

ANALYSIS OF IMPROVED HOUSEHOLD SOLID WASTE MANAGEMENT SYSTEM IN MINNA METROPOLIS, NIGER STATE, NIGERIA

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Abstract

This study analysed improved household solid waste management system in Minna metropolis, Niger state. Multi-staged sampling technique was used to administer 155 questionnaires to respondents, where Minna was divided into two income groups A and B based on the quality of the respondent's houses. Primary data was collected with the aid of structured questionnaires and analysed using descriptive statistics to obtain results for the socioeconomic characteristics of respondents, types of waste generated and methods of disposing solid waste, the level of awareness and reliability of waste disposal methods as well as the willingness of households to pay for solid waste management in the area. The results revealed that majority of the household heads in the study area were male, 94.20% of the household heads fell between the ages of 21 and 50 and also that 96.80% of them had one form of formal education or the other. The results also revealed that 47.10% and 43.20% of the households generated food wastes and polymers respectively as a major constituent of waste disposed. The results of this study went further to reveal that 81.90% of the household heads were aware of the use of collection cans as a method of waste disposal while only 32.90% of them considered the method highly reliable. Multiple regression was used to determine the factors affecting the willingness of households to pay for waste disposal in the study area. The results showed that 76.10% of the respondents were willing to pay for solid waste management which indicates that households in Minna are concerned and willing to cater for their immediate environment. The multiple regression results revealed that age, income, environmental awareness and household expenditure have a positive and statistically significant relationship with the willingness of households to pay for waste disposal in the area while household size has a negative and statistically significant relationship with households' willingness to pay. Based on these findings, it was recommended that more waste management services be made readily available to residents of Minna, waste collection service should be privatised to increase their effectiveness through increased competition and also that community participatory approach be used to create more environmental awareness amongst residents.

Key words: household, management, solid waste, WTP

INTRODUCTION

Household solid wastes refer to refuse from households which result from domestic and household activities such as food preparation, sweeping, cleaning, fuel burning and gardening wastes old clothing, old furnishings retired appliances, packaging and reading materials. With rising urbanization and change in lifestyle and food habits of residents, the amount of solid waste has been increasing rapidly and its composition changing [1]. Over the last few years, the consumer market has grown rapidly leading to products being packaged in different forms including the use of cans, aluminium foils, plastics, and other such non-biodegradable

items that cause incalculable harm to the environment [19]. The characteristics and quantity of the solid waste generated in a region is not only a function of the living standards and lifestyle of the region's inhabitants, but also a function of the abundance and type natural resources found in the region.) The quantity and rate of solid waste generation in the various States of Nigeria depends on the population, age, location, education, occupation, level of industrialization, socioeconomic status of the citizens and the kinds of commercial activities being predominant [7]; [8]. The unprecedented growth in urban population has led to expansion in the size of the Nigerian cities, with drastic changes in land allocation

for residential, commercial, industrial and educational activities. This is further increasing the dimensions of environmental and health hazards resulting from drainage blockages, waste accumulation, disposal problems, noise pollution, among others. There are a number of problems associated with inappropriate waste management mechanism in the densely populated localities. The open waste piles create health problems and pollute the underground water, ultimately causing waterborne diseases [15]

To improve this pressing problem the government and other stakeholders have to put maximum efforts to look for the possibility of managing these wastes properly. Waste management is the generation, prevention, characterization, monitoring, treatment, handling, reuse and residual disposition of solid wastes [19]. It refers to all processes in the proper disposal or recycling of rubbish and garbage. For example solid wastes which do not take time to degenerate can be buried in dump-pits. This is a way of improving soil fertility because on the long run, these wastes decompose as a result of microbial activities which turns them into compost manure which adds less hazardous nutrients to the soil. Plastics can be recycled, wood can be used to make fires, and parts of some discarded appliances can be used to manufacture some other new appliances. Wastes that are not well managed can affect the environment in terms of the contamination of the atmosphere, soil and water. This can cause severe problems for humans and animals population. It can also affect human health in particular by causing convulsion, dermatitis, irritation of nose/throat, anaemia, skin burns, chest pains, blood disorders, stomach aches, vomiting diarrhoea and lung cancer which may lead to death [6] [12] [4]

