Ethiopian Journal of Environmental Studies & Management 14(5): 645 – 653, 2021.
ISSN:1998-0507 doi: https://ejesm.org/doi/v14i5.7
Submitted: June 22, 2021 Accepted: August 12, 2021

SOCIO-ECONOMIC FACTORS INFLUENCING URBAN HOUSEHOLDS WILLINGNESS TO PAY FOR SOLID WASTE ENVIRONMENTAL MANAGEMENT SERVICES IN ABUJA, NIGERIA

***ALABI, O.O.,[1] EMEGHARA, U.U.,[2] ADEDEJI, S.O.I.,[3] OLUMUYIWA, S.A.,[4] BABA, K.C.,[3] OMOLE, E.B.,[5] SANUSI, S.O.,[6] SAFUGHA, G.F.[1] AND AMKPA, R.N.[1]**

[1]Department of Agricultural-Economics, University of Abuja, PMB 117 Gwagwalada-Abuja, Nigeria

[2]Crop Production Department, Federal College of Forestry Mechanization, Forestry Research Institute of Nigeria, PMB 2273 Afaka, Kaduna, Kaduna State, Nigeria

[3]Department of Agricultural Economics and Extension Services, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria

[4]Department of Basic Sciences and General Studies, Federal College of Forestry Mechanization, Forestry Research Institute of Nigeria, PMB 2273 Afaka, Kaduna, Kaduna State, Nigeria

[5]Department of Basic Science, Federal College of Wildlife Management, New Bussa, Niger State, Nigeria

[6]Department of Agricultural-Economics and Extension, Federal University Gashua, PMB 1005, Gashua, Yobe State, Nigeria

*Corresponding Author omotayoalabi@yahoo.com

Abstract

The research study evaluated socio-economic factors influencing urban households' willingness to pay for solid waste environmental management services in Abuja, Nigeria. Specifically, the study was designed to achieve the following objectives: determine the socio-economic profiles or characteristics of respondents, determine the classifications of solid waste and methods of solid waste disposals, evaluate the socio-economic factors influencing urban households' willingness to pay for solid waste environmental management services, identify the constraints faced by urban households' to pay for solid waste environmental management services , and identify the problems solid waste disposed posed to the society in the study area. Multi-stage sampling technique was used. About 100 respondents were selected for this research study. Data were of primary sources. Data were analyzed using descriptive statistics, Probit model analysis, principal component analysis, and problem confrontation index. The results show that the respondents were energetic, active, and resourceful in their middle age ($\bar{x} = 43\ years$) *. The household sizes were large* ($\bar{x} = 6\ people\ per\ households$). *The respondents are literate with 98% of them had formal education. Solid waste among the communities in the area can be classified as wood, food, paper, glass, rubber, metals, plastics, leather or polythene and textiles. Method of solid waste disposals within the communities include: incinerator (12%), private vehicles (18%), public containers (14%) and dumpsite (56%). The statistical and significant exogenous socio-economic factors influencing willingness to pay for solid waste management services include: gender (P< 0.01), age (P < 0.05), marital status (P < 0.10), household size (P < 0.05), level of education (P < 0.01), and income of respondents (P < 0.05). Principal component analysis used in analysing constraints facing respondents shows six constraints with Eigen-values greater than one were retained by the model. The constraints were: lack of incinerator, lack of vehicles, lack of public containers, lack of drainage facilities, lack of street cleaners and poor government policy. The retained constraints explained 86.79% of all variables included in the model. Diseases and vector transmission was ranked 1st, public health issues, flooding, and environmental fouling were ranked 2nd, 3rd and 4th among problems examined by problem confrontation index. The study recommends that incinerator, private vehicles and public containers should be provided for the communities. Government should formulate policies in favour of solid waste management in both urban and rural areas.*

Key Words: *Socio-Economics Factors, Solid Waste Management Services, Abuja, Nigeria*

