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Households' Willingness to Pay for Improved Waste Collection Service in Gorkha Municipality of Nepal

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Abstract: Municipal solid waste management is a growing problem in urban areas of Nepal where municipalities are severely constrained by budget to manage it effectively. Collecting fees from the public can aid finance for improving waste management service. This study evaluates willingness to pay (WTP) by 401 households, selected using a stratified sampling method from all 15 wards of Gorkha municipality of Nepal for improved waste collection service and the factors influencing it. We employed a contingent valuation method to elicit households' WTP, logit regression model to determine factors influencing WTP and tobit regression model to determine factors influencing the maximum amount households are willing to pay for improved waste collection service. Majority of households (61%) are willing to pay an average amount of NRs. 73.38 (0.72 US$) per month. Factors that significantly influence households' WTP are monthly household income, education of household head, environmental awareness and waste collection service. Except for education of household head, all these factors significantly influence the maximum amount of money households are willing to pay. Concerned stakeholders and policy makers should consider these traits of households before enforcing a waste collection fee.

Keywords: willingness to pay; contingent valuation method; solid waste management; Nepal

1. Introduction

Increase in population, income level and urbanization increases the amount of solid waste generation, and if not managed properly, it creates serious negative impacts on human health, environment and also the economy [1]. Greater economic prosperity and increase in the consumption level have intensified the problem of Solid Waste Management (SWM) and is now a major challenge in urban areas of developing countries [2]. A significant portion of the municipal budget is spent on SWM in Asian countries but a rapid increase in population, economic growth and improvement of living standard have resulted in the substantial increase in the amount of solid waste being generated, making SWM even more challenging [3].

SWM is a huge problem for the local and national government of Nepal as well. The average municipal budget spent on SWM is only about 10% and only 62.3% of the total municipal waste generated is collected by the municipalities in Nepal [4]. The most significant aspect of municipal SWM is collection and transportation of solid waste as it demands the major share of municipal budget and has the greatest impact on urban life [5]. In the case of Nepal, almost all of the municipal budget allocated for SWM is spent on solid waste collection, transportation and street-sweeping. The Solid Waste Management Act of 2011 was enacted by the Government of Nepal to be effective from 15 June 2011, which gave full responsibility to the local bodies like municipalities for the SWM service, including an authority to impose and collect fees for the service provided [6]. However, most of the municipalities do not have a formal system to impose fees for SWM related services [4]. Therefore,

financial constraint proves to be the greatest hindrance for providing adequate SWM services in Nepal. Nonetheless, collecting fees from the public for improving the service seems to be the only viable option.

This study was conducted in Gorkha municipality of Nepal where SWM service is restricted by the limited resources. The estimated total municipal solid waste generation is about 6.6 tonnes/day, of which only 2 tonnes/day are being collected by the municipality; i.e., only about 30.3% of the total daily waste generated is collected [4]. The municipality has only one tractor to collect waste within the whole municipality and therefore only households nearby the pitched main road are able to receive the service of waste collection. Until now, this service was provided free of cost and thus the most attainable way to improve the current service is through generating revenue by imposing waste collection fees so that the geographical coverage of waste collection could be expanded and the maximum number of households can be served. But willingness of the households to pay for such a service remains a question as it depends on many factors including their financial ability and how they value the importance and impact of such service.

In order to identify the willingness to pay (WTP) for certain goods or services, especially when the goods being transacted are not being traded in the market, the contingent valuation (CV) method can be used. The CV method is a widely used and accepted technique to study WTP for both marketable and non-marketable goods such as travel cost, reduction in the risk of death, improvement in air quality, sanitation, water supply and other environmental services. Because such conditions are non-existent in the targeted location, WTP cannot be extrapolated from the existing conditions [7,8]. In such a scenario, a "stated preference" approach such as CV is used, which is a direct assessment technique that measures the expected amount of the project in monetary terms by directly asking those who will be benefited by the services under hypothetical circumstances through a questionnaire survey with the assumption that it will be implemented in the near future [7–10].

Thus, with this intent, this study tries to evaluate WTP by households for improved SWM service of waste collection and the factors influencing it. The findings from this study will help the local government and concerned stakeholders to understand the relevant characteristics of households and come up with a suitable fee for waste collection service, which shall help to improve the current overall SWM scenario. This study can also be a guiding tool to conduct WTP studies in other municipalities of Nepal and other developing countries where there is no waste collection fee imposed.

This paper is divided into four sections. Section 1 presents an introduction of SWM problems in developing countries and in Nepal, highlighting the significance of this study, and why the CV method is used to identify WTP by households for improved waste collection service. Section 2 describes materials and methods used in this study. Section 3 presents results from this study, which are comparatively evaluated with the findings from similar studies conducted in Nepal and other countries. Finally, Section 4 concludes the study with policy implications.

2. Materials and Methods

In this study, we used the CV method, which is a stated preference valuation method to elicit WTP by the households in Gorkha municipality for improved waste collection service. A seminal paper by Menegaki et al. [11] compiled a checklist from studies conducted around the world; the authors recommend that it should be reported when the stated preference valuation method is used. Although the checklist is for a web-based survey, it can also be applied for personal interviews. Therefore, we tried to include a relevant checklist for this study to describe in detail the sample selection, questionnaire design and data collection procedures.