In order to clean up the urban area of waste the local authorities have used the strategy of collecting what has been deposited by the urban dwellers without a viable measure of inhibiting the deposition. This effort has proved extremely insufficient as evidenced by the continued piling up of waste heaps in almost every street corner. With the increase in the waste heaps in the street, the residents

demand a better environmental quality. Considering the rapid spatial and population growth of most urban areas with decreasing coverage levels, and with increase in level of waste generated, confronted by increasing public demand for improved services [15], the need arises for a more efficient method of waste management.

This therefore gives rise to the need to evaluate the household solid waste management system in the study area.

Specifically the study examined the types of waste generated and methods of disposing solid waste, level of awareness and reliability of waste disposal methods, the willingness of households to pay for solid waste management and the factors affecting willingness of households' to pay for solid waste management in the study area.

Contingent Valuation Method (CVM) [5] was used to estimate the determinants of household willingness to pay for solid waste management. The contingent valuation method is superior to other valuation methods because it is able to capture use and non-use values.

Other valuation methods like Hedonic Pricing and Travel Cost method tend to underestimate satisfaction derived from services rendered since they measure use values only.

The contingent valuation technique however suffers from one major drawback despite its ability to measure total economic values. The hypothetical nature of the questions used in contingent valuation method surveys may create problems since respondents may have little incentive to provide information on their true willingness to pay.

MATERIALS AND METHODS

The study was conducted in Minna Metropolis (which contains Bosso and Chanchaga Local Government Areas (LGAs), Niger State, Nigeria. Niger State is located between latitudes 8°11'N and 11° 20' N and longitude 4° 30'E and 7° 20'E. It is bordered on the North-east by Kaduna State and on the South-east by the Federal Capital Territory, Abuja. It is also bordered on the North, West, South West and South by Zamfara, Kebbi,

Kogi and Kwara States. The State covers an estimated land area of 76,363 square kilometers and a population of 4,082,558 people [19]. The State is agrarian and well suited for the production of arable crops such as cassava, cowpea, yam, and maize because of favourable climatic conditions. The annual rainfall is between 1100mm and 1600mm with average monthly temperature ranges from 23oC to 37oC [19]. The vegetation consists mainly of short grasses, shrubs and scattered trees.

Sampling Technique

The data from primary source were used for this study. Multi-staged sampling technique was used to select the respondents. The first stage involved the stratification of Minna into two income groups. This step is very important but was quite difficult because willingness to pay for improved solid waste management involves demand estimation and its main determinant is expected to be income [5]. Minna was roughly divided into two income groups using the quality of housing in the absence of any other formal way of stratification. These income groups were further stratified using random sampling technique where households were selected at random for distribution of questionnaires. A total of 172 questionnaires were distributed. Eighty-six copies to high income group areas (group A) and Eighty-six copies to low income group areas (group B), out of these 172 questionnaires, only 155 were recorded as valid, this is as a result of the fact that some household heads were not willing to participate in the survey.

Method of Data Collection

The primary data were collected using structured questionnaires and interview schedule for different household heads in Minna metropolis. The contingent valuation survey was used to obtain an estimate of the value of improvements in solid waste management in the study area. This study used the contingent valuation method (CVM) to elicit the willingness to pay values. In this procedure the household heads were free to answer the open-ended questions by indicating the maximum amount they are willing to pay. The household heads were first

asked whether they are willing to pay anything at all for solid waste management services. The respondents, who said 'no,' were asked to give the reason(s). For household heads who said 'yes', were asked to choose an amount of money from a payment list that corresponded to the maximum amount they are willing to pay monthly for the solid waste management services. Data collected include the socioeconomic characteristics of the household heads e.g. age, sex, income, household size, marital status and all the relevant information needed for this study.

