percentage at 54.2%. An average of 12.21 years was found to be the minimum duration of stay in high income areas and 11.25 years in middle income areas so also 12.90 years in low incomes areas was recorded successfully.

### 3.2 Environmental Concern

The environment influences our lives and should be treated with much concern. Concern with respect to environment, entail whether one is particularly adhesive or not about environmental qualities such as, clean air, density, waste disposal, climate change, green house emission and above all global warming.

**Table 2 Households Environment Concern Opinion**

<b>Variables</b>	<b>High Income Frequency(%)</b>	<b>Low Income Frequency(%)</b>	<b>Middle Income Frequency(%)</b>
Happy to be in an environment clean of solid waste			
Strongly Agree	277 (68.9)	224 (55.7)	129(32.1)
Agree	94 (23.4)	121 (30.1)	207(51.5)
Neither agree nor disagree	30 (7.5)	40 (10.0)	50(12.4)
Strongly Disagree	1 (0.2)	15 (3.7)	16(4.0)
Disagree	0 (0)	2 (0.5)	0(0)
When unhappy, I find comfort In environmental beauty			
Strongly Agree	148 (36.8)	122 (30.3)	88(27.4)
Agree	190 (47.3)	180 (44.8)	248(50.7)
Neither agree nor disagree	54 (13.4)	66 (16.4)	52(18.2)
Strongly Disagree	9 (2.2)	32 (8.0)	12(3.0)
Disagree	1 (0.2)	2 (0.5)	2(0.5)
Sad to see the environment polluted by solid waste			
Strongly Agree	149 (37.1)	143 (35.6)	110(27.4)
Agree	166 (41.3)	169 (42.0)	204(50.7)
Neither agree nor disagree	72 (17.9)	60 (14.9)	73(18.2)
Strongly Disagree	12 (3.0)	29 (7.2)	14(3.5)
Disagree	3 (0.7)	1 (0.2)	1(0.2)
Tidy environment is a source of stress reducer to me			
Strongly Agree	137 (34.1)	132 (32.8)	86(21.4)
Agree	155 (38.6)	169 (42.0)	223(55.5)
Neither agree nor disagree	76 (18.9)	64 (15.9)	73(18.2)
Strongly Disagree	22 (5.5)	34 (8.5)	18(4.5)
Disagree	12 (3.0)	3 (0.7)	2(0.5)

**Source:**  
Field  
Survey,  
2021.

In Table 2, the respondents in High and Middle income areas strongly agreed at 68.9% and 55.7% that they find happiness in environmental cleanliness while the low income households agree at 51.5%. Meanwhile, 47.3% of the respondents in high income neighbourhood, 44.8% in middle income neighbourhood and

50.7% in low income neighbourhoods agreed that they find comfort from environmental beauty. Also, 41.3%, of High income Household Heads, 42.0% of Middle income and 50.7% Low income Household Heads Agreed they are sad seeing the environment polluted from solid wastes.

Table 2 Continuation of Households Environment Concern Opinion

<b>Variables</b>	<b>High Income Frequency(%)</b>	<b>Middle income Frequency(%)</b>	<b>Low income Frequency(%)</b>
Prevention of solid waste is more important than the disposal			
Strongly Agree	152 (37.8)	129 (32.1)	90(22.4)
Agree	137 (34.1)	165 (41.0)	219(54.5)
Neither agree nor disagree	75 (18.7)	73 (18.2)	18.2(18.2)
Strongly Disagree	26 (6.5)	31 (7.7)	4.5(4.5)
Disagree	12 (3.0)	4 (1.0)	0.5(0.5)
A clean environment is valuable in its own right			
Strongly Agree	146 (36.3)	124 (30.8)	85(21.1)
Agree	150 (37.3)	167 (41.5)	210(52.2)
Neither agree nor disagree	84 (20.9)	74 (18.4)	84(20.9)
Strongly Disagree	16 (4.0)	34 (8.5)	21(5.2)
Disagree	6 (1.5)	3 (0.7)	2(0.5)
A clean environment is meant for the benefit of all living things			
Strongly Agree	145 (36.1)	153 (38.1)	96(23.9)
Agree	165 (41.0)	152 (37.8)	213(53.0)
Neither agree nor disagree	72 (17.9)	62 (15.4)	67(16.7)
Strongly Disagree	22 (5.5)	33 (8.2)	24(6.0)
Disagree	13 (3.2)	2 (0.5)	2(0.5)
The negative impact of dirty environment has been exaggerated			
Strongly Agree	58 (14.4)	27 (6.7)	19(4.7)
Agree	56 (13.9)	58 (14.4)	34(8.5)
Neither agree nor disagree	121 (30.1)	80 (19.9)	148(36.8)
Strongly Disagree	108 (26.9)	94 (23.4)	152(37.8)
Disagree	59 (14.7)	143 (35.6)	49(12.2)
I support proper management of waste because it generate income			



