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*Research Article*

# Urban Households' Willingness to Pay for Improved Solid Waste Disposal Services in Kumasi Metropolis, Ghana

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Solid waste management within Kumasi Metropolitan Assembly area continues to be a major challenge for the municipal assembly and one of the key issues is its financial constraints. This study was undertaken to examine households' willingness to pay for improved solid waste management services. A multistage sampling technique was employed to select six hundred respondents for the study. Logistic regression model was used to establish the determinants of willingness to pay for solid waste management whilst the Tobit model was used to evaluate the factors influencing the amount of money the households are willing to pay for improved solid waste management. The logistic model shows that income, age, number of children, quantity of waste generated, and education have significant effects on the willingness to pay, while the amount of money the households are willing to pay was influenced by their income, quantity of waste generated, education, house ownership, and number of children. Thus, the assembly can increase waste collection fees between GHC 3 and GHC 5.00. This would lead to improvement in the waste management within the metropolis. However, the additional charge should take into consideration location and income levels.

## 1. Introduction

Waste is directly linked to human development, both technologically and socially. The composition of different wastes has varied over time and location, with industrial development and innovation being directly linked to waste materials. Some components of waste have economic value and can be recycled once correctly recovered.

Humans generate a great deal of waste as a by-product of their existence. This is evidenced at dumping pits located in or around archaeological sites. Every task, from preparing a meal to manufacturing a computer, and so forth, is accompanied with production of waste material which cannot be used for other things and needs to be disposed of effectively. If not contained and handled appropriately, waste can balloon into a huge problem, as, for example, when garbage ends up in the open ocean where it can make animals and birds sick amongst others.

Waste is sometimes a subjective concept, because items that some people discard may have value to others. It is widely recognized that waste materials are a valuable resource, whilst there is a debate as to how this value is best realized. Such concepts are colloquially expressed in the western culture by idioms like "One man's trash is another man's treasure." On the generation end, waste management agencies have placed an increasing focus on reducing waste so that there is less to cope with. This can be done on an industrial level by developing more efficient processes, reducing packaging, and so forth. Individuals consumers can also make commitment to generate less waste. A big part of this movement has focused on recycling, in which usable goods are reclaimed so that they can be reused or repurposed.

Transportation of waste is a major issue, as appropriate disposal sites may be remote. Frequently, subscription pick-up services are available for people paying a flat fee to have their waste picked up and disposed of. Other people can

also subscribe to specialty services, like medical waste pick-up services, or confidential paper shredding and disposal services.

Waste management practices differ for developed and developing nations, for urban and rural areas, and for residential and industrial producers. For instance, in some cases management for nonhazardous residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for hazardous commercial and industrial waste is usually the responsibility of the generator. Developing effective waste management strategies is critical for nations all over the world, as many forms of waste can develop into a major problem when they are not handled properly. Numerous firms provide waste management services of a variety of types, and several governments also regulate the waste management industry for safety and efficacy.

According to [1] historically, the amount of waste generated by human population in the early ages was insignificant mainly due to the low population densities, coupled with the fact that there was very little exploitation of natural resources. Common wastes produced during the early ages were mainly ashes and human and biodegradable wastes, and these were released back into the ground locally, with minimal adverse environmental impact.

Before the widespread use of metals, wood was widely used for most applications. However, reuse of wood has been well documented. Nevertheless, reuse and recovery of such metals have been carried out by earlier humans. With the advent of industrial revolution, waste management became a critical issue. This was due to the increase in population and the massive migration of people to industrial towns and cities from rural areas. There was a consequent increase in industrial and domestic wastes posing threat to human health and environment.

