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Household perception and willingness to pay for improved waste management service in Mamfe, Cameroon

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Lack of financial resources and public participation are major factors that constrain solid waste management in many towns in developing countries. This study sought to determine the willingness to pay (WTP) and the perception of the inhabitants of Mamfe, Cameroon for an improved solid waste management system. A total of 371 households were interviewed and data analysis to identify the determinants of WTP values was performed using multiple regression models (Probit and Tobit) and Contingent Valuation Method. Approximately 95.1% of the residents were concerned with the problems of solid waste management. 51.5% were satisfied with the present environmental conditions; with 74.5% of the opinion that water pollution caused by poor waste disposal presented the most serious environmental problem. Most of the respondents (85.1%) showed a positive attitude towards WTP for an improved solid waste management system. The monthly mean WTP was 1000FCFA ($1.73) per household and the annual WTP was approximately 180 million FCFA for the entire town. Regression analysis revealed that age, employment type, gender and income of the respondent have a significant relationship with willingness to pay at p<0.05. The trend of WTP and income variables (income and type of employment) was negative and significant implying that this payment could be afforded by a cross section (low, middle and high-income levels) of the population.

Key words: Cameroon, contingent valuation method, household, perception, solid waste management, willingness to pay.

INTRODUCTION

Pacione (2005) alludes to the fact that the provision of waste management services in any large city is an expensive undertaking that makes huge demands on the finances of local 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 (Boateng et al., 2016). Cameroon is ranked in the 144th position out of a total of 177 countries and it is one of a group of 20 countries for which the Human Development Index (HDI) worsened between 1990 and 2006 (UN 2006). Cameroon only achieved one of the seven goals

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on target: access to improved safe water (Parrot et al., 2005). The nation is considered a lower middle-income country with a gross national income per capita of US$1,320 in 2015, compared to an average of US$1,628 for all sub-Saharan African countries. The minimum wage is approximately FCFA 36 000/month or $72 (National Institute of Statistics, 2018) with 37.5% of the population living below the national poverty line, and 27% below the international poverty line of US$1.90 per day (World Bank, 2017). Most of the population have limited access to sanitation services, especially the poorest who live in areas with little infrastructure. Concerning the disposal of solid waste, the government covers 85% of the financial costs for the management of solid wastes for the major cities (most of them serving as regional headquarters) from the state budget and the Councils cover the remaining 15% (Ymele, 2012). This policy further deepens the spatial disparities between urban and rural areas. It is common for both residents and Council authorities in towns to dump waste of all sorts into roadsides, vacant lots, marshlands and water courses. This practice is associated with unsustainable and unplanned urban development and can give rise to air pollution, water pollution, poor sanitation and housing-related health risks. Uncollected and illegally or improperly disposal of wastes poses serious risks to public health and the environment (Wilson et al., 2003; Olley et al., 2006).

Previous studies on waste management in Cameroon have focused on technical aspects such as collection, treatment, disposal practices and their environmental implications (Vermande and Ngnikam, 1994; Ngnikam, 2000) and the legislative and regulatory aspects (Manga et al., 2008); with little attention on the financing of solid waste management. Municipal solid waste management is financed from three principal sources; taxes and revenues generated by Council activities, supplementary budgets from the state and lending facilities from the Government's Council Development Fund (FEICOM) (Manga et al. 2008). Nationally, there is very little exploitation of alternative sources of financing.

Public and private partnerships offer interesting alternatives to MSW services, particularly in terms of innovation (Ahmed and Ali, 2006). Non-governmental organizations (NGOs) and Community-based organizations (CBOs) operate in the informal sector and considerably alleviate the burden of the urban poor in African cities. They also operate in areas where the official operators do not have access because of poor road conditions. In a report on livelihood, the National Institute of Statistics remarked that there is an opportunity for NGOs and CBOs to implement garbage collection and transfers to garbage bins operated by the official operator Hygiène et Salubrité du Cameroun (HYSACAM) (INS 2002). Parrot et al. (2009) investigated some public-private partnerships in urban solid waste management in the city of Yaounde, Cameroon.