Strongly Agree	162 (40.3)	130 (32.3)	92(22,9)
Agree	116 (28.9)	178 (44.3)	225(56.0)
Neither agree nor disagree	96 (23.9)	56 (13.9)	50(12.4)
Strongly Disagree	20 (5.0)	28 (7.0)	29(7.2)
Disagree	8 (2.0)	10 (2.5)	6(1.5)

Source: Field Survey, 2021.

A tidy environment is a stress reducer was agreed by all income groups at 38.6, 42.0% and 55.5% in respect to high, middle and low income households. Meanwhile, 37.8% of respondents in high incomes areas strongly agreed that prevention of solid waste is more important than disposal. However, middle and low income areas agree at 41.0% and 54.5% in that order. A clean environment having value in its own right is having 'agree' with percentage of 37.3, 41.5 and 52.2. Concurrently, across all income group in

Maiduguri metropolis, 41.0%, 37.8% and 53.0% of respondents Agreed to the fact that a clean environment is for the benefit of all. In high income areas, 30.1% of respondents neither agreed nor disagreed that the negative impact of dirty environment has been exaggerated while 35.6% middle income areas disagreed and 37.8% of low income residents Strongly Disagreed that the negative impact of dirty environment has been exaggerated.

Table 2 Continuation of Households Environment Concern Opinion (*n=402*)(*n=402*)(*n=402*)

Variable	High Income Frequency(%)	Middle Income Frequency(%)	Low Income Frequency(%)
I am sad about community exposure to diseases In dirty places			
Strongly Agree	130 (32.3)	127 (31.6)	56(13.9)
Agree	174 (43.3)	183 (45.5)	244(60.7)
Neither agree nor disagree	77 (19.2)	59 (14.7)	84(20.9)
Strongly Disagree	12 (3.0)	26 (6.5)	17(4.2)
Disagree	9 (2.2)	7 (1.7)	1(0.2)
Increase in solid waste is not too bad if it assures satisfaction of our needs			
Strongly Agree	98 (24.4)	32 (8.0)	32(7.7)
Agree	105 (26.1)	69 (17.2)	71(17.7)
Neither agree nor disagree	130 (32.3)	76 (18.9)	144(35.8)
Strongly Disagree	30 (7.5)	122 (30.3)	132(32.8)
Disagree	39 (9.7)	103 (25.6)	24(6.0)
I support waste management because it create more jobs			
Strongly Agree	137 (34.1)	128 (31.8)	86(21.4)
Agree	158 (39.3)	197 (49.0)	219(54.5)
Neither agree nor disagree	72 (17.9)	46 (11.4)	68(16.9)
Strongly Disagree	22 (5.5)	22 (5.5)	24(6.0)