2.1. Data Collection and Sampling Method

There are 9236 households living within 15 wards of Gorkha municipality. Wards are the smallest administrative units in Nepal. The stratified sampling method was used to select the samples from all 15 wards, where each ward was taken as a stratum. In order to take a sample that can be the best

representative of the whole population, sample size was calculated based on the simplified formula for proportions by Yamane [12]. At 95% confidence level and precision of 0.5, the formula is given as follows:

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where n is the sample size, N is the population size, and e is the level of precision.

When the formula in Equation (1) is applied to the total number of households, it gave the required sample size of 384 households, which was divided proportionally among 15 wards. An additional 10% of households from all 15 wards were selected to avoid shortcomings of partly filled questionnaires and non-response. The local government did not have dwelling data of all the households living within the municipality, which is often the case in developing countries [7]. The municipality is covered mostly by hills and mountains, where all the houses do not have proper road infrastructure, and the houses are widely scattered in all 15 wards. At this stage, it would be impractical for the local government to provide waste collection service to all the households within the municipality. Thus, this study considered households that are easily accessible by road. Every alternate house on both sides of the road was approached for the survey. If the household member was unwilling to participate then the next household was approached for the survey until the total sample requirement was fulfilled. Hence, households were selected based on willingness to participate in the survey and accessibility of the households' dwelling location so that the municipality can provide or improve waste collection service in the near future. Despite this limitation, we strongly believe that the sample for this study better represents the whole population of the municipality as all 15 wards are included in this study.

After excluding the partly filled questionnaires, the final sample considered in this study is 401 households that gave a response rate of about 95%. The details of sample selection in this study are presented in Table 1.

Table 1. Sample selection in Gorkha municipality.

Ward No.	No. of Household	Required Sample Size for ±5% Precision Level at 95% Confidence Level	Total Sample Selected after Additional 10% of the Required Sample	Final Sample for this Study (Response %)
Ward 1	518	21	23	22 (96%)
Ward 2	538	22	24	22 (92%)
Ward 3	594	25	28	25 (89%)
Ward 4	786	33	36	35 (97%)
Ward 5	469	19	21	21 (100%)
Ward 6	678	28	31	30 (97%)
Ward 7	450	19	21	19 (90%)
Ward 8	910	38	42	40 (95%)
Ward 9	760	32	35	33 (94%)
Ward 10	653	27	30	29 (97%)
Ward 11	723	30	33	32 (97%)
Ward 12	456	19	21	20 (95%)
Ward 13	430	18	20	19 (95%)
Ward 14	693	29	32	31 (97%)
Ward 15	578	24	26	23 (88%)
Total	9236	384	423	401 (95%)

Source: Field survey (2015).

The survey was conducted from November to December 2015 using the face-to-face interview method, which is considered to produce the highest quality and the most reliable WTP data [7,13]. Due to the vast nature of the survey to be conducted within a limited timeframe, 6 competent university students were hired as enumerators. The enumerators were also selected based on their familiarity with the selected survey area. This is because it is very important to make respondents feel comfortable to obtain reliable information. This could be one of the main reasons for the high response rate. The corresponding author gave training on how to conduct the survey to all the

enumerators beforehand, assisted during the actual survey and also monitored the survey on a daily basis. The probable respondents were first introduced to the purpose, objective and scope of the survey, that is to collect information from the households so that recommendations can be given to the concerned stakeholders to improve the current waste management service, and were told that the researcher cannot guarantee its implementation. It was also mentioned that their identity would be kept strictly anonymous. With their consent to be interviewed, we proceeded with the questionnaire. The survey was conducted in one meeting and it took an average of about 45 minutes to complete.

2.2. Questionnaire Design

A semi-structured questionnaire was used to collect data from the households, which included questions related to the socioeconomic characteristics of the households, current SWM services provided by the municipality, awareness about the impact of waste on the environment, and questions related to willingness of the households to pay a fee for improved waste collection service. The WTP for improved service is mostly reliant on a household's economic conditions and thus it could also be validated by regressing WTP against socioeconomic variables of the target group [7,8]. The awareness of the impact of waste on the environment was an open-ended question, which allowed respondents to answer based on their own understanding rather than influencing their decision by providing additional information. The information was used to identify the current situation of SWM practices and characteristics of the households that can influence their WTP and the maximum amount they are willing to pay for the improved waste collection services.

In order to elicit the maximum WTP amount for improved waste collection service, an open-ended CV method was used in this study. In the present context, it is the most informative and supposedly superior elicitation technique [14]. The open-ended method does not have a range nor a starting point biases, and thus can be highly statistically efficient compared to other discrete formats. Other elicitation techniques are most suited when there is already a price system or fee charged specially to study WTP for improved SWM services [15–22]. Sumukwo, Kiptui, and Cheserek [23] opted for an open-ended technique, as there was no adequate data on pricing for solid waste collection and disposal services. This has also been followed by numerous other studies [16,19,24–26]. Thus, an open-ended question format was considered in this study. A pilot study was conducted with 10 households before finalizing the questionnaire, which gave us a better understanding of the local issues. Irrelevant questions were excluded and relevant ones were included based on the specific context of the study area.

2.3. Contingent Valuation Scenario

Currently, waste collection service is irregular and is provided only in a few main areas in Gorkha municipality. A hypothetical scenario was described to the respondents in order to elicit their WTP for the improved service. The scenario was as follows:

> In order to provide regular waste collection service by the municipality, human resource and number of vehicles should be increased, which incur cost. The municipality can finance the program by imposing a waste collection fee. If the municipality provides regular waste collection service in the near future, are you willing to pay for the improved service considering your household income and expenditure?