According to Parrot et al. (2009), the main waste service provider to the Yaounde Urban Council, (HYSACAM), signed limited official public-partnership with some small NGOs and CBOs (TAM–TAM mobile, GIC–JEVOLEC, ERA–Cameroon and Sarkan Zoumountsi) for the pre-collection of wastes from selected, mostly upper class neighborhoods. The authors report that some of these collaborations proved to be fatal in the long term mainly as a result of lack of funding, high membership costs and mis-targeted areas. Mckay et al. (2015) identified inadequate organizational structure; poor logistical support; lack of capital and technical expertise; inhibiting government policy and regulations; as well as low levels of awareness and education at the household level as the main inhibitors of growth in this sector. Mbeng et al. (2009) in their study reported that although information and awareness campaign are important drivers to behavior change in waste management, these do not necessarily translate into an increased participation in recycling or reuse initiatives because other factors such as economic incentives can hamper participation rate. These studies have so far, explored issues related to the participation of the private sector and public attitudes and awareness in the solid waste sector; they do not however address residents' willingness to pay (WTP) for solid waste management. The current study seeks to determine households' perception of solid waste management and the willingness to pay (WTP) using the contingent valuation method (CVM). This study carried out in Mamfe town (Cameroon) is of significance to towns with limited budgets that are interested in exploring user fees as sources of financing for SWM services under current privatization policy.

CVM uses survey questions to elicit people's preferences for non-market goods by asking them how much they would be willing to pay for specified improvements or to avoid decrements in them (Mitchell and Carson 1989). In its simplest form, the respondent is offered a binary choice between two alternatives, one being the status quo policy and the other alternative policy having a cost greater than maintaining the status quo. Debate over this method lies with issues linked to validity and measurements (Carson, 2000). However, despite these shortcomings, CVM has in recent years been extensively used in both developed and developing countries for valuation of a wide range of environmental goods and services (Whittington, 2002). Examples of recent application of CVM for solid waste-management services in developing country contexts include Niringiye and Omortor (2010), Wang et al. (2011), Amfo-Out et al. (2012), Ezebilo (2013), Addai and Danso-Abbeam (2014), Boateng et al. (2016). In these studies, the socioeconomic and contingent variables found to influence household WTP for solid waste management included the payment amount, age, income, household size, occupation, dwelling type and educational level.

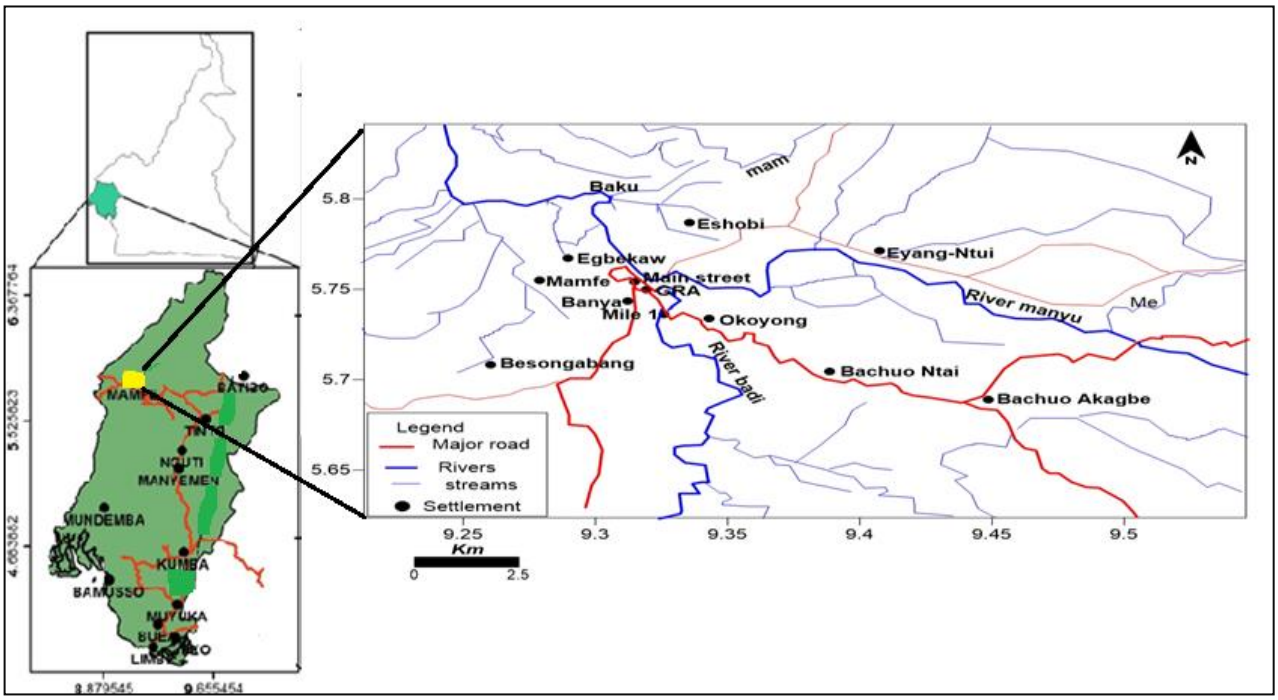

Figure 1. Map of Mamfe, Cameroon.