Disagree	13 (3.2)	9 (2.2)	5(1.2)
----------	----------	---------	--------

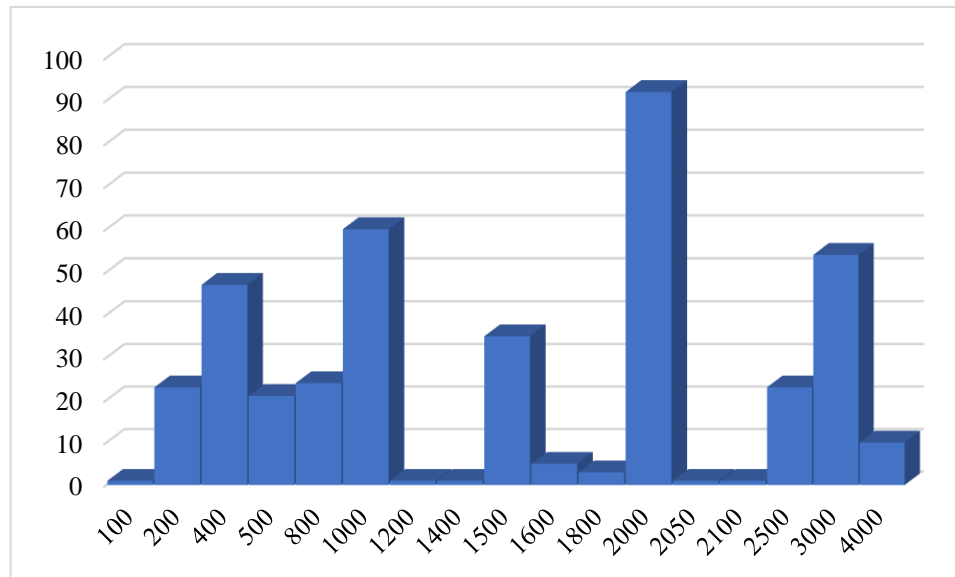
Source: Field Survey, 2021.

They all support proper waste management because it generates income, high income areas have Strongly agreed at 40.3% Middle and Low Income Agreed at 44.3% and 56.0% respectively. While on the other hand, 43.3%, 45.5% and 60.7% in order of income groups are sad about community exposure to diseases due to dirty environment. The idea that generation of solid waste is not a bad idea if it assures satisfaction was Neither Agreed nor disagreed to in High income areas at 32.3% in the same vain the low income areas at 35.8% while Middle income areas also, disagreed at 30.3%. Lastly they all agreed to support waste management

because it creates jobs with percentage of 39.3, 49.0 and 54.5 correspondently.

### 3.3 Open Ended Willingness to Pay for Improved Solid Waste Collection

Figure1 and Table2 shows high income households heads open ended willingness to pay for solid waste collection and it could be observed from the table and histogram that the mean WTP is 2478.36 and almost 90% of the respondents are having ₦2000 as their open ended willingness to pay for the improved solid waste collection services.



**Figure 1** High Income Households' Open Ended Willingness to Pay

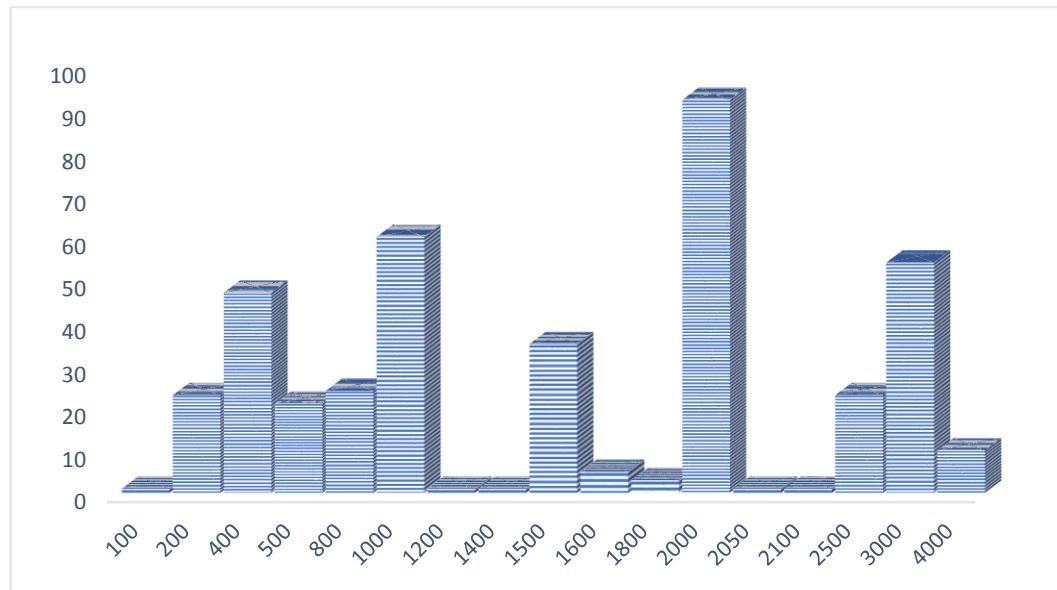
Table 2 High Income Mean Open ended willingness to pay