If the respondents answered "yes", they were asked the following question:

> How much of maximum amount per month are you willing to pay for the improved service?

They were then asked to give reasons why they are willing to pay.

If the respondents answered "no", they were asked to give reasons why they are not willing to pay for the improved service.

For both of the reasons for respondents' willingness or unwillingness to pay, they were asked to give their own personal opinion so that they will not be restricted or influenced by the structured answers.

2.4. Empirical Model

Two levels of analysis using logit and tobit regression models were used in this study. The logit model was used to identify the determinants of households' WTP for improved waste collection service and the tobit model to identify the factors influencing the maximum amount of money they are willing to pay.

The logit model was used because of its comparative mathematical simplicity and asymptotic characteristics, as has been mentioned and used by many other authors for similar studies [17,18,20,21,26–29]. It has a cumulative probability function with the ability to deal with a dependent variable which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables [29]. The logit model to identify household's WTP for improved waste collection service can be specified as:

$$Y = \frac{1}{1+\exp^{-z}} \tag{2}$$

where,

Y = Respondents' response to WTP (Yes = 1, No = 0)

Z = Summation of explanatory variables multiplied by their coefficient, i.e.,

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_8 X_8 + \varepsilon_i \tag{3}$$

where,

β_0 = Constant

$\beta_1, \ldots, \beta_8$ = Coefficient of explanatory variables $X_1, \ldots, X_8$

ε_i = Error term

To find out the probability of households' WTP for improved waste collection service, the parameters from the logit model cannot be used to interpret effects of each of the explanatory variable as the model is nonlinear. In this case, marginal effects are calculated to find the relative magnitude of effects of each of the explanatory variables. The effects of the jth explanatory variable can be summarized as below:

$$\frac{1}{n}\sum_{i=1}^{n}\frac{\partial P[Y_i = 1]}{\partial X_{ji}} = \beta_j \frac{1}{n}\sum_{i=1}^{n} f(X_i'\beta),\ j = 2,\ldots,k. \tag{4}$$

i.e., the mean marginal effects over the sample of n individuals.

The maximum likelihood method was used to estimate the parameters of the multiple logistic response function. The log-likelihood function is as follows:

$$\log L(\beta) = \sum_{i=1}^{n} Y_i\left(X_i'\beta\right) - \sum_{i=1}^{n} \log\left[1+\exp\left(X_i'\beta\right)\right] \tag{5}$$

However, the logit model provides information only about respondents' decision to pay or to not pay for the improved SWM service, but not on the maximum amount of money they are willing to pay. Therefore, the tobit model was used to evaluate factors influencing the maximum amount of money households are willing to pay as used by other similar studies [15,19,21,30,31]. When the dependent variable is not fully observed, i.e., if there are zero values for a substantial part of the sample, then the tobit model is preferred to other linear regression models like Ordinary Least Square [15,19]. Although for convenience the invalid responses could have been discarded to use the valid ones, it could lead to sample selection bias as it will no longer be a random sample despite the initial sample being a random one. This will result in invalidity of the estimates obtained from the given sample that may not be suitable for policy inference.

The tobit model can be given by:

$$y_i = \beta x_i + \varepsilon_i,\ i = 1, 2, \ldots, n \tag{6}$$

where y_i is the dependent variable, i.e., the maximum amount of money the respondents are willing to pay; x_i is a set of explanatory variables, and is assumed to be $N(0, \delta^2)$, i.e., normally distributed and independent of x_i. The observed y_i counterpart of y_i^* can be expressed as:

$y_i = 1$ if $y_i^* > 0$, for willing to pay for improved waste collection service

$y_i = 0$ if $y_i^* \leq 0$, for not willing to pay for improved waste collection service

and y_i^* is a latent (unobservable) variable for WTP_i,

The log-likelihood function for the tobit model is given by:

$$\log L = \sum_{y_i>0} -\frac{1}{2}\left[\log(2\pi) + \log\sigma^2 + \frac{(y_i - x_i\beta)^2}{\sigma^2}\right] + \sum_{y_i=0} \log\left[1 - \varnothing\left(\frac{x_i\beta}{\sigma}\right)\right] \tag{7}$$

where $\varnothing$ is the standard normal cumulative distribution function.

The maximum likelihood estimates of the parameters are calculated by maximizing the likelihood function with respect to β and δ.

In the case of open-ended questions, the mean WTP can be calculated by averaging the total amount [7] that the households are willing to pay, which is given by:

$$\text{Mean } WTP = \frac{1}{n}\sum_{i=1}^{n} y_i \tag{8}$$

where n is the sample size and each y is a reported WTP amount.

The statistical software Stata (Release 13, StataCorp LP, College Station, TX, USA) was employed to run the logit and tobit models for this study.

2.5. Variables Selection for Logit and Tobit Models

The explanatory variables used in the logit and tobit models were based on the significant variables used in other similar WTP studies for improved SWM services. The explanatory variables used in this study are described in Table 2 and are explained below:

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

Variable	Description	Unit of Measure
Income	Total average monthly income of household	Nepalese Rupee (NRs.) (1 US$ = NRs. 102.13) *
Household size	Total number of members currently residing in the house	Number of individuals
Gender	Gender of household head	1 = Male 0 = Female
Age	Age of household head	Years
Education	Total years of education attained by household head	Years
House ownership	Ownership of currently resided house	1 = Owned 0 = Rented
Environmental awareness	Whether respondent is aware of environmental impacts of waste	1 = Yes 0 = No
Waste collection service	Have access to waste collection service	1 = Yes 0 = No

* The exchange rate as of 31 August 2017 [32].