In Africa, municipal solid waste management constitutes one of the most crucial health and environmental problems facing governments of African cities. This is because even though these cities are using 20–50 percent of their budget in solid waste management, only 20–80 percent of the waste is collected. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation. Not only is their quantities increasing but their variety is also increasing, both a consequence of increasing urbanization, incomes, and changing consumption habits fuelled by globalization. This scenario places the already desperate urban councils in a difficult situation especially as they have to develop new strategies to deal with increasing volumes as well as strange varieties of wastes. Poor waste management practices, in particular, widespread dumping of waste in water bodies and uncontrolled dump sites, aggravates the problems of generally low sanitation levels across the African continent.

According to [2], urbanization is on the rise in Africa, and this trend is expected to continue in the future. Of concern is the inability of infrastructure and land use planning methods (including waste management) to cope with urban growth, (the highest in the world) at 3.5 percent annually. This is particularly urgent in slum areas, which constitute a big part of many of the cities and towns in Africa. Waste management infrastructure is largely nonexistent in rural areas of Africa.

Imports of second-hand consumer goods and production and/or import of substandard products are all contributing to the rapid increase in waste generation. Policies should be put in place and existing standards enforced to reverse this trend. Implementation or enforcement of waste regulations and conventions is severely constrained by the lack of good governance, transparency, and prevalence of corruption in some cases. Lack of awareness and appreciation of best practices for environmentally sound management of wastes is a major constraint. A paradigm shift among communities and society at large is needed. Again, the fast growing use of ICT and rapid turnover in technology (particularly computers, mobile phones, etc.) is creating a growing E-waste stream, for which there is no waste management capacity yet. This leads to disposal of both E-waste and municipal waste in dump sites. Changing lifestyles and consumption patterns of the growing urban middle class, in particular, increases the complexity and composition of waste streams in Africa.

The gap between waste management policy and legislation and actual waste management practices is widening due to perennial capacity constraints and lack of waste management facilities for various waste streams. Access to major investments and acquiring the technical know-how needed to resolve the capacity constraints remain a tall order. Waste generation is expected to increase significantly as a result of industrialization, urbanization, and modernization of agriculture in Africa. This will further aggravate the current capacity constraints in waste management.

Progress has been made in waste management policies and strategies. Biogas and compost production from organic waste fractionation has been widely accepted in Africa as a best practice, and progress is being made in developing and implementing specific projects in various countries. However, the use of economic instruments and implementation of polluter-pays principles in waste management have yet to mature in most African countries.

The single largest implementation challenge for managing waste policies remains creating sufficient capacity for environmentally sound management, including, where appropriate, recovery and recycling of various waste streams across Africa. The effort to do this is constrained by access to finance and technical know-how. Current bylaws in most African countries give responsibility for waste management to municipalities, which are often ill-equipped to deal with collection and disposal. Such bylaws are now an impediment to investment in waste management by the private sector.

## 2. Problem Statement

Ghana in general and Kumasi Metropolitan Assembly (KMA) in particular have made several attempts at addressing the waste menace which is on the rise as a result of population hikes, growth in industrialization, and consumer attitudes. The city's bylaws and policies on waste and sanitation seek to address the waste challenge in its entirety on individual basis. The assembly, among its efforts and strategies, has contracted some waste companies to handle waste collection and

disposal. It has also been implementing the polluter-pays principle to get individuals to pay for waste management services. Furthermore, some effort is being made to educate the public and create some level of awareness to enable members of the public to play a role in reducing waste and handling waste efficiently.

However, the level of achievement of this objective leaves much to be desired as there is a presence of piles of wastes on the streets, market centres, and homes. Waste management still remains a herculean task to the Assembly as it has not been able to manage and deal with waste problem to the expected level of it. This situation, according to the KMA, is generally attributed to inadequate finance to clear the solid waste in the case of both the assembly and contracted companies. Thus, the assumption is that if households pay more, then the services would be improved. However, very little has been done to assess the households' willingness to pay for improved waste management services. The question then is that Are the households ready to pay more? How much are they prepared to pay? and What factors determine their motivation to pay and the amount of money they are willing to pay? The main objective of this study is to assess the determinants of households' willingness to pay for improved solid waste management services and the amount of money they are willing to pay.

