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Households' willingness to pay for waste management improvement in Gombe municipality of Kinshasa, DRC

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Abstract

The setting of the willingness to pay for the reservation and protection of the environment is one of the answers that economics science is giving to the environmental problems that society is increasingly confronted with. This study uses the Contingent Valuation Method (CVM) to assess the willingness to pay (WTP) in the municipality of Gombe for the improvement of household waste management. A survey based on 300 households showed that the income, the type of housing, the participation in a collection unit and knowledge of the impact of household waste on the environment positively affect the willingness to pay (WTP); while age, marital status and education negatively affect the willingness to pay (WTP). 71.4% of households agree to share the cost with the city to set up a program to improve waste management. The average WTP is CDF 1500 or $ 0.75.

Keywords: Willingness to pay; Waste Management; Household Waste; Contingent Valuation Method

1. Introduction

The world today is facing environmental challenges at all levels and the major challenges. Climate change, as a result of global warming, has been accelerated by greenhouse gas emissions since the industrial revolution.

Coming from production and consumption patterns, waste is a phenomenon of no less importance. Solutions to their treatments are increasingly costly for communities and the problem of their management remains recurring. (IFDD, 2019). The management of household waste in developing countries is one of the environmental challenges (OCDE, 2006). It is more worrisome than elsewhere, because the organizational and financial resources of companies have not kept pace with the changing needs that accumulate and, as focused on other emergencies, managers simply put on a minimal effort (Tobias, 2003).

With the rapid growth of urban populations coupled with economic growth and living standards, household waste management is becoming a challenge for municipal authorities in developing economies ((Rai, Nepal, Khadayat, & Bharwaj, 2019) ; (Seo S. , Aramaki, Hwang, & Hanaki, 2004) ; (Yukalang, Clarke, & Ross, 2018) ; (Ozcan, Guvenc, Guvenc, & Demir, 2016) ; (Wang & Nie, 2001) ; (Jha, et al., 2008)). Municipalities are responsible for the management of household waste. However, in developing countries, municipalities have not been able to provide effective waste management services due to financial, institutional and appropriate collection techniques ((Hazra & Goel, 2009) ; (Ndlovu, 2016)). Although municipal waste is only part of the waste produced, its management and treatment often absorb more than one third of the public sector's financial efforts to combat pollution (OCDE, 2014). Meanwhile, the financial and organizational resources available for the proper management of household waste by the competent public authorities may not be correlated with growth as expected (Henry, Yongsheng, & Jun, 2006).

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The Democratic Republic of the Congo, like all other countries, experienced an increase in the urban population with multiple repercussions, particularly in the field of the environment. By 2030, the city of Kinshasa will have more than 24 million inhabitants and will be the most populated city of Africa, ahead of Cairo and Lagos (World Bank, 2018).

Waste management has taken a prominent place in the public debate. In Kinshasa, for the past few decades, there has been some kind of trial in relation to the issue of public sanitation, particularly in the city of Kinshasa. A number of obstacles, including the limited resources available for the cleanup of the city, hampers the management of municipal waste in Kinshasa.

That is why, through this article, we have chosen to see to what extent households need to be accountable for the household waste management service through their willingness to pay for the improvement of the common household waste management service. Therefore, the rise of the following main question in this article: What are the determinants of the willingness to pay (WTP) for improved households' waste management in the municipality of Gombe?

The main objective of this article is to evaluate economically the benefits of better household waste management in the municipality of Gombe in Kinshasa. In particular, it will be necessary to determine which factors can influence the acceptance of a household to contribute financially to a new waste management program; to analyze the preferences and motivations of households for improving the quality of the household waste disposal service and to estimate the willingness to pay of households in the Municipality of Gombe, for the improvement of household waste management in order to avoid the nuisance caused by it.

This document is divided into four sections.