2.5.1. Income

The income variable refers to the total household income in Nepalese Rupees. There are many studies which have found that income is positively significantly related to the WTP for improved SWM services [15,16,18,19,23,26,29–31,33]. Income is expected to have a strong influence on the demand for environmental quality and affordability to pay higher waste collection fees. Hence, income is one of the major determinants of WTP and it is also expected to positively influence households' WTP for improved waste collection service.

2.5.2. Household Size

This variable refers to the total number of people currently living in the house including relatives or any other persons. In general, the higher the number of people living in the house, more waste will be generated and might become difficult to manage. Therefore, household size is expected to positively influence households' WTP for improved waste collection service. A significant positive relationship was found in other similar studies [18,25,30].

2.5.3. Gender

This variable refers to the gender of the household head. In general, in the case of developing countries, women are responsible for managing the house which includes cooking, cleaning and disposing waste. Therefore, this study also expects that female household heads are more willing to pay for improved waste collection services. Other studies have found similar relationships [17,18].

2.5.4. Age

Age refers to the age of the household head and this study expects age to negatively influence households' WTP for improved waste collection service. Currently, households do not have to pay any fee for any SWM related services and older people would be more resilient to change, i.e., they would not be willing to pay for the waste collection service if a fee is imposed. Younger household heads could be more educated and aware of the importance of proper waste management than older ones. Previous studies have found the age variable to negatively influence WTP [15,16,23,27,29].

2.5.5. Education

The education variable is the total years of formal education attained by the household head. Educated people are expected to understand the adverse effects of waste on human health and the environment. This study expects that education will have a positive influence on households' WTP for improved waste collection service, as found by many other previous related studies [16–18,21,23,25–31].

2.5.6. House Ownership

This study expects that those who are living in their own house are more willing to pay for the improved waste collection service than those who are living in a rented property. This is because, house owners are more concerned about maintaining the cleanliness of their property and surroundings. Other studies have found a positive relationship between house ownership and WTP [15,16,19,21].

2.5.7. Environmental Awareness

Environmental awareness is likely to increase the demand for environmental goods and services. Therefore, this study expects that households who are aware of the adverse effects of waste on environment are expected to pay for the improved waste collection service as found by other similar studies [15,19,25,26].

2.5.8. Waste Collection Service

Waste collection service is currently available only in a few wards and limited to only a few areas within those wards. This study expects that households who have the waste collection service will be willing to pay for the improved service. This is because the current service is irregular and they might want to share the cost to improve the service presuming that these households are more affluent as they live in the core areas of the municipality than those households who do not have the service.

3. Results and Discussion

3.1. Characteristics of Households in the Study Area

This study found that household head on an average is around 48 years old, predominantly male (73.82%), and has about 7 years of formal education. The average size of the household is 3.72, which is similar to the national census result of 3.69 [34]. The average monthly household income is found to be NRs. 36,854.20 (360.86 US$). There is a huge difference between the minimum and maximum household income found in this study, which is NRs. 8020 (78.53 US$) and NRs. 244,083 (2389.92 US$), respectively. This result reflects the huge economic gap between households residing within Gorkha municipality. Households in very rural settings within the municipality were also considered, which included very poor households whose livelihood depends only on farming. Most of the people who participated in this study live in their own house (87.28%), and less than half of the households (36.66%) have the waste collection service offered by the municipality. Although more than half of the households (58.35%) are aware of the adverse effects caused by waste and its improper management on the environment, it cannot be denied that the remaining households (41.65%) who are unaware about such adverse effects also constitute a significant percentage. The summary of these characteristics of the households in this study is also summarized in Tables 3 and 4.

Table 3. Summary of continuous variables.

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Income	401	36,854.20	28,509.48	8020	244,083
Household Size	401	3.72	1.36	1	9
Age	401	47.90	13.07	23	85
Education	401	7.22	4.33	1	17

Source: Field survey (2015).

Table 4. Summary of categorical variables.

Variable	Observation (Percentage)
Gender:	
Male	296 (73.82)
Female	105 (26.18)
House Ownership:	
Owned	350 (87.28)
Rented	51 (12.72)
Waste Collection Service:	
Have service	147 (36.66)
Do not have service	254 (63.34)
Environmental Awareness:	
Aware	234 (58.35)
Not aware	167 (41.65)

Source: Field survey (2015).

3.2. Willingness of Households to Pay for the Improved Waste Collection Service

Out of 401 respondents, about 61% are willing to pay for the improved waste collection service (Table 5). This share of respondents' WTP is somewhat similar to other similar studies where more than 60% of the respondents provided a positive response [24–26,35–37].

Table 5. Households' willingness to pay for improved waste collection service.

WTP	Frequency	Percentage
Yes	244	60.85
No	157	39.15
Total	401	100

Source: Field survey (2015).

Although the respondents were free to give reasons for their willingness or unwillingness to pay for the improved waste collection service, most of the households gave similar reasons. Almost identical answers were grouped together and categorized as one reason. For example, households gave reasons that they want to keep their house clean, surroundings clean or the environment clean. These answers were grouped together as "to keep their surroundings clean". The answers are presented below based on the frequency of the provided reasons and because most of the respondents gave multiple reasons, the percentage does not tally to 100.

