Households' Willingness to Pay for Improved Solid Waste Management in Banepa Municipality, Nepal

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Abstract

Banepa municipality is facing the problem of solid waste management. Lack of financial resources is fueling this problem. This study was designed to estimate households' willingness to pay for improved solid waste management in Banepa municipality, Nepal. To elicit willingness to pay, single-bounded dichotomous choice contingent valuation method was employed. Study was based on cross-sectional survey of randomly selected 220 households. Out of total respondents, 83 percent were willing to pay for improved solid waste management. It was found that 51 percent households were getting solid waste collection service. The mean willingness to pay is Rs 166 (USD 1.69) per household per month whereas median willingness to pay is Rs 160 (USD 1.63). Result reveals that bid amount, age of respondent, sex of the respondent, household size, level of education of respondent, present waste collection service and household income are the factors affecting willingness to pay for improved solid waste management. Currently, municipality is charging Re 1 (USD 0.01) per household per day as garbage fee. Thus, present garbage fee is far below the mean willingness to pay of households. So, there is the opportunity of increasing garbage fee. The mean willingness to pay may be a guide to municipal authorities to determine appropriate garbage fee.

Keywords: Banepa municipality/ Dichotomous choice/ Single-bounded contingent valuation method/ Solid waste management/ Willingness to pay

1. Introduction

There is rapid urbanization in many developing and least developed countries. With the increasing urbanization, the management of solid waste is becoming more complex in such countries (Medina, 2010). The growth of population is also high in the urban areas, which along with the increased economic activities is posing a serious challenge, on the waste management, to the urban local authorities (Banga et al., 2011). Urbanization is expanding the existing slum areas and creating the new ones in many developing countries (Medina, 2010). For healthy life of the people environmental cleanliness is necessary. But, in developing and least developed countries, lack of proper solid waste management (SWM) is creating environmental pollution, which is posing a big threat on the health of people and reducing the quality of life in urban areas (United Nations Environment Program [UNEP], 2004). With the increase in population of the cities more infrastructures and services are necessary for the people. One of such services is collection of solid waste. However, the SWM is receiving less attention from policy makers and academics than that paid to other urban environmental problems, like air pollution and wastewater treatment (Medina, 2010). In spite of spending a large portion of municipal budget in SWM, only 50-70 percent of the residents are getting solid waste collection service and only 50-80 percent waste is collected in municipalities of most of the developing countries (Cointreau-Levine, 1984; Cointreau-Levine, 1994; Altaf and Deshazo, 1996; Medina, 2010). The people who do not get solid waste collection service either burn the waste on the roadside or dump it on public places and throw on nearby river (Medina, 2010). In Nepal, Solid Waste Management Act (2011) has given the responsibility of making provision of collecting and operating the necessary infrastructure related to the solid waste management to the local bodies, i.e. concerned metropolitan city, sub-metropolitan city, municipality and village development committee. Such service can be provided by local bodies, private or community organization or by the way of public-private partnership. The organization that provides the solid waste management service can impose and collect the service fee from the concerned person, institution or body as per the agreement with the local body. However, due to lack of financial and technical resources, inefficient institutional set up and inadequate infrastructure, the situation of SWM is very poor in most of the municipalities of Nepal. The generation of waste is high and is increasing over time but the waste collection service is inadequate.

The problem of SWM in Banepa municipality is severe. There is inequality in the distribution of services among the people. The people living in the major city areas are getting services more frequently whereas the people who are away from major city areas either should wait long time to get the service or they do not get the service at all. The infrastructure of the municipality regarding the SWM is very poor. There are only three tractors to collect the waste. Only 23 staffs are involving in SWM. Dumping

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site is in inappropriate location. Nearby the dumping site, there is residential area, IT Park and other establishments. The local people are protesting against that dumping site since a long time and they are demanding to shift it in the appropriate place immediately. Currently, the municipality is charging Re 1 (USD 0.01) per household per day as garbage fee. But, this amount is not regularly collected by the municipality. When the citizens go to the municipality office for the official task, for example to make certain document from municipality, at that time municipality does the work of citizens only after clearing the garbage fee. Sometimes, for example, municipality collects the garbage fee from some households after many years because they need not to go to the municipality for official task for a long time. But, it is regularly spending money to collect the waste. The municipality is using almost 23 percent of the budget in SWM (Banepa Municipality [BM], 2012). The waste generated in the municipality involves industrial and commercial waste, household waste, dead bodies of animals (like, dog) and other waste involving waste generated from construction activities, hospitals and so on.