## 3. Methodology

*3.1. Data Collection Procedure.* The sample for the study was selected in three stages; first was the purposive selection of submetros followed by the random selection of electoral areas within the selected submetros. The selection of the submetro was guided by the level of waste management activities within these areas using a report from KMA [3]. The third stage involves random selection of households. In all, 600 households were selected for the study. Data and information were collected through individual interviews using well-structured questionnaires.

*3.2. The Theoretical and Analytical Framework.* Two levels of analyses were carried out. The first was to estimate the determinants of household heads willingness to pay for improved waste management services using the logit model. The second level of analysis was to estimate the determinants of the amount of money they are willing to pay for improved waste management services using the Tobit model.

The logit model as stated by [4] earlier was employed to examine the determinants of household heads willingness to pay for improved waste management services. The study used the threshold decision-making theory proposed by [5, 6] to analyse the determinants of willingness to pay for improved waste management services by household heads. The theory points out the fact that when the individual is faced with a situation to take a decision in this case to pay for improved waste management services or not to pay he/she has a reaction threshold, which is dependent on a certain set of factors. As such, at a certain value of stimulus below the threshold, no reaction is observed while at the critical threshold value, a reaction is stimulated. Such phenomena are generally modelled using the relationship

$$Y_i = \beta X_i + \mu_i, \tag{1}$$

where $Y_i$ is equal to one when a choice is made to pay for improved waste management services and zero otherwise; this means

$Y_i = 1$ if $X_i$ is greater than or equal to a critical value, $X^*$ and

$Y_i = 0$ if $X_i$ is less than a critical value, $X^*$.

Note that $X^*$ represents the threshold value of the independent variables ($X$). Equation (1) represents a binary choice model involving the estimation of the probability of willingness to pay for improved waste management services ($Y$) as a function of independent variables ($X$). Mathematically, this is represented as

$$\begin{aligned} \text{Prob}\left(Y_i = 1\right) &= F\left(\beta' X_i\right), \\ \text{Prob}\left(Y_i = 0\right) &= 1 - F\left(\beta' X_i\right), \end{aligned} \tag{2}$$

where $Y_i$ is the observed response for the $i$th observation of the response variable, $Y$. This means that $Y_i = 1$ for a household head who is willing to pay for improved waste management services and $Y_i = 0$ for a household head who is not willing to pay for improved waste management services. $X_i$ is a set of independent variables such as literacy, monthly income, age, marital status, housing arrangement, and quantity of waste generated, gender, associated with the $i$th individual, which determine the probability of willing to pay for improved waste management services ($P$). The function $F$ may take the form of a normal, logistic, or probability function. The logit model uses a logistic cumulative distributive function to estimate $P$ as follows:

$$\begin{aligned} P\left(Y = 1\right) &= \frac{e^{\beta' X}}{1 + e' X}, \\ P\left(Y = 0\right) &= 1 - \frac{e^{\beta' X}}{1 + e^{\beta' X}} = \frac{1}{e^{\beta' X}}. \end{aligned} \tag{3}$$

According to [7], the model is a regression of the conditional expectation of $Y$ on $X$ giving

$$E\left(\frac{Y}{X}\right) = 1\left[F\left(\beta' X\right)\right] + 0\left[1 - F\left(\beta' X\right)\right] = F\left(\beta' X\right). \tag{4}$$

Since the model is nonlinear, the parameters are not necessarily the marginal effects of the various independent variables. The relative effect of each of the independent variables on the probability of a household head willing to pay for improved waste management services is obtained by differentiating (4) with respect to $X_i$ resulting in (5) [7] as

$$\frac{\partial P_i}{\partial X_i} = \left[\frac{\lambda^{\beta' X}}{1 + \lambda^{\beta'} X}\right] \beta = F\left(\beta' X\right)\left[1 - F\left(\beta' X\right)\right] \beta. \tag{5}$$