- **Section 1** presents an introduction to waste management issues in developing countries and in Congo-Kinshasa.
  Section 2 describes the materials and methods used in this study.
- **Section 3** presents the results of this study and discussions. Finally,
- **Section 4** concludes the study.

2. Material and methods

2.1. The chosen area for the study

The city of Kinshasa covers an area of 9.965 square kilometers (Saint Moulin and Kalombo, 2005), of which 2,500 km^2 are the agglomeration. The city of Kinshasa is limited to the East by the provinces of Mai-Ndombe, Kwilu and Kwango; in the West and North by the Congo River, forming the natural border with the Republic of the Congo Brazzaville and the South (RDC, 2003). Its current population is almost 13 million (INS, 2020).

Table 1 Presentation of the Gombe municipality's data in 2018 (INS, 2020)

N°	Neighborhood	Number of households	Congolese Pop.	Foreign Pop.	Total Pop.
01	BATETELA	265	4,843	1,539	6,382
02	CLINIQUES	496	5,038	2,176	7,214
03	COMMERCE	200	1,505	8,558	10,063
04	CROIX	240	3,106	1,039	4,145
05	FLEUVE	-	2,683	-	2,683
06	GARE	417	6,701	2,947	9,648
07	GOLF	510	6,194	2,961	9,155
08	HT COMMAND	624	7,701	2,839	10,540
09	LEMERA	195	2,930	784	3,714
10	REVOLUTION	509	5,997	2,802	8,799
Total		3,456	46,698	25,645	72,349

Source: Report of the Gombe municipality, 2018.

Administratively, it is divided into 24 municipalities, all urban, Maluku, N'sele and Mont-ngafula, which are urban-rural. The municipality of Gombe is the mirror of the city. From its inception to date, the municipality of Gombe has retained jealously and proudly its special status as the headquarters of the DR Congo institutions and the cosmopolitan city, with a mosaic of peoples representing 81 nationalities in 2013. The population of the Gombe municipality is estimated at seventy two thousand three hundred and nine in 2018, according to the data provided by the municipality's population services.

2.2. Data Collection and sampling

In order to determine the willingness to pay in the municipality of Gombe for the management of household waste improvement, the Contingent Valuation Method (CVM) which is considered a viable method of collection (Boateng, et al., 2019) was used. The data used in this study are from a survey conducted to the households of the Gombe municipality, in the city of Kinshasa based on a questionnaire, which we have adapted according to other studies (Nguyen, 2016). The stratified sampling method was used to select samples from the 10 neighborhoods, where each neighborhood was taken as a stratum for 3,456 households (confer Table 1.). In order to take a sample, which may be the best representative of the population as a whole, the sample size was calculated based on the simplified proportion formula (Muayila, 2020). With a 95% confidence level, a margin of error of 0.5 and a 95% response rate, the formula is as follows:

$$N = \frac{Z^2\, P(1-P)}{e^2} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where N is the sample size (1) **z** confidence level, **P** the probability and **e** margin of error.

After applying the formula (1) to the population of households in the municipality of Gombe, a sample of 288 households required was identified. An adjustment of the sample after taking into account the deviation effects and for an estimated response rate of 95%, led us to consider a sample of 300 households left on the 10 neighborhoods of the municipality.

2.3. Analytical Model

The model chosen in this study is Heckman (1979) based on the work of the Sghaier (2020), Nguyen (2016), Gbinlo (2010), and Fonta et al (2007). Formally, this model can be considered as a two-step model. At once, the household chooses to participate to the program or not, and then a substantial equation at the end of which the household decides to pay.

2.3.1. First stage: Selection's equation

The selection's equation is formalized as follows ((Voltaire, 2011); (Nguyen, 2016)):

$$(Z_i = 0{,}1) \Rightarrow \begin{cases} Z_i = 1 \; si \; Z_i^* > 1 \\ Z_i = 0 \; si \; Z_i^* \leq 0 \end{cases} with \; Z_i^* = \omega_i \gamma + \mu_i \ldots\ldots\ldots (2)$$

With:

i = the household.
Z_i = the binary variable.
Z_i^* = latent variable.
ω_i = the vector (line) of the explanatory variables chosen as the determinants of the decision.
γ represents the vector (column) of the associated parameters.
μ_i = the term error normally distributed under Act N(0,1).