Introduction

Waste management is a global issue, waste has impact on the environment, and new technology is therefore needed to harness this solid waste which is a resource (Rozenberg, 2013). Waste can be defined as objects or materials which are required to be disposed of, or are intended to be disposed of or are disposed of (Alajmi, 2016). Solid waste include garbage, sludge, paper, glass, rubber, food, textiles, leather, plastics, wood, refuse, scrap metal, furniture's, toys, appliances, vehicles, construction and demolition debris, waste from water treatment, water supply treatment plant, litter, rubbish etc. and they are from community activities, industrial, commercial, mining, and from agricultural activities. Solid waste management has become a serious problem for many countries including developing countries. Also, in developing countries people throw away waste in the open dumps which can generate disease transmitting vectors causing health and environmental problems. The educational systems are inadequate and the communities participation do little to clean the environment hence major cities are faced with many problems in terms of health and pollution from the volume of solid waste generated. The increase in solid waste generated in developing countries causes environmental problems and make the situations unfavourable for the development of any human activities. The solid waste generated will increase as the population growth rate increases, and this will continue to increase if right policies that will either minimize or re-use solid waste generated are not adopted or put in place. It is necessary to have precise data about household solid waste and factors that can be identified to influence solid waste management services as this could be helpful for environmental planners in their decision making for managing solid waste.

Markets, schools, government offices, households, hospitals, and commercial establishments are among various sources that generates solid wastes in developing countries. Socio-economic factors that can increase solid waste generation include income level, household sizes, educational level, and household labour force. Furthermore, paper, food, metal and plastic which are solid waste generated from residential houses shows significant relationship with family sizes. There are growing concerns for the increase in volume of solid waste generated by communities in developing nations by public health officials. The concerns are increase in vectors that may spread diseases, aesthetic, contaminations of ground water, pollutions and sanitation issues. Improper waste management increase disease transmissions, contaminate surface or ground water, create greenhouse gas emission and other air pollutants, damage ecosystem, injure people and property, and discourage tourism and other businesses (Ibikunle *et al.,* 2015). In urban cities, population pressure on existing facilities such as electricity, educational institutions, housing, road, electricity, water make solid waste generation and disposal to take unprecedented dimensions (Kayode and Omole, 2011).

The composition and nature of solid waste generation is a product of business and climatic activities (Kayode and Omole, 2011). Urban cities in developing countries are plaque with unmanageable rate of refuse generation and weak disposal method. Increase in population, expansion of commercial activities and uncoordinated growth and development have great impact on socio-economic and environment of urban cities in developing countries. The consequences of solid waste problems

are blockage of drainage systems giving rise to flood disasters, health, environmental issues and pollution problems. According to Grazhdani (2016) a comprehensive study of the variables influencing solid waste production and recycling rate is considered crucial in developing sub-Saharan countries for identifying the mechanism of solid waste generation and forecasting future dynamics in the field. The specific objectives were to: determine the socio-economic profiles or characteristics of respondents; determine the classifications of solid waste, and methods of solid waste disposals; evaluate the socio-economic factors influencing urban households willingness to pay for solid waste environmental management services; identifying the problems solid waste disposed posed to the society, and identify the constraints faced by urban households to pay for solid waste environmental management services in the study area.

Methodology

This research study was conducted in Abuja, Nigeria. Abuja lies between latitudes 9°4′20″ North and the longitudes 7°29′28″ East. The urban city has two seasons they are rainy and dry seasons, in between these seasons we have brief harmattan period. The rainy season starts from March to October. The temperature varies from 28°C to 40°C. Abuja has an area of 8,000 Square Km. The population of Abuja according to NPC (2006) is about 776, 298 people. The main occupation of the inhabitant of Abuja is Agriculture. The inhabitants are involved in growing crops and rearing of animals. Crops grown by the people include sesame, millet, garden egg, sorghum, yam, rice, cowpea, groundnut amongst others. Animals reared include poultry, sheep, rabbit, goat, turkey, and cattle. The urban city has industrial, household and commercial activities with a lot of institutions and offices located in the city centre. Data used were of primary sources Data were obtained with the use of questionnaire. The questionnaire was well-designed and well-structured to answer the objectives of the research study. The questionnaire was subjected to validity and reliability tests. Yamane (1967) equations of estimating sample size were adopted. Yamane (1967) formula for calculating sample size is stated thus:

$n = \frac{N}{1+N(e)^2}$ =100…… (1)

Where, n= Sample Size (Units),
N=Sample Frame (Units),
e=Level of Precision (10%)

Total sample sizes of one hundred respondents were used for this research study. Multi-stage sampling technique was used for selecting the respondents. Data analysis involves the use of the following tools:

Descriptive Statistics

This involves the use of frequency distributions, mean, and percentages to summarize the data collected from respondents. This was used to have summary statistics of socio-economic profiles of respondents, and use to classify solid waste and methods of solid waste disposals

Probit Model Analysis

A Probit model following Alabi *et al* (2014) was used. Probit model is stated as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + U_i \ldots (2)$$

Where,
Z_i= Respondents Willingness to Pay for Solid Waste Environmental Management Services (1, Willingness to Pay; 0, Otherwise),
i = Number of Independent Variables,
β_0= Constant Term,
$\beta_1 - \beta_8$= Regression Coefficients,
X_1= Gender (1, Male; 0, Otherwise),
X_2 =Age (Years),

X_3 = Marital Status (1, Married; 0, Otherwise)
X_4 = Household Size (Total Number of Person),
X_5= Level of Education (0, Non-Formal; 1, Primary; 2, Secondary; 3, Tertiary),
X_6 = Income of Respondents (Naira),
X_7 = Access to Credit (1, Access; 0, Otherwise),
X_8= Main Occupation (1, Civil Service; 2, Trading; 3, Agriculture; 4, Construction Works; 5, Hair Dressing; 6, Driving; 7, Barbing Saloon; 8, Unemployed; 0, Otherwise)
U_i= Error Term.

This was used to evaluate the socio-economic factors influencing urban households' willingness to pay for solid waste environmental management services.

Problem Confrontation Index (PCI)

Problems facing respondents were examined using Five-Point Likert Scale. The Five-Point Likert Scale was defined as: 0 (Strongly Disagree) 1 (Disagree); 2 (Undecided); 3 (Agree); 4 (Strongly Agree).

Problems Confrontation Index is computed as follows:

$$\text{PCI} = P_0X_0 + P_1X_1 + P_2X_2 + P_3X_3 + P_4X_4 \ldots (3)$$

Where
P_0 = Frequency of Problems Strongly Disagree
P_1 = Frequency of Problems Disagree
P_2 = Frequency of Problems Undecided
P_3 = Frequency of Problems Agree
P_4 = Frequency of Problems Strongly Agree

Principal Component Analysis

The constraints facing urban households to pay for solid waste environmental management services were subjected to principal component analysis. Principal component analysis reduces many interrelated constraints facing urban households into few unrelated ones.

Results and Discussion

Socio-Economic Profiles or Characteristics of Respondents

The socio-economic profiles or characteristics of respondents are presented in Table 1.The mean age of respondents was 43 years. About 78% of respondents are less than 50 years of age. This means that the respondents are energetic, resourceful in their active age. The respondents can easily adopt new technologies or innovations about solid waste environmental management services. Furthermore, 57% of respondents are male, while 43% were female. Also, 56% of respondents were married, while 20% are single. Majority (98%) of respondents had formal education. This implies that they can read, write and speak English language fluently. Educated respondents will adopt easily new technologies or innovations about solid waste management services. The households are large with an average of 6 people per households. About 92% of respondents had less than 10 people per households. The main occupation of respondents include: civil services (12%), trading (10%), agriculture (15%), construction work (17%), hair dressing (14%), driving (9%), mechanic (11%), and barbing saloon (12%). This result is in line with earlier findings of Trang *et al*. (2017) who reported that socio-economic factors such as age, income and educational level contribute significantly to variations in household solid waste generation. Also, family size and eating habits have positive correlations with solid waste generation. According to Bolanle and Ali (2004) household numbers directly affect quantity of waste generated in developing countries. World Bank (2001) revealed that low standard of

living, poor socio-economic development and low degree of industrialization can partly reduce solid waste generation.