N	Valid	402
	Missing	0
Mean		2478.36
Minimum		200
Maximum		5000

**Source:** Field Survey, 2022.

The open ended mean willingness to pay for waste collection amongst higher income households is ₦2478.36 and while on the

histogram, the amount with the highest frequency is ₦2000.



**Figure 2** Middle Income Households' Open Ended Willingness to Pay

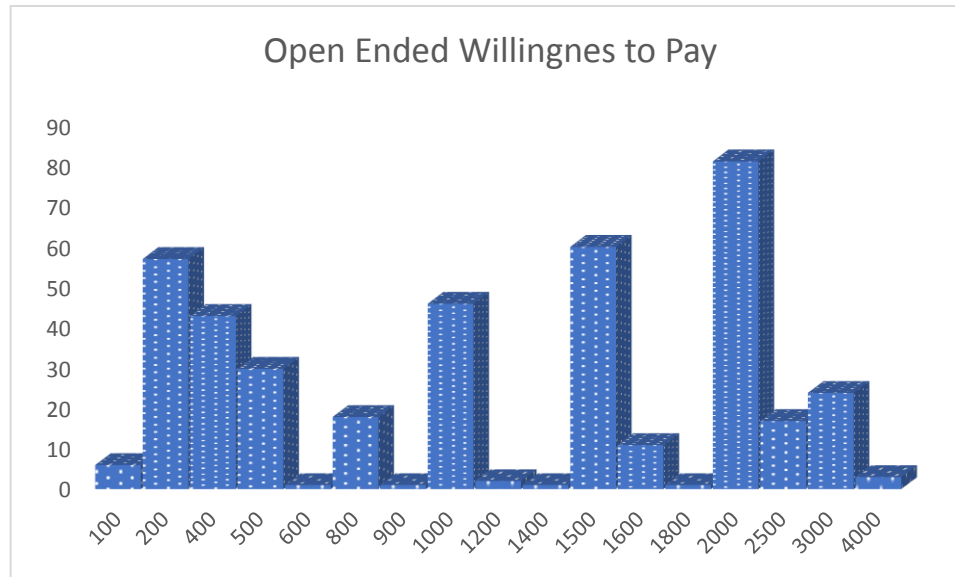
Table 3 Middle Income Households Mean Maximum Willingness to pay

N	Valid	402
	Missing	0
Mean		1565.55
Minimum		100
Maximum		4000

**Source:** Field Survey, 2022.

The middle income households' heads have an open ended willingness to pay of ₦1565.55 and

on the histogram the open willingness to pay is between 2000 as that has the highest frequency.



**Figure 3** Low Income Households' Open Ended Willingness to Pay

Figure 3 revealed low income household heads open ended willingness to pay for improved solid waste collection in the study area and the

mean open ended willingness to pay is ₦1263.18.