The selection's equation is to model the probability of providing a positive response to the question of whether the household surveyed would accept sharing the cost of the waste management improvement program in the city of Kinshasa. The binary variable (Zi = 0.1) captures household choice i participate or not in the program to improve the quality of waste management. This decision is supposed to be based on a latent variable, Zi*, whose behavior is modelled through the selection equation (2).

Considering $Z_i^* = \omega_i \gamma + \mu_i$ the selection's equation

With ω_i the vector (line) of the explanatory variables chosen as the determinants of the decision where γ represents the vector (column) of the associated parameters and μ_i the term of error normally distributed under Act N(0,1). We will seek to apprehend Prob(Z_i = 1) via a probit model by posing:

$$\text{Prob}(Z_i = 1) = \text{Prob}(Z_i^* > 0) = \theta\ (\omega_i \gamma)$$

with $\theta(.)$, the distribution function of the reduced centered normal law.

At the end of this stage is drawn (via the maximum likelihood method (MLM)) an estimate of γ, $\hat{\gamma}$ and from Prob(Z_i= 1) noted Prob(Z_i = 1) with Prob($Z_i^* = 0$) = $\theta\ (\omega_i \hat{\gamma}\ )$.

2.3.2. Substantial equation

Voltaire (2011) formalizes the substantial equation as follows:

$$\begin{cases} Y_i = 1 \quad if\ Y_i^* > 1 \\ Y_i = 0\ (is\ not\ observed)\ if\ Y_i^* \leq 0 \end{cases} with\ Y_i = \beta X_i + \varepsilon_i \text{ (2b)}$$

With:
Y_i = WTP declared
X_i = the vector (line) of the socio-economic variables assumed to act on the determination of WTP;
ε_i = an error term distributed according to normal law N (0);σ_i^2) .

Also called the Heckman regression equation (Nguyen, 2016), it seeks to provide an estimated value of the WTP of households and the impact of its determinants on the sample of households.

As such, it will be possible to use WTP observations declared that for households responding to Z_i = 1. The level of willingness to pay (WTP) is determined using the following linear model:

$$WTP_i = \beta X_i + \varepsilon_i \text{.....(3)}$$

With ω_i and x_i independent observable variables; ($\mu_i \varepsilon_i$) the error terms of the two equations which are assumed to be correlated and distributed according to normal bivariate law with correlation coefficient ρ. The Maximum Probability Method (MPM) normally estimates this type of model. It consists of finding the parameters that maximize the probability (probability density) of generating the observed sample (Racicot & Théoret, 2001).

However, since convergence is sometimes difficult, Heckman's estimator, obtained in two stages, is sometimes preferred. A probit model then first estimates the selection's equation; then, a regression by the Ordinary Least Sauares (OLS) gives the coefficients of the second equation. The Heckman method thus allows an approximation of the results obtained by MPM; the calculated estimators will be slightly biased (Muayila, 2020).

$$\text{Formally,}(\mu_i \varepsilon_i) \rightarrow N\left[\binom{0}{0}, \begin{pmatrix} \sigma_i^2 & \rho\sigma_\varepsilon \\ \rho\sigma_\varepsilon & 1 \end{pmatrix}\right] with\ corr\ (\mu_i \varepsilon_i) = \rho$$

The sample of households such as Z_i = 1 (i.e. $Z_i^* > 0$) only allows the assessment of an amount of a conditional-paid agreed fee given by $S[WTP_i | Z_i^* > 0]$. Nguyen (2016) states that this conditionality is related to the very nature of the sample.