Addai and Danso-Abbeam (2014) used CVM to predict the determinants to pay in Dunkwa-on-Offin, Ghana. The results of the study reveal that willingness to pay for improved solid waste management is significantly related to level of education, gender, household size and age of the household head. Niringiye and Omortor (2010) in their study of the determinants of willingness to pay for solid waste management in Uganda, using the CVM, found that age influences willingness to pay.

MATERIALS AND METHODS

Study area

Geographically, Mamfe is situated at latitude 5.76° N, and longitude 9.28°E (Figure 1). Climatically, it is dominated by the Equatorial climate with high rainfalls (3500-4000 mm) and high temperature (30 -32°C). Mamfe is the capital town of Manyu Division in the South-West Region of Cameroon. It is richly watered by River Manyu with its tributaries at River Baku and River Badi which serves as the fishing ground and major travels roads from the town to Nigeria.

Mamfe is a traditional town characterized by the convergence of surrounding (indigenous) villages linked to the main urban center by new settlements with a population of 60,000. Arrey (2005) in a study carried out within the Mamfe Council (Mamfe Rural Council Monographic Study) classified the town into three sub-areas on the basis of commercial versus residential activities, years of existence and income levels. The three delineated areas are mixed in terms of income groups. For example, there are some households of high-income neighborhoods in the 'indigenous' part of the town, as well as individuals of low-income neighborhoods in the 'government residential area' part of the town.

Research design

The research adopted a mixed triangulation design. Stratified, purposive and random sampling techniques were used to select households for this study. Both primary and secondary data sources were used. Questionnaire survey, interviews with key personnel and observations were the main tools for data collection. Both qualitative and quantitative methods of data analysis were considered. Qualitative data played supplementary role and content analysis of the ideas, opinion, and concepts of data were considered. SPSS Version 21 was used for quantitative analysis of data. Contingent valuation method was employed to elicit household's willingness to pay for the proposed improvement in solid waste management service. With an estimated total of 15,000 households, and on the basis of Yamane (1967)'s sample size formula, a sample size of 377 households was selected for the survey. Household selection was a multi-stage process beginning with stratification of households into three socio-economic strata: high, middle and low-income groups based on the neighborhood. This activity was facilitated by exploiting a spatial economic zoning established by the Council (Arrey, 2005). A purposive sampling based on the standard of housing infrastructure was used to delineate income levels of households within the different income zones.

The data collection was made by hand-delivered questionnaires. Pre-test surveys were conducted in April in 10 randomly selected households in a town outside the study area. People who had no formal education were interviewed based on the questions in the questionnaire, while people who had formal education were handed a copy of the questionnaire (which were filled in the presence of survey assistants). The focus groups, personnel of Waste Management Board (the Hygiene and Sanitation Department authorities of Council) and those involved during the pre-test surveys contributed in the development of questions that were used during the main survey. Following the pre-test surveys, some questions in the questionnaire (e.g. presentation format for the

valuation question and independent variables) were adjusted to reflect the concerns raised by survey assistants and respondents. The main survey was conducted during the months of May and June 2017.

Willingness to pay questions

The CVM was used to quantify each household's decision on whether or not to purchase an improved provision of solid waste management services. CVM is a type of stated-preference approach that employs a hypothetical market system to extract WTP or willingness to accept environmental goods (Carson, 2000). The single-bound Dichotomous CVM was used to acquire the necessary data for both WTP and the associated specific amount to pay.

With the understanding of the market scenario, the respondents were first asked if they will be willing to pay anything for the improvement scenario presented. The response was either 'yes' or 'no'. If the respondent answered "no", they were asked to give reasons why they were not willing to pay for the improved service and to state how they will properly manage their waste such that it will not lead to environmental damage. A 'yes' response to the participating question was followed by the selection from a list of monthly amounts they were willing to pay; (1) 500-1000 FRS; (2) 1000-1500FRS; (3) 2000-4000 FRS; and ≥5000 FRS. This was followed by selection of options relating to time and frequency of collection. The final question for those who answered 'yes' was to state the maximum monthly amount they will be willing to pay based on their selected options in the later. Respondents were then asked to state the maximum amount service charge (per month) they were willing to pay to solve the household solid waste problem**.**

The respondents were asked a series of questions relating to their perception of problems of solid waste and socio-economic status (educational level, income, age, gender, house ownership and other socio-economic determinants). The respondents were asked about their participation in sanitary campaigns and environmental concerns. Incorporation of individuals' socio-economic variables into the CVM helped the researchers to gain information on validity and reliability of the CVM results and increase confidence in the practical application of results obtained from the CVM empirical analysis (Haab and McConnell, 2002).