The reasons for their WTP for improved waste collection service are summarized as follows:

(i) To keep their surroundings clean (92%).
(ii) Can dispose of their waste on a regular basis (65%).
(iii) Willing to share the cost for effective waste management (63%).
(iv) Willing to pay for the waste collection service as they are devoid of such a service (47%).
(v) For regular waste collection service as the current service is irregular (32%).

About 39% of the households are not willing to pay for the improved waste management service. The reasons for their unwillingness to pay are as follows:

(i) Did not have to pay for the service until now and so do not want to pay (91%).
(ii) Household income is less (77%).
(iii) It is the responsibility of the government to provide the service (71%).
(iv) Generate less amount of waste so can self-manage it (54%).
(v) Pay municipal tax so the service should be free of charge (46%).

Although some of the reasons for both willingness and unwillingness to pay are more or less interrelated, it can be generalized that those willing to pay are more concerned about the cleanliness of their house and surroundings, want better waste collection service and feel responsible to share the cost of proper waste disposal. Similarly, households who are not willing to pay do not feel that it is their responsibility and that it should be managed by the local government without any fee being imposed on them.

3.3. Factors Influencing Households' Willingness to Pay for Improved Waste Collection Service

The results from the logit regression model are presented in Table 6. All 401 observations are used in this analysis. The log likelihood for this fitted model is −234.69 and the likelihood ratio (LR) chi-square of 67.50 (df = 8) with a p-value 0.0000 (significant at 1%) states that this model is statistically significant and as a whole fits significantly better than an empty model, i.e., only with the dependent variable. Thus, the validity of the logit model to estimate determinants of WTP for waste collection service is consistent with other similar studies [17,18,20,21,26–29].

Table 6. Logit regression results of factors influencing willingness to pay for improved waste collection service.

Independent Variables	Coefficient	Standard Error	Z-Statistics	Marginal Effect
Income	0.000015 ***	0.00000558	2.64	0.000296
Household size	−0.013933	0.0850556	−0.16	−0.0027974
Gender	0.034510	0.2768044	0.12	0.0069288
Age	−0.002535	0.010983	−0.23	−0.000509
Education	0.083569 **	0.0835693	2.48	0.016779
House ownership	0.135316	0.3496184	0.39	0.0271687
Environmental awareness	0.672828 ***	0.2273787	2.96	0.1350899
Waste collection service	1.257810 ***	0.2523935	4.98	0.2525424
Constant	−1.420311 **	0.6871384	−2.07	
Number of observations		401		
Log likelihood		−234.68687		
LR $chi^2(8)$		67.50		
Probability > chi^2		0.0000 ***		
Pseudo R^2		0.1257		

Source: Field survey (2015). ** significant at 5% and *** significant at 1%.

This study found that the significant variables that influence households' WTP for the improved waste collection service are income, education, environmental awareness and waste collection service. Household size, gender, age and house ownership variables do not have any statistically significant influence on the households' WTP.

The total average income of the household is statistically significant at the 1% level and it positively influences households' WTP decision. This result is supported by other similar studies [15,16,18,19,23,26,29]. The marginal effect result shows that a unit increase in household income would increase the likelihood for households' WTP for improved waste collection service by 0.000296%, i.e., if the monthly household income increases by NRs. 10,000 (97.91 US$), the likelihood for households' WTP increases by 2.96%.

The total years of education attained by the household head is statistically significant at 5% level, with a positive coefficient value. This shows that higher the education level, higher the likelihood for households' WTP for improved waste collection service. The positive relationship between education and WTP for better waste management services is also supported by other studies [16–18,23,26–29]. This is because education increases the awareness and desire for better environmental goods and services. The marginal effect result shows that a year increase in education level increases the WTP for improved waste collection service by 1.68%.

The environmental awareness variable has a positive coefficient and is statistically significant at the 1% level. This result shows that households are more likely to pay for improved waste collection service if they are aware of the adverse impacts of waste on the environment, by 13.51%, compared to households that are not aware. This result supports the findings from other similar studies [15,19,26].

The waste collection service variable is also significant at the 1% level of significance. The coefficient is positive, which was expected in this study. This shows that the households who have the current waste collection service must be aware of the negative consequences if the service is irregular or if there is no service at all. Also, it could be that the level of service is not satisfactory, thus with the hope of improving its quality, households are willing to pay. Households who currently have waste collection service are more likely to pay for the improved waste collection service by 25.25% than those households who currently do not have such service. However, a similar study conducted in Nepal [18] found that households who are receiving the waste collection service are likely to pay less than those households who are not getting the service. This was because the households were getting the service at a very low fee and were unwilling to pay more.

All other variables which were expected to have a significant relationship with WTP were found to not influence households' WTP decision in Gorkha municipality. Household size was expected to have a positive influence similar to the study by Bhattarai [18], but the insignificant relationship is consistent with the findings from other studies [15,19,20,28]. This study expected that female household heads

would be more willing to pay for improved waste collection service like in other studies [17,18,20]. However, no relationship could be concluded as the variable is not statistically significant, but this finding is consistent with other similar studies [15,19,23,28]. Age of the household head variable was expected to have a negative relationship with WTP decision as found by similar studies [16,23,27,29]. The result from this study could not establish this relationship as it is not statistically significant. Other studies have also found similar insignificant relationships [15,21,28]. Lastly, we expected that those who live in their own house would be more willing to pay for improved waste collection service, as they would be more concerned about the cleanliness of their surroundings than those who are living in a rented dwelling. Similar studies have found a positive relationship [15,16,21], but the insignificant finding is consistent with Hagos et al. [19].

