

Analysis of Socio-Economic Factors Affecting Willingness to Pay for Solid Waste Disposal Services

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Abstract

The study investigated the factors influencing willingness to pay for solid waste disposal services in Enugu State. Survey research design was employed for this study and 380 households sampled using multi-stage sampling technique. On average, 67% of the households were willing to pay for solid waste disposal. This is so because most of the households saw waste disposal as a necessity. Those with a higher income, education and of older age were more willing to pay for solid waste disposal than those with lower income, education and younger age. In the same vein, satisfaction with waste disposal services, perceived cost of waste disposal services and knowledge of effects of poor waste disposal were all found to be positively and significantly related to willingness to pay for solid waste disposal services. Household size was found to negatively relate to willingness to pay, meaning that households with larger number of people were less willing to pay for solid waste disposal services. The study thus recommends among others that cost be factored in the designing of waste management system. Massive public awareness on the environmental and health effects of indiscriminate solid waste disposal should be embarked upon by the waste management agencies and Non-Governmental Organizations.

Keywords: Willingness to Pay; Solid waste; Disposal; Households

Introduction

The effective management of solid waste has been observed as one of the major challenges confronting both urban and rural areas throughout the world especially in developing countries. Often, a country's level of development influences the amount of waste it generates. Production and industrial activities in an economy leads to increased solid waste generation. However, efficiency of waste management adopted by a country helps to reduce the effect of waste generation. Available statistics shows that, although the municipal solid waste generation in the developing countries is still low per-capita compared to that in the developed countries, the developing countries account for more disproportionately high share of the world's solid waste generation relative to their share of world's income [1].

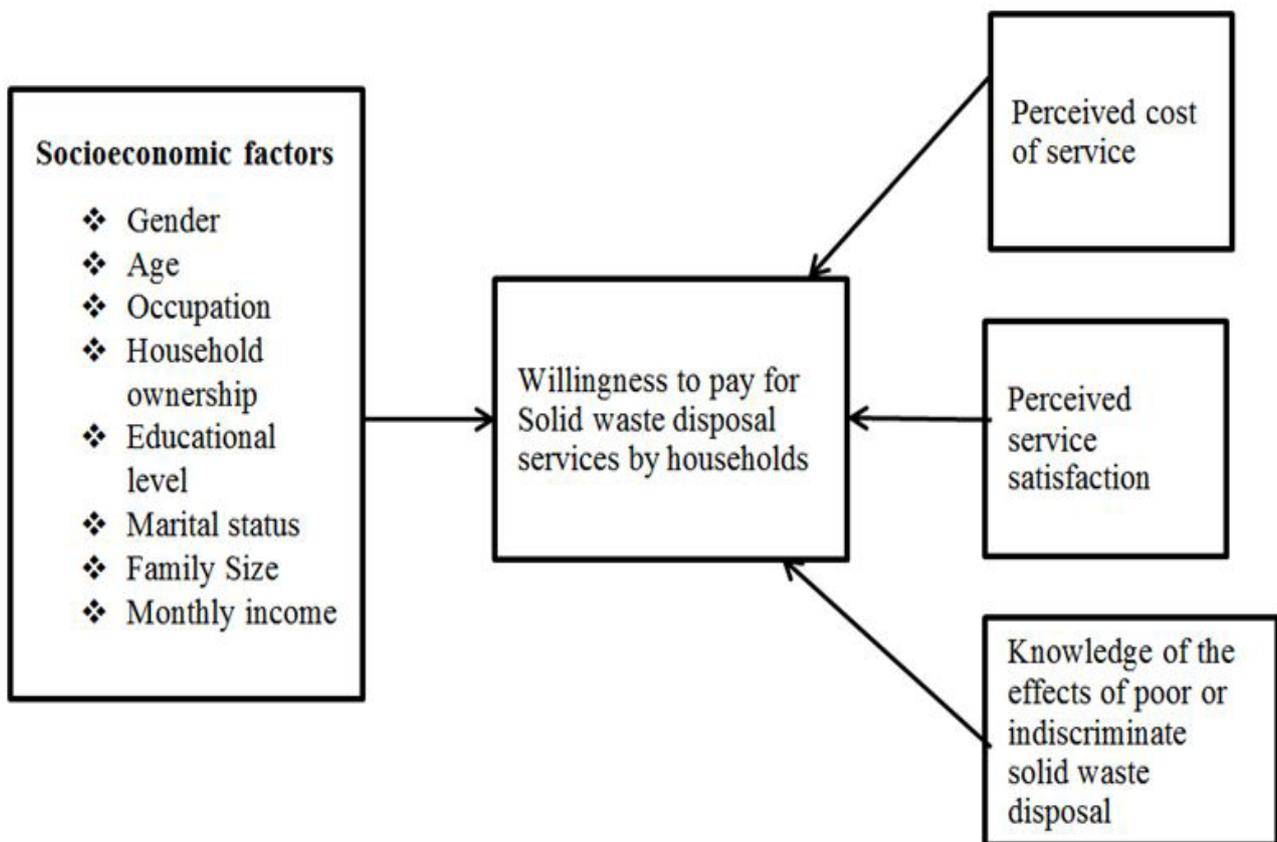
Despite the efforts of the Nigerian government especially at the State level through its waste management agency known as the Enugu State Waste Management Agency (ESWAMA) to ensure the cleanliness and orderliness of the city, yet the city has continued to experienced high level of littering and dumping of refuse. This has led to constant blockage of drainage systems, air pollution with its attendant health implications. The rate solid waste generation waste in the area is not commensurate to the rate of evacuation. Often the dumpsters in the area get filled up with wastes and starts spilling on the ground before the ESWAMA comes to evacuate them [2]. An inefficient municipal solid waste management system may create serious negative environmental impacts like infectious diseases, land and water pollution, obstruction of drains and loss of biodiversity. This is why government at all levels should be concerned about the solid waste management system of its country. Furthermore, an effective solid waste system will increase a nation's economy. This is because a healthy environment will attract both local and foreign investors.