**Table 4** Low Income Households  
**Mean Maximum Willingness to pay**

N	Valid	402
	Missing	0
Mean		1263.18
Minimum		100
Maximum		4000

#### 4. Discussions

From 1206 respondents with 402 respondents for each income groups gave respective charges they think they can pay for improved solid waste collection service in Maiduguri metropolis. The open ended format of contingent valuation is one format that allows respondent state clearly how much they will be willingness to pay for a waste collection service after they most have been presented with a well explained hypothetical market with all the embedded desire attributes. As indicated in Figure 1, respondent from the high income households demonstrate their

willingness to pay for improved waste collection from ₦100 to ₦4000 while the mean of the respondents overall willingness to is ₦2478.4. The researcher learned that, those who are willing to pay lesser amount for solid waste charges in such area are either the little low income earners dwelling in high income areas or those who throw off their waste at the community dumpsite or some undesigned places or those who patronized informal waste collectors popularly known asalmajiri. However, those who show interest in paying higher value are usually those who requested for solid waste

collection services from the state owned solid waste management but also shows their gross dissatisfaction for the services. It could as well be observed that the mean willingness to pay is above the most frequently preferred charge ₦2000 as such a monthly charges of ₦2000 to ₦2500 is achievable in the high income neighborhood. The middle income households shows a great interest in their willingness to pay on improved solid waste collection as the average willingness to pay of the open ended contingent valuation is closely related to their most stated willingness to pay of less than ₦2000. The mean willingness to pay is ₦1565.55. Similarly, the low income communities have an average willingness to pay for improve solid waste collection of ₦1263.18 yet with complete absent of formal waste collector. People from the low income community usually dump their waste in the river bank close to them or burn their waste. It could be observed that the overwhelming WTP by households is associated with their demands for clean and serene environment. Although, as observed, households in the study areas practiced improper waste management but their opinion on environmental concern is positive. This finding is similar to the finding of conducted In Gelemso town by Estete *et al.*, (2023). However, there indifferent responds to this questionnaire item “The negative impact of dirty environment has been exaggerated” could be because they lack the knowledge of the multi-dimensional problems associated dirty environment. But they however, proclaimed being sad about community exposure to diseases. Fadhullah *et al.*, (2022) shows up to 95.9% awareness by east coast residence on Malaysia about dirty environmental related diseases but with a fairly waste management practice. A more focused awareness and emphases on importance of environmental consciousness should be encouraged.

Male households’ heads dominant all the income groups and this conformed to the

findings of Bamlaku *et al.*, (2019) which found a male dominant household heads in Shashemene town, Ethiopia. This could be due to the fact that, the study area is highly cultural and mostly support male gender being the head of the house as against the female and female households’ heads could be as a result of death or separation of spouse. The low income areas recorded a relative younger households’ heads than in the middle and high incomes areas. Higher education has been ascribed to a higher willingness to pay by many studies such as (Chinh *et al* 2021), (Assa, 2013) and Basil *et al* (2006). Although, all respondent show higher willingness to pay. However, those with more higher education from the high and middle income areas yielded a higher willingness to pay. Occupation are mainly activities people do for a living to earn some money thus individuals from the high income areas are mostly government workers while, the low and middle income households are self-employed. Government workers are mainly and are mostly seen as the wealthiest individuals. The three income neighbourhood has households size that is slightly above the Nigerian national average of 5.0 households’ sizes this could be as a result of multiple wives that some household heads has in the study area. This finding aligns to the finding of Chinh *et al.*, (2021).

Those gainfully employed households’ members from low income areas are self-employed while those in middle and high income areas are mainly civil servants or work with the private sector. As expected, households in the low incomes fall within the low income category while the middle and high income households also fall on the same category. Information about income categorisation or starting real income has been a problem in the study area. Most households head have attained the marriageable age and cohabiting are rarely seen in the study area. Almost all the respondent did not belong to any environmental organisations meanwhile those who claimed to belong to one are either

working with solid waste related organisation or community self-driven non-registered solid waste organisations. Contrary to the findings of Brown (2015), that mothers are people concerned with solid wastes disposal. In this study all respondents across income groups have father as the major person concern with solid wastes disposal. Most of the respondents owned their houses and is due to the fact that Maiduguri as a city is predominant occupied by the indigenous people. The least house rent rate is found in low income area. Houses in the study areas has more than 2 room and two and three bedroom flat are the types of houses found in high and middle income areas with low income area having others(Array of rooms) as its housing type. They all have less than 13 years as their duration of stay in their respective neighbourhood.

