ASSESSING WILLINGNESS TO PAY FOR SOLID WASTE MANAGEMENT IN GA EAST MUNICIPAL, GHANA

ABSTRACT

Waste management has been a topic under discussion across the country which needs more attention. This study assesses the willingness to pay for solid waste management in Ga East Municipal, Ghana. Qualitative and quantitative approaches were used, and convenient sampling was used to select 100 respondents with 26 males and 74 females. A probit model was used to analyze factors affecting willingness to pay for solid waste management, Kendall's coefficient of concordance was used to analyze the challenges households face in accessing waste management, and Likert scale was used to analyze the improvement of waste management. The study revealed that age, education, household size, distance, and income are statistically significant and influenced willingness to pay for improved waste management. It was observed that 58% of the respondents representing the majority pay Ghc(1-4) in disposing refuse whilst 81% representing majority are willing to pay Ghc(4-6) for improved service. The study further revealed that inadequate dustbins and collection sites, distance, delay in collection of waste, and lack of waste management programs in the municipal were the significant challenges households face in accessing waste management. Provision of dustbins, allocation of collection points in communities, provision of toilet facilities, education on poor sanitation, and its menace are some measures that can help curb sanitation problems in the District. Therefore, the study recommend that Government and other stakeholders must sensitize members in the district on poor sanitation and its menace especially waste burning causing air pollution and also service providers should provide dustbins at vantage points in communities and pick them early when full, this will help to avoid environmental pollution leading to people's willingness to pay for improved service.

Keywords: Willingness to Pay; Solid Waste Management; Awareness, Sustainable Development, Ghana.

1. INTRODUCTION

Solid waste refers to the rubbish generated from animal and human activities considered useless and undesirable [1]. Waste disposal did not pose a struggle in the early days as habitations were scant with abundant land. Waste disposal became challenging with the upsurge of growth of towns and cities, where large numbers of individuals started to form groups in relatively small areas in search of livelihoods [2]. Waste generation, both domestic and industrial, continues to increase worldwide in tandem with consumption growth. In developed countries, per capita waste generation increased nearly threefold over the last two decades, reaching five to six times higher than in developing countries [3]. Poor sanitation and waste management negatively affect humans by reducing the quality of life, providing food and breeding conditions for vermin and disease vectors, producing odor, diminishing aesthetics, and contaminating surface and groundwater [4]. Solid waste management is an essential aspect of sustainable development for any nation and has been greatly supported by global initiatives. According to [5], the means of solid waste disposal of households were, Collected by ZoomLion (a waste management company in Ghana), burned by households, Public dump (Paid laborer), Public dump (self), and buried by household. [6] noted that most households in rural communities burn their refuse, which threatens the environment. This uncontrolled burning of waste for waste reduction in developing countries is still a common practice contributing to urban air pollution [7]. According to the Ghana Local Government Act of 1993 (Act 462), the various Metropolitan, Municipal, and District Assemblies are responsible for collecting and disposing of the wastes generated within their jurisdiction and operating and maintaining their equipment. This comprises solid waste management, cleaning of drains, promoting public health, and providing adequate and potable water.

However, assemblies have faced numerous challenges carrying out these responsibilities due to inadequate resources to provide a satisfactory and economically viable service. As Ghana aspires to middle-income status, a healthier and wealthier population will generate more waste (domestic, commercial, institutional, industrial, and hazardous). Willingness to pay for solid waste management services or facilities is essential to the success of the private sector's participation in solid waste management programs. The willingness to pay directly impacts (positive or negative) the reliability and success of any solid waste management strategy [8]. The current environmental sanitation status of Ghana leaves much to be desired. Solid waste collection services serve less than 40% of urban residents, and less than 30% have adequate household toilet facilities [9]. There are often no vehicles for the waste collection in rural areas and small towns; hence uncontrolled dumping occurs within the built areas with all attendant health hazards and negative environmental impacts [10]. Government funding alone cannot sustain the collection of waste in the Municipal, of which many people have suggested other forms of engagement that will help curb waste management challenges. Many stakeholders have suggested private sector involvement on a fee-paying basis [11]. Some studies have shown that the willingness to pay for solid waste management services is associated with the education level of household head, monthly aggregate income, the quantity of waste generated per week, access to solid waste management service, and responsibility of solid waste management [8]. However, little is known about the determinants of willingness to pay and demand solid waste management services in semi-rural areas like Abokobi. The proposition that rural and semi-rural people are unwilling and cannot pay for solid waste collection services is just a generalized assumption that may not apply to all rural communities. Generally, many recent studies have focused on urban areas and cities with little known about the determinants of willingness to pay for solid waste collection among semi-rural-urban communities [12]. The study's objectives include: assessing factors affecting willingness to pay, challenges household face in accessing waste management and improvement of solid waste management in Ga East Municipal. This study examined possible factors that influence the inhabitants of Ga East Municipal to pay and demand solid waste management services. The rest of the paper is organized as follows: materials and methods, followed by the discussion of the main findings and and ends with the conclusion and recommendations.