The empirical strategy

The main purposes of this study were to assess the residents' willingness to pay for improved solid waste management, the amounts and obtain the determinants of WTP. In this regard, the issue involved ''yes'' or ''no'' response, on one hand, and the elicitation of specific monetary value for the yes responses; on the other hand the calculation of mean WTP and the estimation of a parametric model that includes respondents' socioeconomic factors in the WTP function. Two models, that is Probit and Tobit were used to analyze the WTP of household. Firstly, since we do not know the random part of preferences and can only make probability statements about "yes" or "no", we used the Probit model to estimate the probability of WTP. Secondly, since the nature of the decision problem for determining the WTP is unknown, the Tobit model was used to identify the factors that determine how much the respondents were willing to pay for improved waste management services study.

Probit model

Despite its shortcomings, this model was found useful in this study, since it was aimed at providing information to policy makers on the possible interventions derived from the findings (1-3).

$$Yi^* = Xi\beta + \varepsilon i \quad (1)$$

Where $\boldsymbol{Yi}^*$ is the unobserved dependent variable. β is a parameter of the model (the intercept and coefficients), Xi is an exogenous set (independent) explanatory variables and εi is the error term, whereby:

$$\boldsymbol{\varepsilon} i \propto \mathbf{N}\{0,^2\}$$

If an individual household i is willing to pay, $\boldsymbol{\gamma i} = 1$ and otherwise $\boldsymbol{\gamma i} = 0$ (zero).

Mathematically, this is given by:

$$\mathbf{Yi} = \begin{cases} \mathbf{1}\ if\ Yi = 1\ (household\ WTP) \\ \mathbf{0}\ otherwise, \end{cases} \quad (2)$$

When $\boldsymbol{Yi}^* = 1$ then $\boldsymbol{\gamma i} = 1$ implying 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:

$$\mathbf{Prob\ (Yi = 1/X) = (2\pi)^{-1/2} exp\ (-(\beta Xi)^{2}/2)} \quad (3)$$

Where; Yi is the dependent Variable (willingness to pay) taking a value of 0 or 1.

Two categories of respondents were identified in terms of MWTP values. The first category included respondents that: - (i) were not satisfied with the current SWM services, (ii) considered SWM to be the responsibility of the government authority and (iii) had low income; and were expected or assumed to offer zero value for improved SWM. The second category included those that were (i) satisfied with the current SWM services, (ii) aware of the SWM system in place and, (iii) in the high-income bracket; and were expected to offer positive roughly distributed values. Since, the dependent variable (MWTP value), was not totally observed (it is censored at zero) and an OLS (ordinary least squares) estimator cannot be applied, a Tobit model for the observed MWTP was employed (Hagos et al., 2012).

Tobit model

The Tobit model identifies the factors that determine how much the respondents are willing to pay for improved waste management services. Tobit model for the observed maximum willingness to pay (MWTP) is given in terms of an index function (4-6):

$$\gamma i = \alpha + X'\beta + \varepsilon i \quad (4)$$

That is,

$$MWTPi^* = \alpha + X'\beta + \varepsilon i \quad (5)$$

$$MWTPi = MWTPi^* \text{ if } MWTPi^* > 0$$
$$= 0 \text{ if } MWTPi^* \leq 0 \quad (6)$$

Where: $\boldsymbol{Yi}$ (MWTP*) is the dependent variable. In this case, it captures the respondents' unobserved maximum willingness to pay for improved solid waste management; MWTPi is a household's actual maximum willingness to pay for improved solid waste management; X' is vector of independent variables; β is vector of coefficients; α is the intercept; and εi is disturbance term, which is assumed to be normally and independently distributed.

Assuming that there is a perceived utility ($\boldsymbol{\gamma i}$) for paying for improved waste management services, and, a utility (0) for not paying for improved waste management services, β is vector of coefficients; α is the intercept.

$$MWTPi = \alpha + \beta 1age + \beta 2\ gender + \beta 3income + \beta 4education +$$

Table 1. Correlation matrix between independent variables.

Variable		Age	Educational level	Type of employment	Income	Gender
Age	Correlation	1	-0.54	-0.272**	0.319**	-0.161**
	Sig		0.125	0.00	0.00	0.003
Educational level	Correlation	-0.54	1	-0.089	0.132*	-0.40
	Sig	0.125		0.104	0.015	0.466
Type of employment	Correlation	-0.272**	-0.089	1	-0.540**	0.079
	Sig	0.00	0.104		0.00	0.147
Income	Correlation	0.319**	0.132*	-0.540**	1	-0.129*
	Sig	0.00	0.015	0.00		0.011
Gender	Correlation	-0.161**	-0.161**	0.079	-0.129*	1
	Sig	0.003	0.003	0.147	0.011**	

*Correlation is significant at the 0.01 level (2-tailed); ** Correlation is significant at the 0.05 level (2-tailed).