3.4. Average Amount of Money that Households Are Willing to Pay for Improved Waste Collection Service

Out of 401 households surveyed in this study, 244 households, i.e., around 61%, are willing to pay for the improved waste collection service in Gorkha municipality. This study used the open-ended CV method to elicit the maximum amount those households are willing to pay for the improved waste collection service. The minimum and the maximum amount that the households are willing to pay is NRs. 10 (0.10 US$) and NRs. 500 (4.90 US$) per month, respectively. The mean WTP amount is calculated using Equation (8). This study found that the mean WTP amount for the improved waste collection service in Gorkha municipality is NRs. 73.38 (0.72 US$) per month. The mean WTP amount from this study is less than a similar study conducted in another municipality of Nepal [18], which was 1.69 US$ per month, but is greater than the study conducted in Bangladesh [22], which was 0.18 US$ per month. Studies conducted in Uganda [16] and Ethiopia [19] found WTP amount to be 1.3 US$ and 1.2 US$, respectively. Hence, the WTP amount from this study is more or less similar to other similar studies in developing countries.

3.5. Factors Influencing Amount of Money that Households are Willing to Pay for Improved Waste Collection Service

The result from the tobit model is presented in Table 7. All 401 observations are used in this analysis. To censor the zero values for 157 observations, i.e., for the households who are not willing to pay, a lower limit of 0 was specified and the model was run. The likelihood ratio chi-square of 78.06 (df = 8) with a *p*-value 0.0000 (significant at 1%) shows that this model as a whole fits significantly better than an empty model, i.e., at least one of the regression coefficients in the model is not equal to zero.

The tobit model results shows that three independent variables, income, environmental awareness and waste collection service, are statistically significantly related to the maximum amount of money that the households are willing to pay for the improved waste collection service. These three variables were also significant variables in the logit model used in this study. Although the education variable was expected to positively influence the maximum amount that households are willing to pay, like in similar studies [21,25,30,31], which was also statistically significant in the logit model, the relationship could not be established in the tobit model. The insignificant result shows that education attained by the household head does not influence the maximum amount of money the households are willing to pay for the improved waste collection service. All other variables which are not significant in the logit model are also not significant in the tobit model.

The household size variable was expected to have positive relationship with the maximum WTP amount for improved waste collection service. While some studies have found this positive significant relationship [25,30], this study could not find any statistically significant relationship, which is consistent with the findings from other studies [15,19,31].

This study expected that female household heads would be willing to pay more for the improved waste collection service than male household heads. However, the gender variable is statistically insignificant and we could not derive any relationship, but the finding is consistent with other similar studies [15,19,21,31].

Table 7. Tobit regression results of factors influencing the amount of money households are willing to pay for improved waste collection service.

Independent Variables	Coefficient	Standard Error	*t*	[95% Confidence Interval]	
Income	0.00077 ***	0.00016	4.80	0.00046	0.00109
Household size	0.09660	3.32337	0.03	−6.43720	6.63039
Gender	0.98878	10.77724	0.09	−20.19948	22.17704
Age	−0.17172	0.43021	−0.40	−1.01753	0.67409
Education	1.59789	1.27318	1.26	−0.90521	4.10100
House ownership	8.23168	13.68001	0.60	−18.66347	35.12684
Environmental awareness	35.24244 ***	8.94840	3.94	17.64972	52.83516
Waste collection service	46.36408 ***	9.08806	5.10	28.49678	64.23138
Constant	−58.30723 **	26.41487	−2.21	−110.23930	−6.37511
/sigma	80.18481	3.88383		72.54913	87.82049
Number of observations		401			
Log likelihood		−1525.5514			
LR $chi^2(8)$		78.06			
Probability > chi^2		0.0000 ***			
Pseudo R^2		0.0249			
Observation summary		157 left-censored observations at amount ≤ 0			
		244 uncensored observations			
		0 right-censored observations			

Source: Field survey (2015). ** significant at 5% and *** significant at 1%.

Some studies found the age variable to have a positive relationship with the maximum WTP amount [21,30,33]. However, this study expected that younger household heads, who could be more educated and aware of the importance of proper waste management, would pay more for improved waste collection service as found by Padi et al. [15]. The insignificant result could not establish this relationship but confirms the study by Ezebilo and Animasaun [31].

The house ownership variable was expected to have a positive influence on the maximum WTP amount but the tobit regression model gave an insignificant result and the relationship could not be confirmed. This result contradicts the findings from other studies [15,19,21] that showed a positive relationship.

The income variable is significant at the 1% level of significance with a positive coefficient. This implies that a unit increase in monthly income increases the maximum amount of money that the household is willing to pay, by NRs. 0.00077 per month, i.e., an increase of monthly household income of NRs. 10,000 (97.91 US$) increases the maximum amount that the household is willing to pay by NRs. 7.7 (0.08 US$) per month. This positive relationship is also supported by other similar studies [15,19,30,31,33].

Those who are aware of the impacts of waste on environment are likely to pay more for the waste collection service as its coefficient is positive and the variable is significant at 1% level, as expected for this study. This relationship is also consistent with other studies [15,19,25]. The tobit regression result shows that households who are aware of the impacts of waste on environment are likely to pay NRs. 35.24 (0.35 US$) per month more than those who are not aware.