2. MATERIALS AND METHODS

2.1 Research Area, Data, and Study Variables

The study was carried in Ga East Municipal on willingness to pay for solid waste management, where data was taken from August – September 2021. [13] estimately indicated that the municipality is able to generate134.25 tonnes of solid waste (plastic waste) every month. The problem has increased as a result of inadequate machinery and equipment by the Assembly and the private collectors. Therefore, waste management behavior in domestic and industrial waste generators can be a possible cause of waste and plastic waste management problems within the municipal. According to [14] residents of Ga East Municipal are fully aware of the harmful effects on the environment of indiscriminate waste disposal. However, their attitude towards waste reuse is not friendly to the environmental waste management methods. The fact that recycling opportunities are not available in the municiapl may also discourage the application of their knowledge about inappropriate waste management which is the reason why the study was conducted in Ga East Municipal.

The study's objectives include examining the challenges residents face in accessing waste management services, determining factors affecting willingness to pay for solid waste management services, and determining improvement of solid waste management. This study employed the mixed method (quantitative and qualitative). Mixed method research is a design that combines or associates both qualitative and quantitative forms [15]. It involves philosophical assumptions, qualitative and quantitative approaches, and the mixing of both approaches in a study. Data were collected using questionnaires that covered the socioeconomic characteristics of the respondents and their households, as well as their willingness to pay for solid waste management services. Systematic sampling was used to determine the households interviewed from the sample frame, and purposive sampling was used to select the communities. Ten (10) respondents were selected from each town totaling to hundred (100) respondents. Thus, every 5th house was interviewed. Primary data was taken from 100 respondents from 10 different communities (Abokobi, Dome, Madina, Taifa, Ashongman, Ayi Mensa, Haatso, Kwabenya, Oyarifa, and Pantang) in the Municipal.

In contrast, secondary data was taken from the District Assembly. Statistical package for social sciences (SPSS) was used to analyze the data generated. The Ga East Municipal Assembly (GEMA) is one of the ten districts in the Greater Accra region of Ghana, the smallest of the ten administrative regions of Ghana and located southeast of the country. The Municipal has more than 60 settlements, 82% of which are in urban and peripheral areas, with about six medical facilities, four large markets, and five recognized industries [16]. "Abloradgei" is one of the fastest-growing settlements in Ga East Municipal, noted for its dump location and another primary environmental concern to the Assembly. The landfill is about 500 meters west of the area's major psychiatric hospital (recently a general hospital and nursing training school) and stands out from about 150 meters.