Analytical techniques

Descriptive statistics was used to identify the types of waste generated as well as methods of disposing solid waste in Minna while multiple regression was used to examine the factors affecting willingness of households' to pay for solid waste disposal in Minna. The contingent valuation survey was used to obtain an estimate of the value of improvements in solid waste management in the study area.

The multiple regression model used to estimate the factors affecting willingness of households' to pay for solid waste disposal in the study area is expressed as:

$$WTP = \alpha + \beta_1 AGE + \beta_2 EDU + \beta_3 H_SIZE + \beta_4 SEX + \beta_5 H_OWN + \beta_6 W_SER + \beta_7 INCOME + \beta_8 E_AWR + \beta_9 W_QNTY + \beta_{10} N_DMPS + \beta_{11} EXP + ui$$

where:

WTP = Willingness to pay for waste management services (Maximum amount the household heads are willing to pay in Naira).

AGE = Age (years)

EDU = Education level (years spent in school)

H SIZE = House hold size.

SEX = Sex (1 if male; 0, otherwise)

HOWN = House ownership, (1= owner of the house and 0 = non owners)

WSER = Waste collection services, (1, if available; 0, otherwise)

INCOME = Income level of the households (Naira)

EAWR = Awareness on environmental effect of improved solid waste disposal (1 if aware; 0, otherwise)

WQNTY = Quantity of waste generated per

month (kg).

NDMPS = Nearness to dumpsite (1 if near; 0, if far away)

EXP = Household expenditure (Naira)

μ_i = The random error term

RESULTS AND DISCUSSIONS

Types of waste generated and methods of disposal

The results of the types of waste disposed by households in the study area are shown in Table 1. The results in Table 1 revealed that most of the households in Minna metropolis generated food waste (47.10%) and polymers in the form of pure water bags (43.20%), since most houses depend on the supply of sachet water as their main source of drinking water.

Table 1. Major constituents of waste generated from households in the study area

Papers	24	15.50
Food waste	73	47.10
Glasses	7	4.50
Plastics	13	18.40
Batteries	4	2.60
Polymers	67	43.20
Wood products	8	5.20
Metallic materials	6	3.90
Packaging materials	21	13.50

* = Multiple response were allowed

Source: Field survey, 2014

Only 5.20% and 4.50% of the household disposed wood products and glasses as waste respectively.. This finding is in disagreement with the results of [16], where plastics, packaging materials and papers (99%, 99% and 97% respectively) were reported to be the major constituent of waste generated in most cities in the country.

The results of the major waste disposal methods adopted by households and their reliability are shown in Table 2. Table 2 shows that 20.60% of the respondents disposed their waste in open spaces; this may be as a result of convenience since these people are closer to dump sites than collection cans while others chose this method because of their unwillingness to pay for waste disposal. This corresponds with the findings of [16] who reported that 47% of the

households dispose their waste in open spaces as a result of long distance from collection cans.

Table 2. Waste disposal methods and Reliability of methods in the study area

Throw to open space	32	20.65
Use collection cans	69	44.52
Burn	38	24.52
Sale for recycle	1	0.65
Re-use at home	2	1.29
Take to latrines	6	3.87
Dig open pit	4	2.58
Use of waste vendor	28	18.06
Waste disposal method Reliability		
Throw to open space	23	14.84
Use collection cans	68	43.87
Burn	30	19.35
Sale for recycle	40	25.81
Re-use at home	23	14.84
Take to latrines	8	5.16
Dig open pit	30	19.35
Use of waste vendor	39	25.16

* = Multiple response allowed

Source: Field survey, 2014

Table 2 also revealed that 44.50% of the households disposed their waste by using collection cans provided by the State government. The results in Table 2 further revealed that 43.87% of the households indicated the use of collection cans by the State government as the most reliable method of waste collection in the study area. This implies that more effort is required by the State government to make more waste collection cans available and accessible to the people in the study area.