The maximum likelihood method was used to estimate the parameters. The implication for applying the logit model in this paper is that the respondents would decide to pay for improved waste management services when the combined effects of certain factors exceed the inherent resistance of not to pay for improved waste management services. The preference for the logistic regression model to the conventional linear probability regression model in analysing the determinants of household heads willingness to pay for improved waste management services is based on the fact that the parameter estimates from the former are asymptotically consistent and efficient. The estimation procedure employed also resolves the problem of heteroscedasticity and constrains the conditional probability of making the decision to pay for improved waste management services lie between zero and one. The main reason for choosing the logit model over the probit model for this paper is because of its mathematical convenience and simplicity [6] and the fact that it has been applied in similar studies by [8, 9] among others.

The logit model provides information only with respect to the household heads' decision to pay for improved waste management services or not to pay, but not on the amount of money they are willing to pay. To estimate the determinants of the amount of money they are willing to pay, the Tobit model is employed. The Tobit model allows us to identify the factors that determine how much the respondents are willing to pay for improved waste management services. The Tobit model was developed by Tobin in 1958 and has been used by a number of researchers including [10–12] in various studies. According to [6, 13], the general formulation of the Tobit model is usually given in terms of an index function. This is given in (6) as

$$y_i = X'\beta + \varepsilon_i, \tag{6}$$

where $y_i$ is the dependent variable, in this case, is the amount of money the respondents are willing to pay. $X_i$ is a set of explanatory variables, and $\varepsilon_i$ is assumed to be an independently and normally distributed stochastic term with zero mean, $(\mu)$, and constant variance, $(\sigma^2)$. Assume that there is a perceived utility $U(y)$ for paying for improved waste management services, and, a utility $U(0)$ for not paying for improved waste management services, Further assume that there is a cluster of the population with no decision to make at the limit [10–12, 14], then

$y_i = 0$ if $y_i^* \leq 0$ for not paying for improved waste management services,

$y_i = 1$ if $y_i^* > 0$ for paying for improved waste management services,

where $y_i^*$ is the unobserved latent variable or the threshold which is observed only when $y_i$ or the amount of money households are willing to pay is positive. The expected value $E_y$ of the amount of money they are willing to pay for improved waste management services is given as follows:

$$E_y = X_i\beta F(z) + \sigma f(z), \tag{7}$$

where $X$ is the vector of explanatory variables; $F(z)$ is the cumulative normal distribution of $z$; $f(z)$ is the value of the derivative of the normal curve at a given point (i.e., the unit normal distribution); $z$ is given as $X\beta/\sigma$; $\beta$ is a vector of Tobit maximum likelihood estimates; $\sigma$ is the standard error of the model. The relationship between the expected value of all observations, $E_y$, and the expected conditional value above the limit $E_y^*$ is given by

$$E_y = F(z)\, E_y^*. \tag{8}$$

Analyzing the policy implications of changes in the relevant explanatory variables is a major component of this paper. To this end, the effect of the change in $i$th variable of $X$ on $y$ leads to the following decomposition:

$$\frac{\delta E_y}{\delta X_i} = F(z)\left(\frac{\delta E_y^*}{\delta X_i}\right) + E_y^*\left(\frac{F(z)}{\delta X_i}\right). \tag{9}$$

Thus (9) suggests that the total change in elasticity of $y_i$ can be disaggregated into two parts, namely, the change in probability of the expected level of intensity and the change in the elasticity of willing to pay for improved waste management services.