2.2 Waste Management

For many years, Ghana's solid waste management has been a major challenge for MMDA. As a result of people moving to urban centers and aggregate density, it is difficult for large cities to dispose of large amounts of waste [17]. This is due to the fact that people rely on indiscriminate dumping as the only way to dispose of household solid waste, leading to pollution and waste accumulation [17]. According to [18], Ghana produces about 3 million tonnes of solid waste annually, based on an estimated population of 22 million and an average per capita waste generation of 0.45 kg. The rapid population growth of Ghana has led to an increase in national waste generation. The amount of solid waste generated per day in Accra was 750-800 tons in 1994 [19]. In 2004, it was 1800 tons per day. In 2007 it was 2000 tonnes per day, but in 2010 this number increased to 2200 [20]. The solid waste management methods at Ga East Municiapl in Ghana are unmanaged waste dumping, controlled dumping, orderly landfill, composting, door-to-door collectors, and private sector collection [21]. The waste company provides house-to-house communal services [22]. Municipal services were provided primarily in low and middle income areas using central containers. Local residents using this type of service brought the waste to a central collection point for disposal. These containers are lifted full of waste and disposed of at the designated landfill [23]. The Private Sector Initiative (PSI) was initiated in Accra and Tema in the early 1990s. Open landfills are most commonly located adjacent to open-lot metropolitan suburbs, wetlands, or surface water sources.

Open landfills are generally established based on considerations for access to collection vehicles, rather than hydrological or public health considerations. Rural areas and small towns often lack collection vehicles, resulting in unmanaged dumping within the city, with all relevant health hazards and negative environmental impacts [21]. Problems with landfills in Ghana include odors, inadequate dressings, the spread of flies and other pests, and smoke from open flames. Others, as the increased amount of waste consumed by these landfills can make it difficult to build new landfills due to land shortages, rising land prices, and the demand for better disposal systems.

2.3 Willingness to Pay

Willingness to pay is the most extreme value a client will pay for an item or administration [24]. Willingness to pay varies by context, individual customer and can fluctuate over time. Households' willingness to pay for solid waste disposal is influenced by many factors. A study by [25] found that unique variables (such as household attitudes towards solid waste), situational variables (such as distance to disposing site) and household awareness of the quality of the environment were important determinants of households' willingness to pay for improved waste management. For example, [26] found that households that are more conscious of environmental quality are more willing to pay for improved solid waste services than households with little or no awareness. Willing to pay for improved solid waste services that increase with distance from landfills. [4] found that respondents who were happy with their current waste management system were more willing to pay than those who were dissatisfied. [27] showed that satisfaction with the services provided does not significantly affect households' willingness to pay for waste treatment services. The amount of garbage generated can also affect the willingness of households to pay for garbage collection [28]. Regarding the amount of waste, [29] point out that the greater the amount of waste generated, the greater the challenges households have in disposing of this waste and the more willingness to pay for service.

2.4 Theoretical Framework

The purpose of this study was to investigate household willingness to pay for improve solid waste management services in Ga East Municipal. The rationale for this study focuses on the threshold decision theory proposed by [30] and [31]. Theory points out that, for example, in situations where an individual has to choose between paying or not paying for an improved solid waste management service, the individual has a response threshold that depends on a particular factor. Therefore, no response is observed at certain stimulus values below the threshold, but the response is stimulated at the critical threshold [25]. This theory is based on the consumer choice model and utility theory, using no merchandized market value and using non-market conditions that cause potential improvement or harm for consumer preference and willingness to pay. Using a standard structural equation model, the threshold model transforms the binary choices and derives a conditional probit model, binary done by individuals [32]. Choice models can accurately predict human decision-making behavior. Neoclassical microeconomic theory models the decision-making process on household willingness to pay for improve environmental protection based on the utility function specifications [33] dealing with people's choices. However, the benefits are not observable and difficult to quantify. However, Utility is unobservable, thus, difficult to quantify. Thus, an indication of consumer willingness to pay for improved solid waste management can be gained using the probit model that is, through eliciting consumer preferences for certain services by conducting surveys.

2.5 Analytical Framework and Estimation Techniques

This section presents the estimation techniques employed to achieve the objectives. The research involves a three stage procedures. First, probit model was used to analyze factors affecting willingness to pay for solid waste management, Kendall’s Coefficient of Concordance was employed to model the challenges household face in accessing imporoved waste management system and likert scale was used to study the improvement of solid waste management system.

Table 1: Variables Description, Coding, and Expected Sign of Relationship.