By combining Voltaire (2011); Green (2012) and Nguyen (2016) it can be demonstrated that

$$S[WTP_i | Z_i^* > 0] = S[WTP_i | Z_i^* > 0]\ X_i\beta + \rho\sigma_\varepsilon\ \lambda(-\omega_i \gamma)$$

With $\lambda(.)$ Heckman's lambda (as opposed to the Mills ratio) $\lambda(\propto_z) \equiv \varphi(\propto_z)/[1 - \Phi(\propto_z)]\varphi$ and Φ denote the density function and the distribution function of a reduced centralised normal law. The corresponding regression model applied only to the sample data *subject to selection via Z_i = 1 may be written as (Heckman regression equation):*

$$WTP_i = X_i\beta + \ \beta_i\hat{\lambda} + \nu_i$$

with $\hat{\lambda}_i \equiv \lambda(w_i\hat{\gamma})$ (value calculated from the first stage on the basis of the PROBIT model results). The omission of Heckman's lambda in the regression's equation would lead to bias in the estimation of β (and thus in the assessment of the average WTP on the population of the households concerned).

2.4. Selection of variables

The choice of explanatory variables in this study is based on other similar studies in the area of WTP assessment in the management of household waste ((Gbinlo, 2010); (Hagos, Mekonnen, & Gebreegziabher, 2012) ; (Maskey & Singh, 2017); Nguyen, 2016; (Sghaier, 2020) ; (Mrhanyo, et al., 2022)).

Table 2 Definitions of explanatory variables

Variables	**Label**	**Type**	**Codification**	**Expected Signs**
Age	Age of household respondent	Explanatory quantitative Variable	Continuous Variable	+/-
Gender	Gender of respondent	Explanatory qualitative Variable	Men = 1 and 0 = female	+
Maritalstatus	If the respondent is married or living in a couple	Explanatory qualitative Variable	if the individual is married or living in a couple = 1; if he or she is a single person = 2 and 3 if other	+/-
Education	Level of education of the respondent	Explanatory qualitative Variable	At least primary level = 1; Secondary = 2; Higher and University = 3 and 4 for postgraduate students	+
Population/household	Number of persons in a household	Explanatory quantitative Variable	Continuous Variable	+
Houshldtyp	The type of dwelling of the respondent	Explanatory qualitative Variable	Housing type: Individual (by=1 or 2 and Collective = 3	+/-
Income	Income from the household	Explanatory quantitative Variable	Income in CDF	+
Collectunit	Waste collection unit participation	Explanatory qualitative Variable	If he participates=1 and if not=0	+/-
Envirdegrad.	Attitude to the problems of environmental degradation	Explanatory qualitative Variable	Interested = 1 and if not = 0	+

Source: Author.

The variables explaining the probability of households participating in the program to improve the quality of household waste management contained in Table 2 can be explained as follows:

2.4.1. Age

This variable is continuous. Afroz and al (2009); Awunyo Vitor et al. 2013 (2013); (Roy & Deb, 2013) **;** (Addai & Danso-Abbeam, 2014) ; Nguyen (2016) stressed that when all other factors are constant, older people are ready to pay more

than younger people. This suggests that older people are more mature to make decisions to assess the relationship between health problems and the environment. Probably because of their age, they are therefore forced to give a higher WTP value. Consequently, Ndolvu (2016) points out that many studies have shown that older people who have free household waste are less willing to pay for improved household waste management (Appiah-Adjei et al, 2015; Ayenew, 2019 ; Bijan and Mrinila, 2017).The negative coefficient at age means that the probability that households will pay for improved household waste management decreases as the age of the respondent increases.

2.4.2. Gender

The sign expected for this study is positive. In most cases in sub-Saharan African cultures, it is for women to clean the house and dispose of household waste (Markey and Singh, 2017; Ndlovu, 2016).

2.4.3. Maritalstatus

We assume that households living in couples can pay a high amount than those living alone. There is some ambiguity, as some studies show that household whose occupier lives alone have a strong influence on WTP for improving household waste management (Ndlovu, 2016). Others like Gbinlo (2010) say that the marriage variable has a negative influence on the willingness to pay, but it simply means that a married person will give a WTP amount significantly less important than a single person.