β5household-size+ β6type of house + β7house-ownership+ β8location+ β9sanitary inspector+ β10trust + εi

(if MWTPi* > 0 = Otherwise (if MWTPi*≤ 0). (7)

Before the Probit model was applied to analyze the effect of explanatory variables on WTP, a correlation matrix of the independent variables was analyzed to test for the occurrence of multi-collinearity among the exogenous variables. Multicollinearity is a serious problem when correlation coefficient is 0.8 (Gujarati and Porter, 1999). Begum et al. (2007) argue that a multiple regression model with a correlation coefficient greater than 0.70 among any two variables shows best in multi-collinearity. The correlation between the variables did not exceed 0.8 (Table 1). This shows that multicollinearity and collinearity are not serious problem in the estimated model. Adjusted R^2 values and F-tests have been tested for examining the theoretical validity of the CVM bids (Sumukwo et al. 2012).

Choice of variables

The variables (Table 2) used in the Probit and the Tobit models were 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 franc CFA. It includes the income of the head of household from all sources. There is a general agreement in environmental economics literature on the positive relationship between income and demand for improvement in environmental quality (Afroz et al., 2009). There are many studies which have found that income is positively significantly related to the WTP for improved SWM services (Padi et al., 2015; Maskey and Singh, 2017). Therefore, we expected the income to affect the willingness to pay and its amount positively.

Like any other environmental and public good, whether households are willing to pay or not for an improved solid waste disposal, they are expected to be affected by various factors. Some of these factors with their prior expectations are defined as follows:

(ii) Age of the respondent. This variable refers to the age of the respondent in years. It is expected that the age of the respondent will affect the willingness to pay negatively. This is because older citizens because of their age make more mature decisions related to evaluating health and environmental issues (Afroz et al., 2009).

(iii) Educational level of respondent: It is hypothesized that education increases the individual's awareness and knowledge of the consequences of improper solid waste management. Thus, it is expected that the longer time in formal schooling (years), the more individuals will be willing to pay for improved waste collection and disposal. As such, educated will positively affect WTP (Sumukwo et al. 2012).

(iv) Households' size. This variable refers to the number of individuals in the household. In larger household members are more aware of the risk involved with unhygienic practices and thus crave for a better service by being more willing to pay for improved service (Hago et al., 2012). It is also expected that with more people in the household, there is likelihood for shared responsibilities in executing domestic tasks and solid waste management, rather than paying the Council to clean the environment.

(v) Household ownership. Individuals living in their homes would like to ensure that their surroundings are clean; this will improve the value of their property. This is in contrast with those renting who do not have any such interests. As a result, it is expected that those living in their own houses will be more willing to pay for the improvement as compared to their tenants (Hagos et al., 2012).

(vi) Type of house: This refers to the housing type in terms of housing units and physical space. It is a variable that is sometimes used to assess the physical space available to households. WTP is expected to be higher for those who live in confined area like flats/bungalows with limited compounds compared to those living in detached houses with compound.

(vii) Type of employment: This variable is based on the employment status (employer) and connotes aspects on the reliability of income. It is expected that households with more secure employment will show higher WTP for services; therefore, WTP decreases with employment status (lower security). This variable is intricately linked to household income.

(viii) Sanitary inspector: WTP for improved waste is expected to be positive for those in areas with no environmental inspector and negative for those in areas with the presence of environmental inspector.

Table 2. Description of explanatory variables used in this study.

Variable	Description	Unit of Measure
Gender (Nominal)	Gender of household head	(i) Male (ii) Female
Age (Ordinal)	Age of household head	(i) <25years (ii) 26-35 (iii) 36-45 (iv) 46-55 (v) ≥56years
Education (Ordinal)	Educational level attained by household heads	(i) Primary school (ii) Secondary school (iii) High school (iv) Post high school
Income (FRS/CFA) (Interval)	Total average monthly income of household	(i) <20,000 (ii) 21,000-50,000 (iii) 51,000-100,000 (iv) 100,001-250,000 (v) ≥250,000
Type of employment (Nominal)	Employment type of household heads	(ii) Government official (ii) Private official (iii) Farmer (iv) Businessmen (v) Retired (vi) Students
Household size (interval)	Total number of members currently residing in the house	(i) 1-2 (ii) 3-5 (iii) 6-8 (iv) >9
House ownership (Nominal)	Ownership of currently resided house	(i) Owned (ii) Rented
Type of house (Nominal)	Type of housing unit	(iii) Flats/bungalows (no compound) (iv) Detached with compound

(ix) Trust: This refers to trust developed between individuals and institutions, in this case 'Mamfe Council' which is the service provider. It is a variable that capture the community perception of the level of confidence they have for the service provider. It is expected that, the WTP will be positive for those household who trust in the reliability of the service provider and negative for those who do not.