Table 1: Socio-Economic Profiles or Characteristics of Respondents

Socio-Economic Profiles or Characteristics	Freq.	Percentage	Mean
Age (Years)			
31 – 40	47	47.00	43.00
41 – 50	31	31.00	
51 – 60	22	22.00	
Sex			
Male	57	57.00	
Female	43	43.00	
Marital Status			
Single	20	20.00	
Married	56	56.00	
Widowed	11	11.00	
Divorced	13	13.00	
Educational Status (Years)			
Primary	33	33.00	
Secondary	29	29.00	
Tertiary	36	36.00	
Non-Formal	02	02.00	
Household Size (Units)			
1 – 5	39	39.00	6.45
6 – 10	53	53.00	
11 – 15	08	08.00	
Main Occupation			
Civil Service	12	12.00	
Trading	10	10.00	
Agriculture	15	15.00	
Construction Work	17	17.00	
Hair Dressing	14	14.00	
Driving	09	09.00	
Mechanic	11	11.00	
Barbing Saloon	12	12.00	
Total	100	100.00	

Classifications of Solid Waste and Methods of Solid Waste Disposals

Table 2 revealed that the various classifications of solid waste among respondents include: wood (7.09%), food (19.67%), paper (13.49%), glass (5.88%), rubber (13.37%), metals (5.82%), plastics (11.71%), leather (13.32%) and textiles (9.63%). The methods of solid waste disposals by respondents include: incinerators (12%), private vehicles (18%), public containers (14%), and dumpsite (56%). The result is in line with Kayode and Omole (2011) who reported in their study the types of waste generated to include: leaves, polythene, textiles, stationeries, glass, bones, leather, abattoir waste and metals.

Table 2: Classifications of Solid Wastes among Sampled Respondents

Solid Waste	*Frequency	Percentage (%)
Wood	123	07.09
Food	341	19.67
Paper	234	13.49
Glass	102	05.88
Rubber	232	13.37
Metals	101	05.82
Plastics	203	11.71
Leather or Polythene	231	13.32
Textiles	167	09.63
Total	*1734	100.00

*Multiple Responses

Table 3: Methods of Solid Waste Disposals

Method of Solid Waste Disposal	Frequency	Percentage (%)
Incinerator	12	12.00
Private Vehicle	18	18.00
Public Container	14	14.00
Dumpsite	56	56.00
Total	100	100.00

Maximum Likelihood Results of Socio-Economic Factors Influencing Willingness to Pay for Solid Waste Environmental Management Services

Predictor variables included in the Probit model as factors influencing willingness to pay for solid waste management services and the results of the Maximum Likelihood Estimates are presented in Table 4.The socio-economic factors under consideration are gender, age, marital status, level of education and income of respondents. Level of education of respondents is statistically significant at ($P < 0.01$). The marginal effect was 0.2093, this implies that as respondents acquire formal education, the literate level increases, the respondents become aware and increases the probability or likelihood of respondents to pay for solid waste environmental services by 0.2093 units. Income of respondents is also statistically significant at ($P < 0.05$). The coefficient of income is positive. A 1% increase in income of respondents will lead to probability or likelihood of 12.61% increase in likelihood of respondents to pay for solid waste management services. The Pseudo-R^2 was 0.7961, this implies all the predictor variables included in the model explained 79.61% of the variations in the willingness of respondents to pay for solid waste management services. The LR Chi Square was significant at ($P < 0.01$) and the Log Likelihood was –109.211 which implies that the variables included in the Probit model were correctly specified. In line with this result, World Bank (2003a) and Fehr *et al*. (2000) reported that income level and lifestyle directly affect the quantity of waste generated in developing countries. Also, Trang *et al.* (2017) reported that increase in income can change the consumption patterns of households, this can results in changing the composition and quantities of household waste.