To obtain the marginal effect of the observed variable that is of interest in this paper, the following formula [6] is used:

$$\frac{\delta E(y/X_i)}{\delta X_i} = \beta^* \operatorname{Prob}(0 < y^* < 1). \tag{10}$$

According to [7], the log likelihood of the Tobit model is specified as

$$\ln L = \sum_{y_i>0} -\frac{1}{2}\left[\log(2\pi) + \ln\sigma^2 + \frac{\left(y_i - X_i'\beta\right)^2}{\sigma^2}\right] + \sum_{y_i=0} \ln\left[\frac{1-\phi\left(X_i'\beta\right)}{\sigma}\right]. \tag{11}$$

Maximising this likelihood function with respect to $\beta$ and $\sigma$ gives the maximum likelihood estimates of these parameters. Stata (version 10) was the statistical software employed to estimate the empirical parameters by MLE.

## 4. Choice of Variables for Logit and Tobit Models

The variables used in the logit and the Tobit models are presented in Table 1. The choice of variables was based more on related studies by researchers as follows.

(i) *Income*. This variable refers to the monthly money income of the household in terms of Ghana Cedis. It includes the income of the head from all sources. There is a general agreement in the environmental economics literature on the positive relationship between income and demand for improvement in environmental quality [15]. Therefore, we expect the income to affect the willingness to pay and its amount positively.

Table 1: Description of explanatory variables used in the model.

| Variable | Description | Unit of measure |
|---|---|---|
| Income | Monthly income of the household | Ghana Cedis (GHC) |
| Gender | Gender of respondents | Binary = 1 if male, 0 = otherwise |
| Age | Age of respondents | Years |
| Education | Number of years of formal education | Years |
| Marital status | Marital status of respondent | D = 1 if married 0 = otherwise |
| Time spent in the area | How long respondent has been living in the area | Years |
| Housing arrangement | Housing arrangement | Binary = 1 if owner occupied, 0 = otherwise |
| Number of dependents | Number of household members below 18 years of age | Number individuals |
| Quantity of waste | Volume of waste generated | Number of GHC 30 worth plastic (polythene) bag |
| Responsibility of solid waste management | Responsibility of solid waste management | Binary 1 = if they think KMA is responsible, 0 = otherwise |

(ii) *Gender*. This study expects female respondents to be more willing to pay than men, since traditionally it is the role of women to clean the house and dispose of the waste.

(iii) *Age*. This refers to the age of the respondent and it is expected to affect the willingness to pay negatively. This is because old people may consider waste collection as the government responsibility and could be less willing to pay for it, while the younger generation might be more familiar with cost sharing and hence may be willing to pay more for improved waste management.

(iv) *Education*. This variable is taken to capture the number of years the respondent spent in formal school system. Education is expected to have positive and significant effect on waste management. Thus, the longer period the individual spent in formal school system, the more likely that he/she would be willing to pay more for improved waste management.

(v) *Marital status*. The marital status of the household head is expected to influence the value the individual places on waste management. This is due to the fact that married people are likely to be more responsible to keep the environment clean and hence are more likely to be willing to pay more for improved waste management.

(vi) *Length of stay*. This refers to the number of years the household has been living in the area. This is expected to influence the willingness to pay in the positive direction, since the longer the year the household has been there, the more they would understand the problem of solid waste management of that area, and the more they would be willing to pay for improvement in the waste management.

(vii) *Number of children in the household*. This refers to the number of household members who are below 15 years of age. This variable is expected to have a negative effect on the willingness to pay. This is due to the fact that the more children in the household, the more they would prefer to use their children to clean the environment than paying more to the metropolitan authorities to clean the environment.

(viii) *Quantity of waste generated*. This variable stands for the quantity of waste the household generates within a week. For the purpose of this study, the unit of measurement used is a shopping plastic (polythene) bag (30 Ghana pesewas worth), which is common as a convenient means for measurement to most respondents during the survey. The study hypothesizes the willingness to pay to be positively related with the quantity of solid waste generated, since the higher the generation, the more would be the problem households' face in storage and taking the waste for collection, and they would be willing to pay more.