RESULTS AND DISCUSSION

Socio-economic characteristics of the respondents

After eliminating missing or inconsistent answers to valuation questions, 371 (98.9%) responses are considered valid representative sample for Mamfe residents' population. The sex distribution of the sample is 56.9% females and 43.1% males. The age group with the highest frequency is 36-45 years, that is, 28.5% of the respondents, while those above 56 years account for 9.4%. The mean age of the respondents is 39.5 years. This implies that respondents are economically active and are able to earn more income. This can influence their decision to pay for an improved waste management service. Most of the respondents have attained the secondary school level of education. This implies that majority of the respondents have acquired basic

educational knowledge, a factor that can influence their WTP. Income generated by most Mamfe residents is either through employment in the formal or business sector, with a mean income class of 50000-100000 FRS. This illustrates the huge gap in income with only 10.5% of the population in the high-income bracket. In terms of employment, the business sector is the highest (30%) followed by the government and the private sector (17.5 and 19.1% respectively) with the least being students and retirees (4.3 and 4.9% respectively). Over 70% of the respondents live in detached building (with compound) with close to 50% ownership. The household size with the most frequency (45.8%) is 3-5 persons.

Public perception of the local environment

The environmental quality of an urban landscape can portray the level of public environmental awareness of a community. Public awareness reflects many aspects of environmental status, such as people's knowledge, personal consideration and behavior, public capacity, and the local citizens' attitude towards sustainable society as a whole, etc. (Song et al., 2016). Over ninety percent (95.1%) of the respondents are very much concerned about the problems of environmental degradation; the illegal dumping of waste in streams, roadsides and gutters, and some of the health diseases that may come from poor waste management such as malaria, typhoid and cholera. However, only 51.5% of the respondents are satisfied with the current environmental situation of the town. Considering that only the HIRA currently receives some level of service (about once in two months); this level of satisfaction is quite high. Similar surveys in Ningbo, Quingdao, Zhuhai, Macau and Dalian city of mainland China showed satisfaction rates of 49.9, 72, 83.8, 92.4 and 95.5% respectively (Song et al., 2016). Concerning participation in environmental activities, 88.6% indicate that they have participated in one or two environmental activities organized by the Ministry of Environment on national environmental day and the usual "Keep Mamfe Clean" which holds every first Thursday of the month. Approximately, 74.5% of the respondents are of the opinion that water pollution poses the most serious environmental problem. With regards to their participation in waste separation, 73.1% indicated they are willing to sort waste at home if the government required them to do so.

Willingness to pay

Most of the respondents (85.1%) indicate that they are willing to pay some amount of money in the contingent market. For the 14.9% respondents who state that are unwilling to pay anything, 41% (23) indicate that they could not afford to pay, 36.4% are of the opinion that waste management is the responsibility of the government while 21% (12) do not consider the service important enough to pay for it. This supports the findings of Wang et al. (2014) and contradicts the findings of Seth et al. (2014) in which 62% of the respondents were unwilling to pay.

With regard to the valuation question, the response for the willingness to pay at each bid level ranges from 500 FRS to ≥5000 FRS per month (Table 3) with the majority (45.2%) of the respondents choosing the bid 500-1000 FRS while 7.7% selected the ≥5000 FRS bid. These chosen bids represent the minimum expected WTP of the respondents. The mean bid amount is 1000 FRS (with a 95% confident interval of 750 FRS and 1500 FRS representing the lower and upper limits respectively; approximately US$1.73: current exchange rate). This amount is comparable to those reported in previous studies, $1.98 in Ilorin (Ezebilo, 2013). The mean bid represents 1-2% of the respondents' mean income (50,000-100,000FRS bracket); higher than that obtained for Ilorin, 0.83% (Ezebilo, 2013). This percentage is still higher (2.8%) relative to the minimum wage of 36,000 FRS/month.

A validation question was asked to investigate the validity of households' WTP bids and their respective maximum WTP value; the results show that 6.3% of the households are not ready to contribute above what they bided. Nearly all the respondents (93.7%) expressed WTP response uncertainty (that is, they were WTP more than their maximum bids when prodded further and hence expressing uncertainty on their initial maximum WTP amounts). When expanding the samples to all households in Mamfe, using the total population of 60,000 inhabitants with a mean number of 4 people per household, the estimated number of households stands at 15,000. It can be deduced that the annual WTP value is approximately 180 million FRS /year. This projected value can be used as reference values to design a conservative payment scheme and determine the total available finance for a solid waste management system.