Table 4: Parameter Estimates of Probit Model of Socio-Economic Factors Influencing Willingness to Pay for Solid Waste Environmental Management Services

Variables	Coefficient	Standard Error	Marginal Effects
Gender (X_1)	0.124***	0.434	0.0147
Age (X_2)	0.158**	0.427	0.1028
Marital Status (X_3)	0.136*	0.286	0.2041
Household Size (X_4)	0.103**	0.288	0.2819
Level of Education (X_5)	0.131***	0.459	0.2093
Income of Respondents (X_6)	0.127**	0.356	0.1261
Access to Credit (X_7)	0.180*	0.360	0.2101
Main Occupation (X_8)	0.011**	0.032	0.1206
Constant	13.61	0.021	0.2051
LR Chi Square	79.51***		
Pseudo $-R^2$	0.7961		
Log-Likelihood	-109.211		
Prob > Chi^2	0.0000		

***-Significant at P <0.01, **-Significant at P <0.05, **-Significant at P <0.10

Principal Component Analysis of Constraints Facing Respondents to Pay for Solid Waste Management Services

Principal Component Analysis is an analytical tool that can reduce many interrelated variables into few unrelated ones. The constraints facing respondents to pay for solid waste management services were subjected to principal component analysis (Table 5). Six constraints that have Eigen-Values greater than one were retained by the model. The retained constraints were lack of incinerator, lack of vehicles, lack of public containers, lack of drainage facilities, lack of street cleaners and poor government policy. Lack of incinerator with Eigen-value of 3.3544 explained 16.41% of all retained constraints facing respondents. All retained constraints explained 86.79% of all variables included in the model. The Chi-square value of 2067.328 was statistically significant at 1% probability level.

Table 5: Results of the Principal Component Analysis of Constraints facing Respondents

Constraints	Eigen-Value	Difference	Proportion	Cumulative
Lack of Incinerator	3.3544	0.2569	0.1641	0.1641
Lack of Vehicles	2.3205	0.4431	0.1360	0.3001
Lack of Public Containers	2.5340	0.3410	0.1594	0.4595
Lack of Drainage Facilities	2.1036	0.3140	0.1432	0.6024
Lack of Street Cleaners	1.7960	0.2790	0.1621	0.7648
Poor Government Policy	1.3520	0.1690	0.1031	0.8679
Bartlett Test of Sphericity				
KMO 0.773				
Chi-Square 2067.328***				
Rho 1.00000				

Problems of Solid Waste Disposal within the Rural Communities

Problems of solid waste disposal within the rural communities were subjected to problem confrontation index using Five-Point Likert scale (Table 6). Diseases and vector transmissions($\bar{x} = 33.27$) was ranked

1st among all problems identified. Public health issues ($\bar{x} = 30.33$) was ranked 2nd. Flooding($\bar{x} = 29.93$) and environmental fouling ($\bar{x} = 29.33$) were ranked 3rd and 4th respectively. This result is in line with earlier results of Abdel-Shafy and Mansour (2018) who reported that open canals and drains are being blocked by dumping huge amount of solid and garbage waste in both urban and rural areas of developing countries.

Table 6: Problems Confrontation Index of Respondents

Problems	SD	D	U	A	SA	TF	Mean	Rank
Environmental Pollution	24	16	33	24	34	421	28.07	5th
Public Health Issues	13	25	22	34	38	455	30.33	2nd
Flooding	37	25	38	27	28	449	29.93	3rd
Environmental Fouling	17	23	35	28	32	440	29.33	4th
Blockage of Drainage	26	27	21	38	21	400	26.67	6th
Diseases and Vector Transmission	37	31	26	33	38	499	33.27	1st

SD – Strongly Disagree, D– Disagree, U – Undecided, A-Agree, SA – Strongly Agree, TF – Total Frequency