Variable Name	Variable Description	Unit of Measurement	Expected Sign
Sex	Sex of respondent.	1 if a respondent is male, 0 otherwise	+/-
Age	Age of respondent	Years	+/-
Education	Education level of respondent	Years	+/-
Occupation	Occupation of respondents,	if a respondent is working or not	+/-
Marital Status	Marital status of the respondent	Dummy; 1 if married and 0 if otherwise	+/-
HHIncome	Average monthly income of households	Ghana Cedis (Gh¢)	+/-
HHsize	Number of individuals in a household	Number of HH size	+/-
Distance	Distance from house to a dumping site	Kilometers	+/-

Variables used in the Probit model

2.5.1 Probit Model

The individual's decision to pay for solid waste management services is dichotomous, involving two mutually exclusive alternatives. The individual is either willing or unwilling to pay for waste management services. The framework for such inquiry has its origins in the decision-making threshold theory. A response happens only after the intensity of the stimuli rises beyond the individual's reaction threshold. This entails that every individual has a reaction threshold influenced by several factors when faced with a choice. The individual may be willing to pay or unwilling to pay. This results in a binary dependent variable, y, which assumes a value of zero (unwilling to pay) and one (willing to pay). Since the outcome of Probit is dichotomous, the respondent either accepts or rejects the proposed amount for the cost of waste management service.

Therefore, Probit is modeled based on the utility function presented by equation (1). Thus, we assume an individual household has willingness to pay (WTP) (price for the improved waste collection service) represented by:

$$WTP_i = \beta\chi_i + \mathcal{E}_i \qquad (1)$$

Where WTP_i is households' WTP, χ_i represents the vector of explanatory factors and ε_i signifies the systematic random error with zero mean and unit variance that arises from the unobserved factors about *i*'s WTP.

Households may or may not be willing to pay for the service. In such cases, the dependent variable assumes a latent (unobserved) status as represented by the following equation:

$$y_i = \chi_i\beta + \varepsilon_i \quad (2)$$

in which y_i is the unobserved dependent variable.

β is a parameter of the model (the intercept and coefficients),

$\boldsymbol{X}_i$ is an exogenous set (independent) explanatory variables and

ε_i is the error term, whereby; $\varepsilon_i \sim N[O,\sigma^2]$

If an individual household *i* is willing to pay, $y_i = 1$ *and* otherwise $y_i = 0$ (zero). Mathematically, this is given by

$$yi = \begin{cases} 1\ if\ yi = 1(household\ willingness\ to\ pay\ ) \\ \quad 0\ otherwise \end{cases} \quad (3)$$

When y_i =1, then y_i = 1 implies, the specific household is willing to pay a positive price for the service. This probability that a household would be willing to pay can be estimated by the Probit model below:

$$Prob(yi = 1/X)\ (2\pi)^{-1/2} exp(-\beta X_i)^2/2) \quad (4)$$

Where;

yi is the dependent variable (willingness to pay) taking a value of 0 or 1;

X_i is the vector of explanatory variables of Age, Gender, Household income, level of education, household size, distance,occupation, marital statu and β is the coefficient vector.

Therefore, the regression equation that incorporates all the identified factors above is as follows;

$$y = \beta_o + \beta_1 Age + \beta_2 Gender + \beta_3 Education + \beta_4 Occupation + \beta_5 Msaritalstatus + \beta_6 Income + \beta_7 Householdsize + \beta_8 Distance \quad (5)$$

2.5.2 Kendall's Coefficient of Concordance

Challenges household face in accessing reliable waste management services was examinied. A table was presented in the questionnaires of the significant challenges of which respondents were asked to analyze problems according to the most pressing concern to the least critical issue. Kendall's coefficient of concordance was used to analyze the problems according to the most urgent problem to farmers to the least pressing problem.