Factors determining willingness to pay

The Probit regression results of factors influencing households' WTP for improved SWM are presented in Table 4. The estimation result shows the likelihood ratio chi-square of 143.2(df=11) with a p-value of 0.008 meaning that the joint significance test of all variables in the model is significant at 5% level. This implies that the variables correctly predict the model. The Probit regression gave a Pseudo R-squared of about 0.6572, suggesting that approximately 65.72% of the variation in WTP is explained by the explanatory variables. This is an indication that the estimated Probit model has integrity; it is appropriate and is generally good. The validity of the Probit model in estimating households' WTP is in line

Table 3. Distribution of responses by bid amount.

Bid (amount in francs)/month	''Yes'' votes	Percentage
500-1000frs	140	45.2
1000-1500frs	79	25.5
2000-4000frs	67	21.6
≥5000frs	24	7.7

Table 4. Probit results for willingness to pay determinants.

	Parameter	Coefficients	S.E	Z	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Probit	Age	0.038	0.059	0.646	0.004*	-0.077	0.153
	Gender	-0.010	0.121	-0.080	0.014*	-0.247	0.227
	Trust	-0.011	0.091	-0.123	0.902	-0.190	0.168
	Location (Residential area)	0.181	0.080	2.265	0.024*	0.024	0.338
	Number of persons living per household	-0.087	0.073	-1.194	0.233	-0.229	0.056
	Type of employment	-0.034	0.037	-0.918	0.059*	-0.106	0.038
	Educational level	0.028	0.054	0.515	0.607	-0.078	0.133
	House ownership	-0.032	0.131	-0.244	0.807	-0.288	0.224
	Income level	-0.092	0.057	-1.625	0.004*	-0.203	0.019
	Type of house	0.055	0.133	0.409	0.062*	-0.207	0.316
	Sanitary inspector	-0.156	0.096	-1.633	0.102	-0.344	0.031
	∆Prob>chi² (0.008)						
	∆LR chi² (11) 143.2						
	∆Pseudo R-squared (0.6572)						

PROBIT model: PROBIT (p) = Intercept + BX; *represents significance at 5%.

with related studies by Hagos et al. (2012) and Seth et al. (2014). The following independent variables: household type, educational level and house ownership are insignificant in determining WTP; whereas, gender, age, income level, location (residential area), type of employment and type of house are significant.

Gender shows a negative coefficient and is significant ($p<0.05$) on WTP. This indicates that female respondents are more willing to pay for improved solid waste management than males, a situation that can be explained by the fact that in Cameroon (more so in this locality that is more rural) women are traditionally responsible for maintaining hygiene and sanitation in the home; cleaning and waste disposal. This result lends credence to findings of Afroz et al. (2009) and Aggrey and Douglason (2010).

The positive coefficient for age ($p<0.05$) indicates that holding all other variables constant, older people are willing to pay more than younger people. This may suggest that older citizens make more mature decisions related to evaluating health and environmental issues, possibly due to their age. This result is in line with findings of Afroz et al. (2009) but contradicts the findings of Aggrey and Douglason (2010). The later held that older citizens view waste collection, as government responsibility and could be less willing to pay for it.

The variable type of housing is positive and significant. This indicates that WTP is higher for those who live in confined area like flats/bungalows with limited compounds compared to those living in detached houses with compound. In such units, the limitation of space (to permit on site disposal and reduce the immediate impact of poor waste disposal) can increase their demand for waste management services. This contrasts with findings by Ezebilo et al. (2013).

Households' income shows a negative and significant ($p<0.05$) relationship with WTP, indicating that holding all other variables constant, the income of the head of household even though significant did not have the expected sign on WTP. Thus, an increase in household's income does not necessarily increase the WTP for a better waste management service. This is contrary to economics theory which postulates that higher income households have a greater demand for waste management and are more willing to pay for it (Hagos et al., 2012; Maskey and Singh, 2017). The coefficient of the variable type of employment is negative and significant with WTP. This indicates that employment

Table 5. Tobit Regression results of factors influencing the amount of money respondents are WTP.