## 5. Conclusion

This study concludes that, households in the study areas have willingness to pay for improved solid waste collection amongst all incomes group. However, all respondents are concerned about their environmental wellbeing. The study suggested that, the municipality should formerly partner with private wastes collectors to ensure wider coverage and efficiency in the solid wastes services value chain as it provide a foundation for the setting up of solid waste collection fees by municipal and some well-equipped solid wastes collection firms given the fact that, respondent have willingness to pay for the improved solid waste collection. Further studies may look into solid waste source separation and premium weight charge.

## References

- Adam, S. U., Shamsudin, M. N., Sidique, S. F., Rahim, K. A., & Radam, A. (2015). Solid waste pollution concern in economic value assessment: Is it uni-dimensional or multidimensional? *Resources, Conservation and Recycling*, 104, 49-60
- Alhassan, H., Asante, F. A., Oteng-Ababio, M., & Bawakyillenuo, S. (2017). Do socio psychological factors influence households' willingness-to-pay for improved solid waste management services? Evidence from Ghana.
- Amoah, A. (2018) "Willingness to Pay for Improved Solid Waste Collection and Its Implication on Business Orientation Practices of Local Governments in Ghana." *American Journal of Environmental Protection*, 6 (3) 77-97
- Assa, M. (2013). Emerging Solid Waste Market in Lilongwe urban, Malawi: An Application of dichotomous choice contingent valuation method. *Journal of Sustainable Development in Arica*, 15(4.)56-65
- Ayenew, B., Tilahun, A., Erifo, S and Tesfaye, P. (2019) Household Willingness to Pay for Improved Solid Waste Management in Shashemene Town, Ethiopia. *African Journal of Environmental Science and Technology*. 13(4),162-171 (Hoomweg&Bhada-tata, 2012; Ayenew, Talihun, Erifo&Tefaye, 2019).
- Balasubramanian M. (2019). Households willingness to to pay for improved solid waste management services: using contingent valuation analysis in india. *Municipal solid waste management*, 48.
- Bamlaku, A., Abari, T., Solomon, E., & Paulo, T. (2019). Household willingness to pay for improved solid waste management in Shashemene town, Ethiopia. *African Journal of Environmental Science and Technology*, 13(4), 162-171.
- Barbier, E. B., Acreman, M., & Knowler, D. (1997). *Economic valuation of wetlands: a guide for policy makers and planners*. Gland: Ramsar Convention Bureau.
- Basil, M., Di Matteo, M., & Ferini, S. (2006) Analyzing demand for environmental quality: A willingness to pay/accept study in the province of Siena (Italy) *waste management*, 26(3), 209-219.