This is a statistical procedure used to identify and rank a given set of constraints or problems from the most influential to the least significant and to measure the degree of agreement or concordance among the respondents on the preferences [34]. The total rank score for each preferred factor was computed, and the element with the least score was assessed as the most pressing problem, while the aspect with the biggest score was considered the least critical problem. The total rank scored computed used to calculate the coefficient of concordance (w) to measure the degree of agreement among respondents. If there is an entire agreement among the respondents` ranking, the ranking is perfect.

$$w = \frac{12S}{P^2(n^3-n)} - P^T \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where:

W = Kendall's coefficient

P = Number of respondents

N= number of quality of perception

T= correction factor for tied ranks

S= sum of statistics

2.5.3 Likert scale Model Specifications

A Likert scale is a rating scale used to assess opinions, attitudes, or behaviors [35]. In the Likert type, the respondents indicate the degree of their agreement or disagreement to the statement. According to [36] Likert scale are quick to compile and straight forward to code, and do not discriminate unduly on the biases of how articulate the respondent where **SA = Strongly Agree, A = Agree, MA=Moderately Agree, D =Disagree, SD =Strongly Disagree**

3. RESULTS AND DISCUSSIONS

3.1 Challenges Household Face in Accessing Waste Management Services

The results of Kendall's coefficient of concordance are presented in table 2. It is evident that inadequate dustbin and refuse dumpsites were considered and ranked as the most challenging factor with a mean rank of 2.81. The next most problematic factor for residents in Ga East Municipal is a delay in collecting waste with a mean rank of 2.92. Distance to dispose of the waste was ranked as the third most challenging problem in accessing solid waste management services with a mean rank of 3.27. One of the residents' primary concerns was the unavailability of waste management programs in the Municipal, ranked as the fourth most challenging problem with a mean rank of 4.42. The results indicate that most people in the Municipal dump refuse at unapproved sites, with a mean rank of 4.47. The sixth challenge affecting residents accessing solid waste management service is the service cost with a mean rank of 4.72. The stench in dumping sites is considered the least pressing problem in the Municipal with the mean rank of 5.40. A Kendall's coefficient of (0.752) shows the agreement among respondents in the ranking of challenges which is significant at a 1 % significance level as the critical value is 0.021. Kendall's coefficient (0.752) shows a 75.2% agreement among respondents in ranking their challenges in accessing waste management services.

Table 2: Challenges Residents Face in Accessing Waste Management Services

Problems	Mean Rank	Rank
Inadequate dustbins and refuse dump sites	2.81	1st
Delay in Collection of Waste	2.92	2nd
Distance	3.27	3rd
No waste management programs in the municipal	4.42	4th
Dumping refuse at unapproved sites	4.47	5th
Cost of service	4.72	6th
The stench in dumping areas	5.40	7th

N = 100; Kendall's Wa = .752; Chi-Square = 74.947; Sig. = .021.

Source: Field Survey, 2021

3.2 Factors Affecting Willingness to Pay for Solid Waste Management Services

This section summarizes the estimation results of the probit regression model. The probit model results presented in Table 3 showed the likelihood ratio chi-square of 7.4847(df=8) with a *P*-value of .021, meaning that the joint significance test of all variables in the model is significant at 1% level, implying that the variables correctly predict the model. This further means that the null hypothesis that respondents' willingness to pay (WTP) for improved solid waste management (SWM) is not determined by gender, occupation, and marital status. The Probit regression gave a Pseudo R-squared of about 0.748, suggesting that the explanatory variables explain approximately 75% of willingness to pay (WTP) variation. This indicates that the estimated Probit model has integrity; it is appropriate and is generally reasonable. The validity of the Probit model in assessing households' willingness to pay (WTP) is in line with related studies by [37]. The results from table 3 indicate that age, education income, household size, and distance are significant and hence influence households' willingness to pay (WTP) for improved solid waste management (SWM) services. The age of the respondent was statistically significant at 5% as *P*=.05 (.04) and had a positive impact on the willingness to pay (WTP), which is consistent with [37] that age affects people's willingness to pay for waste management services. Education and distance have positive impact on willingness to pay (WTP) for solid waste management services, which were proven

statistically significant at 10% as *P*=.10 (.06) and (.07), respectively. Income of households was proven statistically significant at 1% as *P*=.01 (.009) and has a positive impact on the willingness to pay (WTP) for improved solid waste management services, which is consistent with [38] that household income affects willingness to pay for improved solid waste management services. Household size was proven significant at 5% as *P*=.05 (.04) and has a positive impact on willingness to pay (WTP) for improved solid waste management, which is consistent with [39] that household size influences willingness to pay for improved solid waste management.