Variable	Coefficient	S.E.	t-statistic	p-values	95% Confidence Interval	
					Lower bound	Upper bound
Constant	1.764	0.241	7.333	0.000*	1.291	2.238
Gender	-0.035	0.039	-0.903	0.367	-0.112	0.042
Education level	-0.024	0.018	-1.363	0.174	-0.059	0.011
Age	0.042	0.019	2.167	0.031*	0.004	0.080
Household size	-0.032	0.024	-1.298	0.195	-0.080	0.016
Type of employment	-0.039	0.012	-3.201	0.002*	-0.062	-0.015
Type of house	-0.105	0.042	-2.529	0.012*	-0.187	-0.023
Household Income	-0.052	0.019	-2.721	0.007*	-0.089	-0.014
Household ownership	0.051	0.044	1.164	0.245	-0.035	0.136
Trust	0.031	0.030	1.033	0.302	-0.028	0.091
Location (Residential area)	0.034	0.021	1.154	0.057	-0.025	0.187
Inspector	0.057	0.038	1.842	0.081	-0.052	0.241

*Significant at p<0.05.

status (income reliability and job security) has an inverse relationship with WTP. This is contrary to the a priori expectation that households with more secure employment will show higher WTP for services. It, however, exhibits the same trend with household income; to which it is intricately linked.

Catalano et al. (2016) suggest that household income and other related variables (such as location of a household and type of employment) may show significantly negative relationship with WTP for a public good, which is more a problem of data rather than the consequence of an unexpected behavior. These authors intimated that if annual payments are small and can be afforded by a cross section (low, middle and high-income levels) of the population, and if fewer households of the studied population belong to the high-income group; this little variation cannot make the coefficient positive. This explanation is highly plausible in our study, where only 10.5% of the households are ranked as high income (≥250,000) level. This result can also be linked to the fact that low-income households have stronger demands for public SWM services, whereas the high-income may have the ability to employ private solutions as has been reported in previous studies (Wang et al., 2011, 2014). Also, low- and middle-income residential areas (LIRA and MIRA) inhabitants are more WTP for an improved waste management service than the high-income residents (HIRA); possibly because this area (HIRA) is receiving some level of service.

Determinants of the amount of money households

The Tobit regression results of factors influencing the amount of money respondents are willing to pay for improved waste management services are presented in Table 5. The theoretical validity of CVM bids (Tobit regression) was performed to check the behavior of WTP determinants (Mitchell and Carson, 1989; Sumukwo et al., 2012). The Tobit regression gives a Pseudo R-squared of 0.6572. Four of the exogenous independent variables in the demand for improved SWM are statistically significant ($p<0.05$) predictors for the maximum amount of money households are WTP for improved solid waste management service, that is, household income, type of house, type of employment and age of respondents. These four variables are also significant variables in the Probit model used in this study. Gender, which is significant in determining WTP, is not a significant predictor in the amount respondents are WTP. Similar observations were reported by Awunyo-Vitor et al. (2013).

The coefficients of age variable show positive and significant relationship with the amount of money the respondents are willing to pay for improved solid waste management. This may be explained by the fact that as people gets older, they tend to understand the need of a clean environment (Afroz et al., 2009). In addition, they may also know that access to funds by waste management organization can improve their services (Awunyo-Vitor et al., 2013). The coefficient of household income is negative and significant; implying that increase in household's income does not necessarily increase the amount residents are WTP for a better waste management service. This is contrary to economics theory which postulates that higher income households have a greater demand for waste management and are more willing to pay for it (Hagos et al., 2012; Maskey and Singh, 2017).

The coefficient for the variable type of employment is negative and significant. This implies that less reliable income source is a predictor of the amount households

are WTP for the improvement of SWM services. This is contrary to the expectation that households with more secure employment will show higher WTP for services. Education is not statistically significant in either equation, in contrast to most CVM studies which show that, on average educated households are willing to pay for improvements in solid waste management services (Banga et al., 2011; Sumukwo et al., 2012). Seth et al. (2014) and Niringiye and Omortor, (2010) made the same observation, that is the insignificance of education in WTP.

Conclusion

A high level of concern over the problems of environmental degradation is displayed by the population (95.1%) with 74.5% of the opinion that water pollution posed the most serious environmental problem. Over fifty percent (51.5%) of the population indicated that they were satisfied with the current level of environmental sanitation. Participation in environmental activities, particularly the monthly 'keep clean' exercise is very high 88.6 and 73.1% indicated they were willing to sort waste at home; if the government required them to do so.

With regard to WTP for improvement in SWM services, over 85.1% indicated their willingness to pay some amount of money in the contingent market, with a mean bid amount of 1000 FRS (approximately US$1.73: current exchange rate). This represents 1-2% of the mean monthly income (50,000-100,000FRS) bracket. The trend of WTP and income variables (income and type of employment) is negative and significant. According to Catalano et al. (2016) this could result from the fact that annual payments are small and can be afforded by a cross section (low, middle and high-income levels) of the population. It is therefore possible that this could be a suitable take off fee for any such scheme.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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