Evidence from the literature shows that the provision of waste management services in any large city is an expensive undertaking that makes huge demands on the finances of the governments. Apart from making investments in capital equipment, money is also required for the day to day operational cost of the service in the procurement of fuel, spare parts and working gear [3,4]. Dhungana [5] argued that to make waste management efficient, local governments and other service providers should have a reliable and sustainable means of obtaining funds to cover the costs of the service. He further noted that for waste management to be sustainable, both the government and the general public

will share the cost and bear the financial burden involved. Considering the submission of Dhungana [5], above, it is therefore important to note that the sustainability of funds to manage solid waste will be largely determined by the willingness of neighborhoods to pay for solid waste disposal services. Furthermore, this willingness to pay (WTP) will largely be predicated on several socioeconomic and other factors.

In view of this, [6], in their study on household's willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana, found that age, household size and income influenced with consumers' willingness to pay for an improved solid waste management system. They found females more willing to pay and males less willingness to pay. Gender according to Ojok, *et al.* [7] played a significant role in influencing households' willingness to pay for solid waste disposal services. For Naol [4] household expenditure, quantity of waste generated and level of education significantly influenced consumers' willingness to pay.

Addai and Danso-Abeam [6] and Amfo-Out, *et al.* [8] all concluded that the education had positive and significant impact on household's willingness to pay for solid waste management. The higher people's level of education, the more would appreciate a clean environment, hence willing to pay to maintain the environment. Household size was found by Addai and Danso-Abeam [6]; Assa [9] and Ojok, *et al.* [7] to be significantly correlated with willingness to pay for waste management. Based on the above factors identified by the studies reviewed, this study therefore investigates these factors with a view to identifying the critical factors that influences the attitude and willingness of households in Enugu metropolis to pay for solid waste disposal. Other factors investigated include perceived waste disposal service quality, perceived cost of waste disposal service and knowledge of the effects of poor or indiscriminate solid waste disposal (Figure 1).