Table 3: Factors Affecting Willingness to Pay for Solid Waste Management Services

Factors	Regression Coefficient	Standard Error	*P*>|z|
Gender	0.055	0.3105	0.859
Age	0.032	0.0982	0.041**
Education	0.048	0.0958	0.062*
Occupation	0.016	0.1333	0.907
Marital Status	0.038	0.1190	0.747
Income	0.005	0.1162	0.009***
Household Size	0.100	0.1653	0.043**
Distance	0.054	0.1206	0.065*
Number of observations			100
LR chi2(8)			74.947
Prob > chi2			0.021
Pseudo R-squared			0.748

Source: Field Survey, 2021

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

3.2.1 Amount Paid for Waste Management

The findings from table 4 show that majority of the respondents representing 58%, pay Ghc1-Ghc4 when disposing refuse, 32% of the respondents pay Ghc5-Ghc8 for disposing refuse, 7% of the respondents pay Ghc9-Ghc11, and 3% pay Ghc1 for disposing refuse.

Table 4: Amount Paid for Waste Management

Amount Paid (Ghc)	Frequency	Percentage (100)
50	2	2
1	3	3
2	58	58
3	5	5
5	32	32
Total	100	100

Source Field Survey, 2021

[1] Gh¢1 = $0.15

3.2.2 How Much Household Want to Pay

Table 5 shows the amount household are willing to pay when waste management services are improved in the Municipal. 3% of the respondents are willing to pay Gh¢1-3, 81% of the respondents are willing to pay Gh¢4-6, 7% are willing to pay Gh¢7-9 Cedis, while 9% are willing to pay more than Gh¢10 Cedis.

Table 5: How Much Household Want to Pay

Amount (Ghc)	Frequency	Percentage
1-3	3	3.0
4-6	81	81.0
7-9	7	7.0
>10	9	9.0
Total	100	100.0

Source Field Survey, 2021

[1] Gh¢1 = $0.15

3.3 Improvement of Waste Management

To improve waste management in the Municipal, the study revealed from table 6 that some waste management practices which could help manage poor sanitation, which includes: provision of dustbins by

the Government, allocation of dustbins at allocated points, provision of toilets facilities, educating people on the essence of practicing sound sanitation and improving drainage system in the District.

Table 6: Improvement of Waste Management

Improvement of Waste	Frequency	Percentage
Provision of dustbins	37	37.0
Allocation of a collection point	17	17.0
Provision of toilet facilities	5	5.0
Education	27	27.0
Improved drainage	14	14.0
Total	100	100.0

Source Field Survey, 2021

CONCLUSIONS

The study was to investigate willingness to pay for solid waste magement in Ga East Municipal. Conclusions were made from the study that factors such as age, education, household size, distance, and income are statistically significant and influenced willingness to pay for improved waste management. The study revealed that factors such as gender, occupation of respondents and marital status which were expected to influence willingness to pay were proven insignificant which means that they don't influence willingness to pay. It was observed that 58% of the respondents representing the majority pay Ghc(1-4) in disposing refuse whilst 81% representing majority are willing to pay Ghc(4-6) for improved service. The study further revealed that inadequate dustbins and collection sites, distance, delay in collection of waste, and lack of waste management programs in the municipal were the significant challenges households face in accessing waste management services. Provision of dustbins, allocation of collection points in communities, provision of toilet facilities, education on poor sanitation and its menace are some measures that can help curb sanitation problems in the Municipal.

RECOMMENDATIONS

On the basis of findings from this study, the following recommendations are proposed:

1. Government and other stakeholders must sensitize members in the district on poor sanitation and its menace especially waste burning causing air pollution in the Municipal.
2. Service providers should provide dustbins at vantage points in communities and pick them early when full, this will help to avoid environmental pollution leading to people's willingness to pay for improved service.
3. The Municipal Assembly should enforce law to enact severe punishment on individuals who litter the environment anyhow, this will serve as a deterrent to others to help imrove sanitation in the Municipal.

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