Conclusion

Solid waste management is a serious problem in urban and rural areas of developing countries. Most of the respondents are young, active, and energetic in their youthful age. The respondents are literate as they had formal education. The household sizes were large with average of 6 people per household. Solid wastes in the area are classified as wood, food, paper, glass, rubber, metals, plastics, leather or polythene, and textiles. The various methods of solid waste disposals include incinerator, private vehicles, public containers, and dumpsite. The statistical and significant predictor socio-economic variables influencing willingness of respondents to pay for solid waste management services include gender, age, marital status, household size, level of education and income of respondents. The retained constraints facing respondents to willingly pay for solid management environmental services evaluated using principal component analysis include: lack of incinerator, lack of vehicles, lack of public containers, lack of drainage facilities, lack of street cleaners and poor government policy. Problem confrontation index revealed that diseases and vector transmission was ranked 1st, public health issues was ranked 2nd, flooding was ranked 3rd, environmental fouling, environmental pollution and blockage of drainage were ranked 4th, 5th and 6th respectively.

Recommendations

Based on the results of these findings, the following recommendations were made: Drainage facilities should be provided within the urban and rural areas. Incinerator should be made available in the study area. Vehicles should be adequately provided for easy movement of solid wastes from homes. Public containers should be made available at appropriate locations within the urban and rural areas. Appropriate government policies should be formulated in favour of solid waste management services.

References

Abdel-Shafy, H.I. and Mansour, M.S.M. (2018). Solid Waste Issue: Sources, Composition, Disposal, Recycling, and Valorization.

Egyptian Journal of Petroleum, 27: 1275 – 1290.

Alabi, O.O., Lawal, A.F., Awoyinka, Y.A. and Coker, A.A. (2014). Probit Model Analysis of Smallholder Farmers Decision to Use Agrochemicals Inputs in Federal Capital Territory Abuja, Nigeria, *Turkey International Journal of Food and Agricultural Economics (IJFAEC),* 2(1): 85-93.

Alajmi, R.G. (2016). The Relationship between Economic Growth and Municipal Solid Waste and Testing the EKC Hypothesis: Analysis for Saudi Arabia. *Journal of International Business Research and Marketing,* 1(5): 20 – 25.

Bolanle, B. and Ali, M. (2004). Sampling Households Waste at Source: Lessons Learnt. *Gaborone Waste Management and Research,* 22: 142 – 148.

Fehr, M., De Castro, M.S.M.V. and Calcado, M.D.R. (2000). A Practical Solution to the Problem of Households Waste Management in Brazil. *Resources, Conservation and Recycling,* 30(3): 245 – 257.

Ibikunle, O.A., Fawole, T.G., Sangotola, T.M. and Aderinto, S.J. (2015). Socio-Economic Impact of Solid Waste on Environment: A Case Study of Ido Local Government Area, Ibadan, Nigeria. *International Journal of Advanced Research in Engineering and Management (IJAREM)*, 1(9): 95 – 105.

Kayode, A.M. and Omole, F.K. (2011). Some Socio-Economic Factors Affecting Solid Wastes Generation and Disposal in Ibadan Metropolis, Nigeria. *Journal of Environmental Issues and Agriculture in Developing Countries,* 3(1):55 – 64

NPC, (2006). National Population Commission, Nigeria National Population Census Data 2006.

Rozenberg, A. (2013). Municipal Solid Waste: Is It Garbage or Gold. Available at: www.unep.org/geas [Accessed 1 February 2014]

Trang, T.T., Dong, H.Q., Toan, D.Q., Hanh, N.T.X. and Thu, N.T. (2017). The Effects of Socio-Economic Factors on Households Solid Waste Generation and Composition: A Case Study in Thu Dau Mot, Vietnam. *Energy Procedia,* 107: 253 – 258.

World Bank (2001). Philippines Environment Monitor 2001. World Bank-Country Office Manila, Pasig City, Phillipines, pp 29.

World Bank (2003a). Indonesia Environment Monitor 2003. World Bank Indonesia Office, Jakarta, Indonesia, pp 33 – 41.

Yamane, T. (1967). *Statistics: An Introductory Analysis.* 2nd Edition, New York, Harper and Row Publishers