Source: Author's construct 2019

Figure 1 :Causal links of factors influencing Households' Willingness to Pay for Solid Waste Disposal Services

Materials and Methods

Survey research design was employed for this study. This research design is fitting for this study as it involves administering a survey/questionnaire to a sample or to the entire population of people to describe the attitudes, opinions, behaviors, or characteristics of the population. A structure questionnaire was used to collected data for the study. The first part of the questionnaire elicited demographic and socio-economic data of the respondents while the second part elicited information on the possible factors that influences the respondent's willingness to pay for solid waste disposal services.

The study was carried out in the city of Enugu, South Eastern Nigeria. Enugu metropolis is situated between latitude 06°21 and 06°30N and longitude 07°, 26 and 07°, 37E of Greenwich Meridian. Enugu metropolis consists of three Local Government Areas namely: Enugu North, Enugu East, and Enugu South. The 2015 projected population of Enugu metropolis is 919,708. The sample size of this study was determined using Krejcie & Morgan [10] formulae expressed as:

$$n = \frac{X^2 \times N \times P \times (1 - P)}{ME^2 \times (N - 1) + (X^2 \times P \times (1 - P))}$$

Where:

- n = Sample Size
- X² = Chi-Square for the specific confidence level at 1 degree of freedom (1.96 @ 95%)
- N = Population Size
- P = Population Proportion (0.5 for this study)
- ME² = Desired Margin Error (expressed as proportion)
- Sample size (n) = 384

Multi stage sampling method was employed. There are three local governments that make up Enugu metropolis (Enugu East, Enugu North and Enugu South). In the first stage, two residential areas were purposively selected from each of the LGAs. They are Independence Layout and GRA from Enugu North LGA, Trans Ekulu and Emene from Enugu East LGA, and Uwani and Achara Layout from Enugu South LGA. In the second stage, two Streets were randomly selected from each of the residential areas. In Independence Layout, Ezeilo and Ukehe streets were selected while in GRA, Charles and Nwodo streets were selected.

In Trans-Ekulu, Bishop Shanaham and Dimka streets were selected while in Emene, Nwafor road and Uga streets were selected. In Uwani, Nnaji and Peter Okoye streets were selected while in Achara Layout, Enugu Agidi streets and Kenneth road were selected. Finally, houses were randomly selected for the study after the count of three house numbers. 146 questionnaires were distributed equally among the four selected streets in Enugu East, 134 questionnaires distributed equally among the four selected streets in Enugu North, while the remaining 104 questionnaires were also distributed equally in the selected four streets in Enugu South, making it a total of 384 questionnaires distributed in the twelve selected streets. The distribution of the questionnaires was based on the contribution of the LGAs to the study population (Table 1).

Name of LGA	Percentage Contribution to the Study Population	Questionnaires Allocated(Sample)
Enugu East LGA	38%	146
Enugu North LGA	35%	134
Enugu South LGA	27%	104
Total	100	384

Source: Author’s questionnaire distribution, 2019

Table 1: Questionnaire allocation to the three LGAs based on percentage contribution to the study population

Model Specifications

The Binary Logit model was adopted for this study. The model is intended to measure the probability that residents are willing to pay for waste disposal or not. The Logit model is used for prediction of the probability of occurrence of an event by fitting data to a logistic function. The Logit model is specified below.

$$P_i = \Pr(y_i = 1) = \frac{e^{X\beta}}{1 + e^{X\beta}}$$

Based on the above formulations, the model was therefore stated mathematically as:

$X\beta$ for the model:

$$WTP = \beta_0 + \beta_1G + \beta_2A + \beta_3O + \beta_4HO + \beta_5E + \beta_6MS + \beta_7HS + \beta_8Y + \beta_9S + \beta_{10}PE + \beta_{11}KS + \mu_0$$

Where, WTP = Willingness to pay for waste disposal (1 for Yes; 0 for No)

G = Gender (1 for male; 0 for female)

A = Age (years)

O = Occupation

HO = Household Size (1 for owned, 0 for rented)

E = Educational level (no formal education, basic education, secondary education and tertiary education but no formal education was the controlled variable)

MS = Marital status (Single, married, divorced and widowed but single was a controlled variable)

HS = Household Size (number)

Y = income (average monthly income)

S = Satisfaction with Waste Management Services (1 for satisfied; 0 for not satisfied)

PE = Perceived Cost (perception of waste disposal services by Waste Management Agency) [1 for affordable; 0 for not affordable]

KS = Knowledge of effect of waste (Awareness of the health of poor waste disposal [1 for yes; 0 for unawareness of health effect of indiscriminate waste disposal])

$\mu_0 \dots \mu_{10}$ = Stochastic term (include all omitted variables that can influence the dependent variables).