(ix) *Responsibility for solid waste management*. This variable is taken as a proxy to examine the attitude of the respondents towards who should manage waste in the metropolis. This study expects positive attitude towards cost sharing to influence the willingness to pay in the positive direction. It is specified as dummy variable 1 if they think KMA is responsible for waste disposal and 0 otherwise.

(x) *Tenancy/housing arrangement*. Those living in their own houses are expected to be more willing to pay for the improvement as compared to their tenants. This is because the house belongs to the owners and if the place is clean they may have a higher value for their properties.

## 5. Results and Discussion

*5.1. Willingness to Pay by Those Not Currently Paying.* The study revealed that good proportion of 342 (57%) households are willing to pay for improved services while 258 (43%) are unwilling to pay for improved services. Some of the reasons given for the unwillingness to pay include the following.

(i) There is no waste management service provided in the area.

(ii) Some do dispose their waste in secondary receptacle of which they were not charged for.

(iii) They dispose their waste generated in holes dug around their homes.

(iv) It is the responsibility of the government to pay for them.

Table 2: Logit regression results of factors influencing willingness to pay for improved waste management services.

| Independent variables | Coefficient | Std. errors | *P* values | Marginal effect |
|---|---|---|---|---|
| Education | −0.0154 | 0.0083* | 0.062 | 14.8039 |
| Length of stay | −0.0093 | 0.0032*** | 0.003 | 11.6667 |
| Bags of waste generated | 0.0024 | 0.0021 | 0.255 | 17.9608 |
| Age | 0.0029 | 0.0024 | 0.236 | 48.2157 |
| Housing arrangement | 0.1630 | 0.0812** | 0.045 | 0.6470 |
| Distance | −0.0003 | 0.0002* | 0.077 | 0.7135 |
| Gender | −0.0975 | 0.0410** | 0.018 | 0.8235 |
| Total income | −0.0003 | 0.0097 | 0.975 | 6.4902 |
| Satisfaction | −0.0101 | 0.0445 | 0.821 | 0.3333 |
| Responsibility | −0.0233 | 0.0355 | 0.513 | 2.7255 |
| Goodness of fit measures | | | | |
| log likelihood | | | | −39.0401 |
| Restr. Log likelihood | | | | −108.6294 |
| McFadden *R*-squared | | | | 0.6406 |
| LR statistic (14 df) | | | | 239.1788*** |

***Significant at 1%; **significant at 5%; *significant at 10%.

(v) It is not necessary to pay for waste when there are other equally important issues.

Considering the above reasons, education is important to encourage individual households to pay for improved waste management services. Also KMA should do more to ensure that all submetro have their fair share of waste management services. More households could be made to accept to pay for waste services when the necessary conditions are brought to bear.

*5.2. Determinants of Households' Willingness to Pay for Improved Waste Management.* The logit regression results of factors influencing willingness to pay for improved waste management are presented in Table 2. The logit regression gave a McFadden *R*-squared of about 0.64. The log likelihood ratio (LR) statistic is significant at one percent, meaning that at least one of the variables has coefficient different from zero. Therefore, it can be concluded that the logit model used has integrity and is appropriate. The validity of the logit model in estimating willingness to pay for improved waste disposal is consistent with related studies [16].

The number of years of schooling shows positive and significant relationship with the willingness to pay for improved waste management services. This result supports the findings of [15]. The higher the educational level, the higher the probability of the person's willingness to pay for improved waste management services. This is because the fact that as individuals receive education, they tend to understand the need for waste management better. The marginal effect revealed that an additional year of schooling would increase the likelihood of person's willingness to pay for improved waste management services by about 15%.

Length of stay in the area variable is positive and significant at 5% level of significance. This is because the longer people stay in an area, the more they are concerned about the environment and sanitation in the area. An additional year stay in an area within KMA increases the likelihood of individual willingness to pay for improved waste management services by 11.66%.