2.4.4. Education

We assume that those who are educated will be more willing to participate in the program. The above variables are thus assumed to have only an influence on the choice of participating in the program or not. However, if considering that some of them also have an impact on the amount of the agreed fees to be paid, they will appear in the two model equations. Afroz and al (2009); Gbinlo (2010); Samukwo et al. (2012); Djemaci (2012); Adepoju and Salimonu (2013); Subhan et al. (2014); Nguyen (2016) and Markey and Singh (2017) found that this variable has a positive influence on the WTP of households for the improvement of household waste management services.

2.4.5. Household_pop

The expected coefficient for this quantitative explanatory variable, which gives the number of persons in the household surveyed, would be positive. Some studies show an influence between the number of people living in a household and WTP, while others find that this is the opposite. The Ndlovu study (2016) confirms the influence of household size on WTP for improving household waste management.

2.4.6. Househld_typ

This variable refers to the type of housing. Households living in high-storey neighborhoods, owners and those living in collective dwellings are willing to pay for improved waste management. Several studies have demonstrated the influence that binds the type of housing to WTP (Gbinlo, 2010; Hagos, D.; Mekonnen, A.; Gebreegziabher, Z., 2012; (Awunyo-Vitor, Ishak, & Jasaw, 2013) ; On the other hand, there was no influence (Maskey and Singh, 2017).

2.4.7. Income

This variable has an important role to play in the selection of WTP (Nguyen, 2016). Several studies have shown that income is significantly linked to WTP for improving household waste management (Maskey and Singh, 2017). Participation in the program requires financial burdens, the more easily a household earns its life and the greater its probability of participating in the program (Gbinlo, 2010).

2.4.8. Collect_unit

Improving the management of household waste in the city of Kinshasa involves a presentation of services in the sector. Most of the expected respondents are affiliated with a waste collection service. To improve management means to understand the shortcomings of what exists in order to bring about change. Participation in a collection unit depends on the standing of the neighborhood.

2.4.9. Envirdegrad

The expected sign for the coefficient of this variable is positive. Many respondents are implicitly interested in the environmental problems caused by waste in general and household waste in particular. Several studies in this case that of Roy and Deb (2013) confirm this hypothesis.

3. Results and discussion

3.1. Households characteristics in the study area

Table 3 Socioeconomic characteristics of households in the municipality of Gombe

Variables	Modalities	Fi	%
Gender	Male	118	39.33
	Female	182	60.67
		300	100.0
Age	Continuous quantitative variable	43 years of average	Max 67 years Min 22 years
		300	100.0
Marital status	Single	202	67.33
	Married	64	21.33
	Other	34	11.33
		300	100.0
Education	Primary	11	3.67
	Secondary	8	2.67
	Superior and University	273	91.00
	Postgraduate	8	2.67
		300	100.0
Size of household	Continuous quantitative variable	On average 4 pers/Household	Max 9 pers. Min 1 pers
		300	100.0
Housing Type	Lessee	215	71.67
	Owner	85	28.33
		300	100.0
Revenue	Quantitative variable	On average CDF 600,000	Max over CDF 600,000 Min CDF 100.000
	Less than CDF 100000		
	More than CDF 600,000		
		300	100.0
Participation in a Collection Unit	Yes	184	61.33
	No	116	38.67
Knowledge of the impact of waste on the environment	Yes	276	92.00
	No	24	8.00
		300	100.0

Sources: Author, survey data analysed using the software Stata 14.