Apriori Expectation

Gender (G): Gender (1 = male and 0 Female) is supposed to affect WTP. A positive relationship between WTP and Gender is expected to exist. Females are assumed to take care of the environment as hence would have higher WTP.

Age (A): Based on empirical studies reviewed, age is expected to be inversely related to WTP. As people grow older, they are expected to become conservative, avoid expenditures and their WTP will decrease.

Occupation (C): Occupation is expected not to be related to WTP for solid waste disposal services. Where a person works or what he does is assumed not to affect his willingness to pay. Rather how much he earns is rather expected to be a determinant of WTP.

House Ownership (HO): There is no relationship expected between HO and WTP for solid waste disposal. It is assumed that a person's WTP is not affected by whether he or she owns or rents his or her apartment.

Education (E): Education is expected to positively influence will WTP for solid waste disposal services. The more the years of schooling, the more people understand better the importance of proper waste management. The educated will be more willing to pay than the illiterate.

Marital Status (MS): Marital status is expected not to be related to WTP for solid waste disposal services.

Household Size (HS): Household size is expected to be negatively related to WTP. This study assumes that due to the budgetary constraints in terms of cost associated with large family size, households with more number of people are expected to be less willing to pay for solid waste disposal services than households with lesser than number of people.

Income (Y): Household monthly Income is expected to be positively and significantly influence WTP. Those with a higher income are expected to be more willing to pay for solid waste disposal services than those who have little or no source of income.

Satisfaction with Waste Management Services (S): (1 for satisfied; 0 for not satisfied). This is expected to have a positive relationship with WTP. The utility in terms of satisfaction people derive from a services is supposed to spur or motivate them to willingly pay for such services.

Perceived Cost (PC): perception of waste disposal services cost by Waste Management Agency [1 for affordable; 0 for not affordable] is expected to be positive and significantly relate to WTP. Man being economic in nature will always consider cost in whatever he does. Those who perceive the waste disposal services to be affordable are expected to have higher WTP than those who perceive the cost to be unaffordable.

Knowledge of effect of Waste (K): Awareness of the health effect of poor waste disposal [1 for yes; 0 for unawareness of health effect of poor waste disposal). Just as for perceived cost and satisfaction, K is expected to be positively related to WTP as those that are aware of the health effects of poor waste disposal should be more willing to pay for waste disposal services than those who are not aware.

Discussion of Results

Demographic Characteristics of Respondents

From result presented in Table 2, men accounted for 52.6% of the respondents. This is largely due to the fact that men are traditionally considered as the bread winners/household heads especially in a patriarchal society like Enugu State. 82.8% of the household heads were within the ages of 31years to 50 years. This affirms that most men in the Igbo ethnic group marry from their thirties upwards as the age of thirty is often acknowledged as the age of maturity. On occupation of the household heads, 51% were employees (civil servants, private firm employee, etc). This is expected considering the fact that Enugu is largely a civil service/administrative city.

Also, 40.1% of the household heads are artisans (self-employed business people) affirming the entrepreneurial spirit of the Igbos. 79.2% of the respondents lived in a rented apartment while 20.8% owned the house the lived in. 52.1% of the respondents had a first degree for a tertiary institution while 28.1% had a postgraduate degree. This underscores the high literacy level of the city with the attendant tertiary institutions located in the city. 49.2% of the household heads were married while 28.6% are still single/unmarried. Household sizes of 1-3 persons where more, followed by 4-6 persons and then above 6 persons. This shows that family planning has gained considerable ground in the city. With 64% of the household heads having an monthly income of N50,000 - N150,000 (N50,000 - N100,000, 28.1%; N101,000 - N150,000, 35.9%), one could conclude that the household heads are averagely middle income earners.