The coefficient of housing arrangement variable is significant at 5% level of significance. This result indicates that landlords are more willing to pay for improved waste management services as compared to tenants. This is particularly so because in Ghana landlords are summons in case the city authorities have problem with the sanitation and not the tenants. As the distance to dumping site increases the likelihood of the respondents' willingness to pay for improved waste management services is higher. This is because increase in distance increases the cost (finance and time) of waste disposal by individuals. One kilometre increase in distance to dumping site increases the likelihood of individual's willingness to pay for improved waste management services by 71%.

The coefficient gender variable is negative and significant at 5% level of significance. This result supports the appropriate expectation that female respondents have a higher likelihood of willing to pay for improved waste management services as compared to their male counterparts. This is particularly so because in Ghana women are mainly responsible for waste management at the household level.

*5.3. The Amount of Money Respondents Are Willing to Pay for Improved Waste Management Services.* Households who were paying were asked to indicate how much more they are willing to pay and the result is presented in Figure 1.

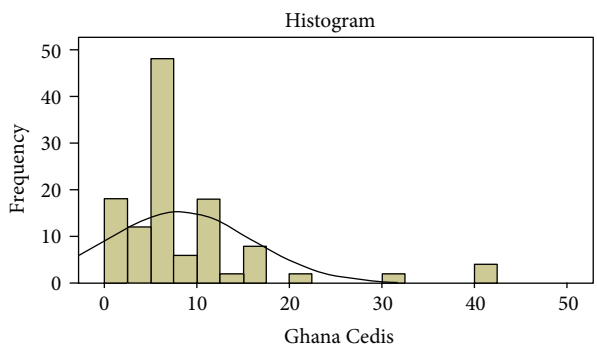
From Figure 1, it could be noted that close to 50% of the households who are currently paying for solid waste management services are willing to pay GHC 5.00 more for the hypothetical situation described for waste management services. Very few (about 6.3%) were willing to pay more than GHC 10.00.

Thus, the majority of the respondents are willing to contribute at least GHC 5.00 more in support of the improvement in the waste management services within the metropolis.

Table 3: Tobit regression results of factors influencing the amount of money respondents are willing to pay for improved waste management services.

| Independent variable | Coefficient | Std. errors | $P > z$ | Marginal effect |
|---|---|---|---|---|
| Age | 0.2376 | 0.0854*** | 0.005 | 0.4724 |
| Gender | 3.0367 | 2.2908 | 0.185 | 0.8780 |
| Marital status | −0.6668 | 2.9889 | 0.823 | 0.8780 |
| Number of children | −0.5199 | 0.6764 | 0.442 | 2.0731 |
| Income | −0.0100 | 0.0018*** | 0.000 | 0.1126 |
| Education | 0.5215 | 0.2331** | 0.025 | 14.6341 |
| Length of stay | −0.5231 | 0.1669*** | 0.002 | 8.9268 |
| House ownership | 6.1376 | 2.1265*** | 0.004 | 0.7560 |
| Bags of waste generated | 0.2996 | 0.0993*** | 0.003 | 17.3171 |
| Distance | −0.0172 | 0.0059*** | 0.004 | 182.8540 |
| Goodness of fit measures | | | | |
| $R$-squared | | | | 0.6962 |
| Adj. $R$-squared | | | | 0.6714 |

***Significant at 1%; **significant at 5%.




Mean = 8.13, std. dev. = 7.884, $N$ = 140

Figure 1: The additional amount of money households are willing to pay.

The mean or average amount of money the respondents are willing to pay is GHC 8.13.

The next section investigates the factors which influence the amount of money the respondents are willing to pay for improved waste management services.

*5.4. Determinants of the Amount of Money Households Are Willing to Pay for Improved Waste Management Services.* The Tobit regression results of factors influencing the amount of money respondents are willing to pay for improved waste management are presented in Table 3. To determine which of the factors identified using the logit model influences the amount of money the respondent are willing to pay for improved waste management services, the truncated Tobit model was used. The truncation was as a result of the fact that those respondents who are not willing to pay for improved waste management services were excluded from the analysis. The Tobit regression results gave an adjusted $R$-squared of about 0.67 which implies that at least one of the explanatory variable included in the model has coefficient different from zero. Giving this goodness of fit measure (adjusted $R$-squared), it can be concluded that the Tobit model used in reliable and has the requisite explanatory power. All the included explanatory variables met the apriori expectations.