Households who have current waste collection service are likely to spend more on the waste collection service as the coefficient is positive and significant at 1% level. The result shows that households who have a current waste collection service are likely to pay NRs. 46.36 (0.45 US$) per month more than those households who currently do not have the service. This could be because they are expecting better service for the amount they pay.

4. Conclusions and Policy Implication

With the growing amount of municipal solid waste and municipalities' inability to manage it properly mainly due to financial constraints, collecting fees from the public for improving the

waste management service seems to be the only viable option. This study was conducted in Gorkha municipality of Nepal where the waste collection service is restricted only to limited areas. It evaluates WTP by 401 households selected using a stratified sampling method from all 15 wards of the municipality for improved SWM service of waste collection and the factors influencing it. This study employed the CV method which directly asks the beneficiaries their desired amount under hypothetical circumstances with the assumption that it will be implemented in the near future. The logit regression model was used to determine the factors that influence WTP for improved waste collection service and the tobit regression model was used to determine the factors that influence the maximum amount of money that the households are willing to pay for the improved waste collection service.

This study found that the majority of surveyed households (61%) are willing to pay for the improved waste collection service. The mean WTP amount that households are willing to pay is NRs. 73.38 (0.72 US$) per month. The municipality or the concerned stakeholders may consider this as a reference amount to impose a solid waste collection fee in Gorkha municipality as no such fee has been charged to the households until now. Improved regularity of SWM services and better geographical coverage of solid waste collection can be achieved by the revenue generated by the solid waste collection fee.

The factors that significantly influence households' WTP are monthly household income, education of household head, environmental awareness and waste collection service. The significant factors that influence the maximum amount of money households are willing to pay for improved waste collection service are monthly household income, environmental awareness and waste collection service. Concerned stakeholders and policy makers should consider these traits before enforcing a waste collection fee. For instance, since households' awareness of the environmental impact is positively significantly related to both WTP and the maximum amount of waste collection fee they are willing to pay, the government and concerned stakeholders should educate the households about adverse effects of indiscriminate disposal of waste on the environment in order to raise more funding for SWM.

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References

1. Hoornweg, D.; Bhada-Tata, P. *What a Waste: A Global Review of Solid Waste Management*; World Bank: Washington, DC, USA, 2012.
2. Japan International Cooperation Agency (JICA). *Supporting Capacity Development for Solid Waste Management in Developing Countries: Towards Improving Solid Waste Management Capacity of Entire Society*; JICA: Tokyo, Japan, 2005.
3. Asian Productivity Organization (APO). *Solid Waste Management: Issues and Challenges in Asia*; Asian Productivity Organization: Tokyo, Japan, 2007.
4. Asian Development Bank (ADB). *Solid Waste Management in Nepal: Current Status and Policy Recommendations*; Asian Development Bank: Mandaluyong City, Philippines, 2013.
5. Coffey, M.; Coad, A. *Collection of Municipal Solid Waste in Developing Countries*; United Nations Human Settlements Programme (UN-HABITAT): Nairobi, Kenya, 2010.
6. Government of Nepal. Solid Waste Management Act, 2068 (2011). 2011. Available online: http://extwprlegs1.fao.org/docs/pdf/nep137767.pdf (accessed on 21 July 2011).
7. Alberini, A.; Cooper, J. *Applications of the Contingent Valuation Method in Developing Countries: A Survey*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2000; Volume 146, ISBN 9251045275.