Item	Frequency	Percentage
Sex		
Male	202	52.60%
Female	182	47.40%
Age		
18-30years	20	5.20%
31-40years	148	38.50%
41-50years	170	44.30%
51years and above	46	12%
Occupation		
Employee	196	51.00%
Unemployed	34	8.90%
Self-Employed	154	40.10%
House Ownership Status		
Owner	80	20.80%
Rented	304	79.20%
Educational Qualification		
First School Leaving	15	3.90%
O'Level	61	15.90%
OND, HND, B.Sc	200	52.10%
Postgraduate	108	28.10%
Marital Status		
Married	189	49.20%
Single	110	28.60%
Divorced	54	14.10%
Widowed	31	8.10%
Household size		
1-3 persons	165	43.00%
4-6 persons	139	36.20%
7 persons and above	80	20.80%
Monthly Income		
Below N50,000	26	6.80%
N50,000 – N100,000	108	28.10%
N101,000 – N150,000	138	35.90%
N151,000 – N200,000	72	18.80%
Above N200,000	40	10.40%

Source: Field Survey Results

Table 2: showing the demographic characteristics of respondents (n=384)

Factors Influencing Willingness to Pay for Solid Waste Disposal Services

The results of the logit regression analysis in Table 3 indicate a significant relationship between household monthly income and willingness to pay for solid waste disposal services. The estimated marginal effect is 0.343, meaning that households with higher income would be 34.3% more willing to pay for solid waste disposal services than those with lower income. With a coefficient of 1.892 and $p=0.034$, household monthly income has a positive and significant relationship with WTP. This finding is in tandem with the apriori expectation. Income is expected to be positively related to WTP. This is further validated by the environmental economic theory which assumes that the demand for an improved environmental quality increases with income. Consequently, those with a higher income are expected to be more willing to pay for and waste disposal services than those who have little or no source of income.

Unexpectedly, the logit results show that age is positively significant (coefficient = 1.336, $p=0.013$) with WTP for solid waste disposal services. This finding is in contrast with several studies that found age not significantly influence WTP [3,11]. From the logit results, Increase in age is said to increase willing to pay for waste disposal services. People with significant age are often likely to take care of their environment and ensure its cleanliness. The coefficient of age suggests that, holding everything else constant; a one-year increase in the respondent's age will increase WTP by P 1.336. An estimated marginal effect of 0.430 implies that households' with older people as head are 43% more likely to be willing to pay for solid waste disposal.

Variable	Marginal effect	Coefficient	P value
Constant		-2.36	0.001
Gender	-0.001	-0.373	0.472
Age	0.43	1.336	0.013
Occupation	0.185	-2.091	0.241
Household Ownership	0.4	-0.814	0.126
Educational level	0.54	0.483	0.042
Marital Status	0.002	0.026	0.273
Household size	0.363	-0.469	0.042
Monthly Income	0.343	1.892	0.034
Satisfaction with waste disposal service quality	0.333	1.477	0.001
Perceived cost of waste disposal service	0.284	1.643	0.016
Knowledge of effects of poor waste disposal	0.343	2.36	0.024

Cox and Snell R-square=0.280; Nagelkerke R- square=0.408; Chi-square=65.588; P-value=0.001

Significance at 5% level of confidence

Source: Field Survey Results, 2019

Table 3: showing factors influencing willingness to pay for solid waste disposal services

The results further show that respondents' gender, marital status and household ownership status do not significantly influence willingness to pay for waste disposal services. This result is in contrast with earlier findings that showed that these variables significantly influenced household willingness to pay for solid waste disposal services [6,12]. Based on the apriori expectation, gender is supposed to be positively related with WTP as earlier studies have shown that women take care of the environment more than men. However, from the findings of this study, factors other than accounted for the WTP. Furthermore, educational level as expected was found to significantly and positively influence willingness to pay for solid waste disposal service ($p = 0.042$, with a marginal effect of 0.540), meaning that households with educated household head are 54% more likely to pay for waste disposal than those with less educated household heads. The higher the education attained, the higher the probability of the individual's willingness to pay for improved waste disposal services. This is supported by other studies that found that people with higher education are better able to understand and appreciate waste disposal services and so they would be more willing to pay for solid waste disposal services [6,11,12].