The coefficients of age variable shows positive and significant relationship with the amount of money the respondents are willing to pay for improved waste management and it is significant at 5%. This may be explained by the fact that as people get older, they tend to understand the need of a clean environment. In addition, they may also know that access to funds by waste management organization can improve their services. As age increases by one year, the amount of money individual would be willing to pay would increase by 47%. The coefficient of household income is positive and significant. This result is in agreement with the environmental economics literature on the positive relationship between income and the demand for improvement in the environmental quality [17].

A GHC 1 increase in household income is likely to increase the amount of money the respondents are willing to pay by 11.26%. This result shows that there is a positive relationship between education and the amount of money the respondents are willing to pay for improving waste management services. This may be explained by the opportunity education gives to people to understand the consequence of improper waste disposal.

In Ghana, cost of housing is high and, moreover, landlords are persons held responsible for an unclean house in case the actual cause of the filth is not immediately identified. Thus, it is not surprising that respondents living in their own houses would pay a higher amount of money for improved waste management services.

The longer the respondents stay in a particular community, the higher the amount of money they are willing to pay for improved waste management services. This could be because the longer stay in the area would help one to understand the problem of sanitation in the area better and whip up the need for proper sanitation of the area in the individual. Additional year stay in a house would result in 8.92% increase in the amount of money the respondents are

willing to pay. The volume of waste generated has a positive and significant relationship with the amount of money respondents are willing to pay. This can be explained by the fact that those who generate larger volume of waste would have more problems with disposal and hence would be willing to pay more for its disposal.

Distance to solid waste dumping sites has the expected sign and is significant at 5%. As the distance to the dumping sites increases the amount of money the respondents are willing to pay also increases. This is because increase in distance complicates the problem of solid waste management as people would have to walk far distances to dispose of waste.

## 6. Conclusion and Policy Implications

Respondents were willing to pay more for improved waste management services. The determinants of willingness to pay for improved waste management services were identified using logit regression model. Level of education, length of stay in the area, housing arrangement, and distance to solid waste dumping sites as well as gender were noted to significantly influence the respondents' likelihood of willingness to pay for improved waste management services.

Generally, the majority of the respondents are willing to pay GHC 5.00 more for improved waste management services. Again, the factors influencing the amount of money respondents are willing to pay for improved waste management services were determined using the Tobit model. The significant factors include age, income, education, length of stay, house ownership, bags of waste generated, and distance to dumping sites.

The assembly should take advantage of the fact that residents of the metropolis see waste management as a collective responsibility and not the sole role of the government. It must therefore endeavour to provide tailor-made services and possibly preinvest to provide first class services (improved waste management services) as the public pledge their preparedness to pay when the services are improved.

Income level of individuals was realized to determine willingness to pay more for improved services. The assembly can therefore abolish the flat rate payment system and surcharge the first and second class residential areas to pay relatively more (because they can afford) and use the excess amount of money to subsidize the third class residential areas (because they cannot afford).

The sanitation bylaws of the KMA need an urgent review as some sections seem to be outmoded (e.g., fine of GHC 5.00 for sanitation offenders). Copies of the revised bylaws must not be kept under lock and key as is currently being done but rather made readily available to the public. Abridged versions should be printed and distributed to all citizens of the metropolis. It must also be published on the assembly's website for easy access by internet users.

The assembly should invest in educating the public thoroughly to understand the impact of waste on the socioeconomic development of a nation and the roles of the individuals. They should also be made to understand well the polluter principle and why it is necessary and the contents of the bylaws and their implications.

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