8. Mitchell, R.C.; Carson, R.T. *Using Surveys to Value Public Goods: The Contingent Valuation Method*; Resources for the Future: Washington, DC, USA, 1989; ISBN 0-915707-32-2.
9. Damschroder, L.J.; Ubel, P.A.; Riis, J.; Smith, D.M. An alternative approach for eliciting willingness-to-pay: A randomized Internet trial. *Judgm. Decis. Mak.* **2007**, *2*, 96–106.
10. Fujita, Y.; Fujii, A.; Furukawa, S.; Ogawa, T. Estimation of Willingness-to-Pay (WTP) for Water and Sanitation Services Through Contingent Valuation Method (CVM)—A Case Study in Iquitos City, The Republic of Peru. 2005. Available online: https://www.jica.go.jp/jica-ri/IFIC_and_JBICI-Studies/jica-ri/publication/archives/jbic/report/review/pdf/report10_2.pdf (accessed on 13 October 2017).
11. Menegaki, A.N.; Olsen, S.B.; Tsagarakis, K.P. Towards a common standard—A reporting checklist for web-based stated preference valuation surveys and a critique for mode surveys. *J. Choice Model.* **2016**, *18*, 18–50. [CrossRef]
12. Yamane, T. *Statistics: An Introductory Analysis*, 2nd ed.; Harper and Row: New York, NY, USA, 1967.
13. Carson, R.T.; Flores, N.E.; Martin, K.M.; Wright, J.L. Contingent valuation and revealed preference methodologies: Comparing the estimates for quasi-public goods. *Land Econ.* **1996**, *72*, 80–99. [CrossRef]
14. Whynes, D.K.; Frew, E.J.; Wolstenholme, J.L. Willingness-to-pay and demand curves: A comparison of results obtained using different elicitation formats. *Int. J. Health Care Financ. Econ.* **2005**, *5*, 369–386. [CrossRef] [PubMed]
15. Padi, A.; Addor, J.A.; Nunfam, V.F. An econometric model of factors influencing households' willingness to pay for improved solid waste management service within the Sekondi–Takoradi metropolis in the western region of Ghana. *J. Econ. Sustain. Dev.* **2015**, *6*, 15–29.
16. Banga, M.; Lokina, R.B.; Mkenda, A.F. Households' willingness to pay for improved solid waste collection services in Kampala City, Uganda. *J. Environ. Dev.* **2011**, *20*, 428–448. [CrossRef]
17. Addai, K.N.; Danso-Abbeam, G. Determinants of willingness to pay for improved solid waste management in Dunkwa-on-Offin, Ghana. *J. Agric. Environ. Sci.* **2014**, *3*, 1–9.
18. Bhattarai, K. Households' willingness to pay for improved solid waste management in Banepa municipality, Nepal. *Environ. Nat. Resour. J.* **2015**, *13*, 14–25.
19. Hagos, D.; Mekonnen, A.; Gebreegziabher, Z. Households' Willingness to Pay for Improved Urban Waste Management in Mekelle City, Ethiopia. 2012. Available online: http://www.rff.org/files/sharepoint/WorkImages/Download/EfD-DP-12-06.pdf (accessed on 13 October 2017).
20. Oteng-Ababio, M. Solid waste management in Ghana: Willingness-to-pay for improved services. *Ghana J. Geogr.* **2010**, *2*, 85–107.
21. Awunyo-Vitor, D.; Ishak, S.; Jasaw, G.S. Urban households' willingness to pay for improved solid waste disposal services in Kumasi metropolis, Ghana. *Urban Stud. Res.* **2013**, *2013*, 1–8. [CrossRef]
22. Afroz, R.; Hanaki, K.; Hasegawa-Kurisu, K. Willingness to pay for waste management improvement in Dhaka City, Bangladesh. *J. Environ. Manag.* **2009**, *90*, 492–503. [CrossRef] [PubMed]
23. Sumukwo, J.; Kiptui, M.; Cheserek, G.J. Economic valuation of improved solid waste management in Eldoret municipality. *J. Emerg. Trends Econ. Manag. Sci.* **2012**, *3*, 962–970.
24. Mahima, S.; Thomas, S. Estimating households willingness to pay for solid waste management with special reference to Palakkad district in Kerala. *Int. J. Soc. Sci. Interdiscip. Res.* **2013**, *2*, 73–80.
25. Roy, A.T.; Deb, U. Households willingness to pay for improved waste management in Silchar municipal area: A case study in Cachar District, Assam. *IOSR J. Humanit. Soc. Sci.* **2013**, *6*, 21–31. [CrossRef]
26. Anjum, R. *Willingness to Pay for Solid Waste Management Services: A Case Study of Islamabad*; Pakistan Institute of Development Economics: Islamabad, Pakistan, 2013.
27. Mary, O.; Adelayo, A. Household willingness to pay for improved solid waste management in Akinyele local government area. *J. Biol. Agric. Healthc.* **2014**, *4*, 76–82.
28. Song, Q.; Wang, Z.; Li, J. Residents' attitudes and willingness to pay for solid waste management in Macau. *Procedia Environ. Sci.* **2016**, *31*, 635–643. [CrossRef]
29. Aggrey, N.; Douglason, O.G. Determinants of willingness to pay for solid waste management in Kampala City. *Curr. Res. J. Econ. Theory* **2010**, *2*, 119–122.
30. Nkansah, E.; Dafor, N.K.; Essel-Gaisey, F. Willingness to pay for improved solid waste disposal in Tema metropolis. *UDS Int. J. Dev.* **2015**, *2*, 116–127.
31. Ezebilo, E.E.; Animasaun, E.D. Economic valuation of private sector waste management services. *J. Sustain. Dev.* **2011**, *4*, 38–46. [CrossRef]

32. Nepal Rastra Bank. Foreign Exchange Rates. Available online: https://www.nrb.org.np/fxmexchangerate.php?YY=2017&MM=08&DD=31&B1=Go (accessed on 1 September 2017).
33. Subhan, M.; Ghani, A.B.A.; Joarder, M.H.R. Urban community willingness to pay for improved solid waste management in Malaysian municipality: A choice modeling approach. *Asian Soc. Sci.* **2014**, *10*, 122–136. [CrossRef]
34. Central Bureau of Statistics (CBS). *National Population and Housing Census 2011: Urban Tables*; Central Bureau of Statistics: Kathmandu, Nepal, 2014; Volume 7.
35. Karthigarani, R.; Elangovan, V. Household Willingness to Pay for Better Solid Waste Management in Sivagangai District, Tamil Nadu. 2016. Available online: http://www.internationalseminar.org/XVII_AIS/TS1_PDF/10.R.%20Karthigarani%20&%20V.%20Elangovan.pdf (accessed on 13 October 2017).
36. Jones, N.; Evangelinos, K.; Halvadakis, C.P.; Iosifides, T.; Sophoulis, C.M. Social factors influencing perceptions and willingness to pay for a market-based policy aiming on solid waste management. *Resour. Conserv. Recycl.* **2010**, *54*, 533–540. [CrossRef]
37. Eshun, T.B.; Nyarko, F. Willingness to pay for improved waste management services: The case of Tarkwa-Nsuaem municipality. *Asian-Afr. J. Econ. Econom.* **2011**, *11*, 187–196.