The results of the household willingness to pay for solid waste disposal are shown in Table 3. The results in Table 3 show that 76.10% of the households were willing to pay for waste disposal. This implies that given the advantages of improved services, most households in the study area were willing to pay part of their income, to sanitise their immediate environment. This result agrees with that of [1] who also reported that 87.5% (a majority) of the households were willing to pay for solid waste disposal in Nigeria. Table 3 further shows that 7.70% of the population gave a reason of meager income for their unwillingness to pay. While 6.50% gave the reason of lack of enough information about solid waste management.

Table 3. Household willingness to pay for solid waste disposal in the study area

Willing to pay	118	76.10
Not willing to pay	37	23.90
Reasons for not being willing to pay:		
1. Meagre income	12	7.70
2. Not willing to place a naira value	8	5.20
3. Not well informed about it	10	6.50
4. Don't want to participate in the survey	2	1.30
5. Solid waste management is of no value	5	3.90

Source: Field survey, 2014

The results of the regression model showing the factors affecting the household willingness to pay for waste management services in the study area are shown in Table 4. The value of the coefficient of determination (R²) indicated that 58.06% of the variations in willingness to pay response were explained by the factors in the regression model. The F-value 3.44, is significant at (P<0.01) percent, meaning that the variables included in the model jointly and significantly explained the variations in willingness of household to pay for solid waste disposal service in the study area.

Table 4. Regression results for factors affecting the respondents' willingness to pay for waste disposal service in the study area

Age (X ₁)	0.89	2.03**
Education (X ₂)	-0.11	-0.81
Household size (X ₃)	-0.25	-1.80*
Sex (X ₄)	-0.16	-0.67
House ownership (X ₅)	-0.32	-0.97
Waste collection services (X ₆)	-0.18	-0.68
Income (X ₇)	0.22	2.36**
Environmental awareness (X ₈)	0.59	1.69*
Waste quantity (X ₉)	-0.12	-0.69
Nearness to dumpsite (X ₁₀)	0.13	0.53
Household Expenditure (X ₁₁)	0.43	2.80***

F-value = 3.44***

R-squared = 0.5806

*** = significant @ 0.01 probability level, ** = significant @ 0.05 probability level and * = significant @ 0.10 probability level

Source: Field Survey, 2014

The regression coefficients of age (X₁), income (X₇), environmental awareness (X₈) and household expenditure (X₁₁) were positive and statistically significant. This implies that increased in these variables, all other variables held constant led to an increase in willingness to pay for solid waste disposal service by household in the study area. This result is not unexpected because increase in income and awareness about health implications of unclean environment will definitely lead to the demand for high

environmental quality. Also, the contingent valuation study is based on how much people are willing to put a money value on improved solid waste management and this ability is influenced by income.

This result agrees with the findings of [5], [9],[16], [15] who reported that the household willing to pay for solid waste disposal service is positively related to the income, expenditure, age and awareness of the household in the cities. The regression result further shows that household size was negatively related to the household willingness to pay for waste disposal service in the study area. This result is confirmed by the finding of [1] who reported that household size is negatively related with the willingness of households to pay for solid waste disposal service.

CONCLUSIONS

This study examined the household solid waste management system in Minna metropolis, Niger State, Nigeria.

This study revealed that food waste and polymers were the major constituents of waste generated from households in the study area, while most of them indicated the use of collection cans provided by the State government as the most reliable method of waste collection in the study area.

Majority of the households were willing to pay to sanitise their immediate environment given the advantages of improved waste management services.

Also, the findings further revealed that age, income, household expenditure, environmental awareness and household size had influence on the value placed on the service of solid waste management.

Based on the findings of this study, it is therefore recommended that community participatory approach should be used by government to create more awareness on solid waste management among the people.

Also, private waste collection services should be encourage in the study area, this will go a long way in improving the effectiveness waste collection in the metropolis.

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