Perceived cost of waste disposal services was found to be positive and significant with willingness to pay for waste disposal services. This is in tandem with the aprior expectation. The results of this study indicate that with a coefficient of 1.893 and significant at 5% level ($p = 0.001$) a marginal effect of 0.333 mean that households who perceived the cost of waste disposal services to be affordable are 33.3% more willing to pay for waste disposal than those who perceive the cost to be unaffordable. Awunyo-Vitor, et al. [3] noted that the amount of money people are willing to pay depends on their perception of the amount they are asked to pay and the quality of waste disposal services they get.

The result of this study further shows that just as higher education would lead to more willingness to pay for waste disposal services, the awareness/knowledge of the negative effects of poor or indiscriminate waste disposal would increase individual's willingness to pay for waste disposal. This shows that individuals who are aware of environmental health have a greater position towards the willingness to pay for solid waste management than those who are not aware. With a coefficient of 2.360, $p=0.024$ and a marginal effect of 0.343 mean that individuals who are aware of the negative implication of poor waste disposal are 34.3% more willing to pay for solid waste disposal services [13].

Similarly, satisfaction with solid waste disposal services had positive and significant relationship with WTP ((1.477, $p=0.001$). A marginal effect of 0.333 as seen in the logit regression result means that individuals who perceive solid waste disposal services as having quality are 33.3% more likely to be willing to pay for solid waste disposal services than those who perceive it otherwise. However, household size as anticipated has a negative and significant effect on willingness to pay (-0.469, $p=0.042$). This shows that as a household increases, willingness to pay waste management degenerates. This most probably can be as a result of the cost implication and burden associated with large family size. The estimated coefficient of household size implies that a unit increase in household size will decrease WTP by P 0.469. This suggests that larger family size bring out difficulties in terms of budgetary constraints, hence the decreased WTP [14,15].

Conclusion and Recommendations

Using Logit regression model, the study analyzed the influence of socioeconomic factors on residents' willingness to pay for waste disposal services. The study found that gender, marital status and household ownership status did not determine willingness to pay. This is in contrast with several studies that highlighted gender as a major determinant of willingness to pay for improved solid waste disposal services noting that women are more likely to be willing to pay for waste disposal than men. However, this study found that factors other than gender influences willingness to pay. These factors include Age of household head (older people were

found to take care of the environment and hence willing to pay for solid waste disposal services than younger people), House hold size (large family size bring about difficulties in budgetary constraints and hence willing to pay), educational level (households with educated heads are more likely to appreciate the environment and thus willing to pay for solid waste disposal).

Other factors that were found to influence willingness to pay for solid waste services are perceived household income, cost and quality of waste disposal services and awareness/knowledge of negative impact of poor or indiscriminate solid waste disposal. Those who perceived the cost to be affordable and quality good enough were more willing to pay than those who did not. Also those who had knowledge of the hazards associated with poor or indiscriminate solid waste disposal were more willing to pay than those who didn't. The positive and significant relationship between household monthly incomes, perceived cost of waste disposal services and willingness to pay together with the negative significant sign that family size had with willingness to pay shows that cost is very critical to sustainable solid waste disposal system.

Based on the above findings, the study recommends that the government through its numerous environmental agencies with support from civil society organizations should engage in massive awareness campaigns about the consequences of waste mishandling and benefits of payment for proper waste management services. It is also recommended that the agencies responsible for solid waste disposal in Enugu State should improve on the quality of its services and also make it cost-effective as this will increase willingness to pay for solid waste disposal services. In addition, public education campaigns through the mass media and also mainstreaming environmental management subjects in the school curriculum could also be adopted in order to properly inform the citizens about the need to take care of their environment and patronize the services of solid waste disposal companies, since education has been found to be statistically significant with the willingness to pay for solid waste disposal services.

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