The results of this table indicate that 61% of the respondents are women, 39% are men. It should be inferred that the majority of our respondents are female. This is clearly visible on the ground in developing countries where more women (heads of household) are found during the day at home than men at all households. Similar studies confirm this (52%

for Gbinlo, 2010; 54.5% in Ho Chi Minh and 69.71% in Hanoi for Nguyen, 2016) but other studies showed that the female gender was not the majority, 26% for Maskey and Singh (2017) ; 12% for Behanzin et al (2020), 49% for Mumujuya (2021) et 43% for Mrhanyo et al (2022). The results of this analysis show that the average age of the respondents is 43 years. This is because the majority of heads of household are adults and parents. The highest or maximum age is 67 years and the lowest or minimum age for heads of households is 22 years. Mostly, 202 heads of households out of 300 were single, followed by husbands. Most of the others are divorced, widowed (women) and other heads of households in a common-law relationship.

With regard to the level of education acquired, it should be noted that 273 heads of households out of the total surveyed, i.e. 91% each have a higher and university degree, the remainder are divided into the three remaining categories. This explains by the fact that the level of education has a significant impact on the likelihood of adopting the household waste management program we propose.

In each household surveyed, there are an average of 4 persons per household including the head of household. The maximum number is 9 persons and the smallest number or minimum number for a household is one person. Regarding the Housing Type, 215 households out of 300 surveyed, there is 72% are tenants against 85 households, where 28% are owners. One hundred eighty-four (184) households surveyed participate in a household waste collection unit (61%), while one hundred sixteen (116) households do not.

The results of Table 3 also show that the average income of heads of household surveyed in this study is between CDF 600,000 (or $300 at the time of the survey) on average. The minimum income is CDF 100 000 ($50 at the time of the survey) while the maximum is more than CDF 600 000. This income, according to some officials, could evolve over the next 5 years and thus contribute positively to the household waste management program to combat the various diseases. The majority of Gombe community's households are aware of the impact of household waste on the environment. As shown in Table 3, 276 households surveyed (92%) answered yes, while 24 households (representing 8%) replied by no.

3.2. Households willingness to pay for the household waste management improvement

Table 4 Households WTP for household-waste management improvement

Variables	Modalities	Fi	%
Willingness to pay (WTP) of head of household	Yes	214	71,33
	No	86	28,67
		300	100,0
Average amount to be paid per household	Quantitative variable	Average CDF 1500	Max CDF 2500 Min CDF 0
		300	100,0

Sources: Author, based on survey data, 2022.

The results of this table indicate that 71.3% of respondents are in favor of supporting the household-waste management improvement program in the Gombe municipality. 28.67% are not in favor. The average amount for improving household waste management is CDF 1500 ($0.75; with an exchange rate of $1 = CDF 2000) per the month, the minimum is CDF 0 to a maximum of CDF 2500 ($1.25; with an exchange rate of $1 = CDF 2000).

3.3. Factors influencing households' willingness to pay for improved waste management in the municipality of Gombe.

The result of multivariate regression in the table above shows that the probability of Chi2 is significant and lower threshold of significance.($\alpha = 0,05$), $0.0000<0.05$. Variables in the model and R2 significantly explain a household's decision to make payments for the improvement of waste.

Table 5 Households' WTP for waste management improvement

Variables	Coefficients	Marginal effects (dy/dx)	Z	P>|z|
GENDER	-.2511322	-.0014026	-0.37	0.708
AGE	-.4071435	-.0020594	-4.91	0.000
MARITAL STATUS	-2.721359	-.0137651	-3.07	0.002
EDUCATION LEVEL	-2.32218	-.011746	-2.56	0.011
HOUSEHLDPOP	-.2308303	-.0011676	-0.83	0.408
HOUSEHLDTYP	1.015573	.0051369	3.71	0.000
HOUSEHLDINCOM	1.004184	.0050793	4.08	0.000
PARTICIP_UNIT~S	9.200173	.9961309	4.45	0.000
HOUSEHLDWASTE~R	2.594796	.3321842	2.39	0.017
	Number of observations		= 300	
	Chi2(28)		= 106.19	
	Prob > chi2		= 0.0000	
	Pseudo R2		= 0.9219	
	Log semblance		= -13.848867	