- Buba HB, (2016), Assessment of household solid waste management in Gombe, Nigeria. Department of urban and regional planning faculty of environmental design ahmadubello university, Zaria, Nigeria.Pp 44.
- Chinh, P.C., Hung, N.T., Ky, N. M., Ai, N. T., & Tam, N. M. (2021).Willingness to Pay for Improving Household Solid Waste Management in Vietnam. *Applied Environmental Research*, 43(2), 1-14
- Estete, H., Desalegn, A., Tigu, F., (2023). Knowledge, attitudes and practices on household solid waste management and associated factors in Gelemso town, Ethiopia PLoS ONE 18(2): e0278181. <https://doi.org/10.1371/journal.pone>
- Fadhullah, W., Imran, N.I.N., Ismail, S.N.S., Jaafar, M.H., & Abdullahi, H. (2022).Household solid waste management practices and perceptions among residents in the East Coast of Malaysia. *BMC Public Health*, 22(1), 1-20.
- Gedefaw, M. (2015).Assessing the current status of solid waste management of Gondar town, Ethiopia.
- Gedefaw, M. (2015).Assessing the current status of solid waste management of Gondar town, Ethiopia.
- John, J. (2015). Assessment of Community Participation in the Municipal Solid Waste Management: Case of Kigoma Municipal Council (Doctoral dissertation, The Open University of Tanzania).
- Julius, M; Charles, N; Shylet, M; (2017) Determinants of Willingness to Pay for Solid Waste Management in Gweru City, Zimbabwe.*Alanya Academic Review Journal*, 1 (3) 15-21
- Maskey, B; Singh, M, (2017).Households' willingness to Pay for Improved Waste Collection Service in Gorkha Municipality of Nepal. 4, 77 [www.mdpi.com/journal/environments](http://www.mdpi.com/journal/environments)
- Mitchell, R., & Carson, T. (1989). R (1989) Using Surveys to value public goods: The contingent valuation method. Washington DC: Resources for the future
- Mombo, F., & Bigirwa, D. (2017). The role of Sub-Saharan Africa Countries' households waste charges on sustainable cities development
- Mukhtar, A., & Akpan, J. C. (2018).Assessment of challenges facing solid waste management in Maisandari neighbourhood of Maiduguri Metropolis, Borno State, Nigeria. *Int. J. Res. Innov. Soc. Sci*, 2(7), 170-177.
- Mulat, S., Worku, W., & Minyihun, A. (2019). Willingness to pay for improved solid waste management and associated factors among households in Injibara town, Northwest Ethiopia. *BMC research notes*, 12(1), 1-6.
- National Bureau of Statistics.(2018). Statistical report on women and men in Nigeria.National Population Commission. (2016). Nigeria.(2006). Census Report National Population Commission. (2016). Nigeria.(2006). *Census Report*.
- Ndau, H., & Tilley, E (2018).Willingness to Pay for Improved Household Solid
- Oyedotun, T. D. T., Kasim, O. F., Famewo, A., Oyedotun, T. D., Moonsammy, S., Ally, N., & Renn-Moonsammy, D. M. (2020). Municipal waste management in the era of COVID-19: perceptions, practices, and potentials for research in developing countries. *Research in Globalization*, 2, 100033.
- Oyedotun, T. D. T., Kasim, O. F., Famewo, A., Oyedotun, T. D., Moonsammy, S., Ally, N., & Renn-Moonsammy, D. M. (2020). Municipal waste management in the era of COVID-19: perceptions, practices, and potentials for research in developing countries. *Research in Globalization*, 2, 100033.
- Pattnaik, S., & Reddy, M. V. (2010). Assessment of municipal solid waste management in

- Puducherry (Pondicherry), India. *Resources, Conservation and Recycling*, 54(8), 512-520.
- Saleh, M., & Marzuki, A. (2022). Challenges of SWM Hierarchy System: The Stakeholders New Saga In Perspectives.
- Sizya, R; (2015) Analysis of Inter - Household Willingness to Pay for Solid Waste Management in Mwanza City, Tanzania. *Journal of Resources Development and Management* vol 4.
- United Nations Environment Programme, & International Resource Panel (2013). City-Level Decoupling: Urban Resource Flows and the Governance of Infrastructure Transitions.  
<https://wedocs.unep.org/20.500.11822/8488>
- Usman, A. S. (2014). Estimation of economic value and determinants of solid waste source-separation among urban-poor households in Lagos, Nigeria. Doctoral dissertation, The University Putra Malaysia.
- World Bank. (2022). Transition to a Circular Economy: an Evaluation of the World Bank Group's Support for Municipal Solid Waste Management (2010-20).
- Yoda, R. M., Chirawurah, D., & Adongo, P. B. (2014). Domestic waste disposal practice and perceptions of private sector waste management in urban Accra. *BMC public health*, 14(1), 1-10.