Sources: Author, based on data from the survey analysed using the sotfware Stata 14; ***** significant at 10%, ** significant at 5%, * significant at 1%.**

As shown in Table 5, this study revealed that the significant variables influencing the WTP of households for improving household waste management are age, marital status, education, household type, income, waste collection services and awareness on environment preservation. Gender and household population variables have no statistically significant influence on the WTP of households. Age has a negative influence and a significant effect at 1% level. This means that for an increase in the respondent's age of one year, the household's WTP decreases by 0.2%. This study contradicts the results of Bhattarai (2015), but confirms those of others (Appiah-Adjei et al., 2015; Subhan et al., 2014; Hagos et al., 2012 and Gbinlo, 2010).

The marital status variable has a negative effect with statistical significant effect ($p<0.01$) as shown in Table 5. The marginal effect shows whether a single person becomes married his WTP decreases significantly by 1.4%. The education level (education) as the two variables discussed above have a negative influence on WTP and is statistically significant at 5% level. This coincides with the Dhungana study (2018).

The household's total average income is statistically significant at 1% level and positively influences the WTP decision of households. This is corroborated by other similar studies (Maskey and Singh, 2017; Roy and Deb, 2013; Nguyen, 2016; Ndlovu, 2016; Hagos et al., 2012; Samukwo, 2012, Bamlaku and al, 2019; Dilsath A. and Prasada D., 2021).

The variable of knowledge of the environmental impacts of waste has a positive coefficient and is statistically significant at the 1% threshold. This result shows that households are more likely to pay for an improved waste collection service if they are aware of the negative environmental impacts of waste. This result corroborates the findings of other similar studies (Maskey and Singh, 2017; Hagos, D. at al, 2012; Dilsath, A. at al, 2021).

The variable participation to a waste collection unit is also significant at the significance level of 1%. The coefficient is positive, which was expected in this study. As the municipality of the Gombe is considered the city of the Congolese capital, households that currently have a waste collection service are more likely to pay for the improved waste collection service in the likes of 99.6%, contrary to those who do not use a waste collection service. However, a similar study in Nepal (Bhattarai, 2015) found that households that benefit from the waste collection service are likely to pay less than households that do not benefit from the service.

The housing type of household variable has a positive coefficient as expected; it has a significant impact ($p<0.01$). As confirmed by the research of Gbnilo (2010), Hagos, D. and al (2012); Awunyo-Vitor, D. and al (2013) and Dhungana (2018).

The gender variable from the survey and the size of the household have no effect on the willingness to pay of Gombe municipality's households, for the improvement of household waste management.

4. Conclusion

This study was conducted in the municipality of Gombe in Kinshasa, in the Democratic Republic of the Congo. It assesses the WTP of 300 households selected using a stratified sampling method in the 10 neighborhoods of the municipality for the proper management of household waste through the waste collection service and the factors affecting it. This study used the Contengent Evaluation Method, which directly asks beneficiaries to determine the amount of fees they wish to pay in hypothetical circumstances assuming that it will be implemented in the near future.

This study revealed that the majority of households surveyed (71.4%) is ready to pay for improved household waste management. The average amount of WTP that households are willing to pay is CDF 1500 ($ 0.75 US) per month. The municipality or stakeholders concerned may consider this as a reference amount on which to impose a tax for waste collection charge in the municipality of Gombe, as no such tax has been charged on households up to now. Better regularity of household waste management services and better geographical coverage of their collection is achieved through the revenue generated by the household waste collection fee.

The variables that positively and significantly influence WTP are monthly income, type of housing, participation in the collection unit and knowledge of the impact of household waste. The age, marital status and education variables are significant but negatively influence household WTP of households for the improvement of household waste management. This means that service providers and those in charge of the city must take into account all the characteristics before a waste collection fee is all set up.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors were involved in the study design, experimental design and scientific writing of the article.

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