Solid waste management is one of the major problems of Banepa municipality. Like in other municipalities of Nepal, the volume of solid waste is increasing in Banepa municipality over the time but the municipality lacks the sufficient resources to manage the waste. In such situation, it is important to know whether the households in Banepa municipality are interested to contribute for the improved solid waste management. Within this context, this paper tries to address the questions: What is the current situation of solid waste management in Banepa municipality? Are the households interested to pay for the improved solid waste management? If yes, how many households are interested to pay for that and how much amount they are willing to pay? Which factors influence households' willingness to pay for improved solid waste management? Are the households satisfied with the existing SWM service? Are the households environmentally aware?

Many people, in Nepal, think that the municipality is responsible for the management of solid waste. But, there is not sufficient resource with the municipalities. In such situation, it is important to investigate on the demand side aspect of SWM. But, in the past such investigation was not conducted in Banepa municipality. In this context, this study seeks to assess the households' willingness to pay (WTP) for improved solid waste management in Banepa municipality. Specifically, the objectives of the study are: to assess the current situation of solid waste management in Banepa municipality, to estimate the households' willingness to pay for improved solid waste management and to determine the factors influencing it, to examine whether the households are satisfied with the present SWM service and to examine whether households are environmentally aware.

To study the households' WTP, the contingent valuation method (CVM) was applied. This method is applied by many researchers, to study SWM, in different countries. However, the economic studies applying contingent valuation technique to estimate households' willingness to pay for improved solid waste management in Nepal are either very limited or non-existent. In case of Banepa municipality, it is the first study of this type. Zen and Siwar (2015) studied the household acceptance of curbside recycling scheme in Kuala Lumpur, Malaysia. Study was conducted on 460 households. It was found that 41 percent respondents were willing to pay for curbside recycling scheme. Ezebilo (2013) studied the WTP for improved residential waste management in Kwara state, Nigeria. For this, 236 households were studied. This study found that more than 80 percent respondents were in support of residential waste management. The mean WTP was USD 24. To improve the WTP for improved solid waste management researcher suggests for providing information to the residents on the benefits of involving private sector in SWM. Banga et al. (2011) studied the household willingness to pay for improved solid waste collection services in Kampala city, Uganda. The study was based on 381 households. Data were collected by applying random sampling technique. Double-bounded dichotomous choice method was employed to estimate the households' mean WTP for improved solid waste collection service. Study found that majority (79.8 percent) households were willing to pay for improved solid waste collection service. The mean WTP was Ugandan Shillings (USh) 2,439. To avoid free-rider problem, researchers recommend setting a socially acceptable fee for which the majority of people are willing to pay. Afroz et al. (2009) employed the CVM to estimate the willingness to pay of respondents to improve the waste collection system in Dhaka city, Bangladesh. The study estimated how WTP differs between the households receiving door to door waste collection system (RDDW) and households not receiving door to door waste collection system (NRDDW). By applying stratified random sampling technique, 480 households were selected. To estimate WTP of respondents, the double-bounded dichotomous choice method was employed. On average, the respondents in Dhaka were willing to pay Taka 13 per household per month. The mean WTP in the RDDW area was Taka 15.8 per household per month whereas in NRDDW area, it was Taka 12 per household per month. Study emphasizes on the comprehensive, integrated and incentive compatible policy for the solid waste management in Dhaka. Researchers suggest that to increase the WTP of households, enough information should be provided to them and they should be encouraged to become involved in the proposed solid waste management program. Sujauddin et al.

(2007) studied the household solid waste characteristics and management in Chittagong, Bangladesh. By applying random sampling technique, 75 households were selected and interviewed. Almost 44 percent households were willing to pay US$ 0.3 to US$ 0.4 per month to the waste collector. The study recommends charging the waste collection service on the basis of volume of waste generated by the households. Researchers conclude that household solid waste can be converted from burden to resource through segregation at the source. Begam et al. (2006) studied the willingness to pay for improved construction waste management in Klang Valley of Malaysia. By applying purposive stratified random sampling technique, 130 contractors were interviewed. Study found that 68.5 percent of the contractors were willing to pay for improved construction waste collection and disposal services. The average WTP was RM 69.88 per ton. The study suggests that government can intervene to improve waste collection and disposal services driven by the private sector.

There are differences on the methods employed by different researchers. Some researchers applied the single-bounded dichotomous choice method whereas others applied the double-bounded dichotomous choice method. Most of the studies focused on investigating existing situation of solid waste management and determinants of WTP. Apart from these issues, this study examines whether the households are satisfied from the existing waste collection service and whether they are environmentally aware.

2. Methodology

2.1 Theoretical Framework of Contingent Valuation Method

This study is based on CVM, which is a survey-based method to elicit the willingness to pay for non-market values. It elicits the WTP of the respondents to obtain improvement or avoid damages on environmental goods and services in a hypothetical market (Seller et al., 1985). Due to its flexibility, it has been widely used to estimate the WTP (Chuen-Khee and Othman, 2010). It is only feasible method for including passive-use considerations in an economic analysis (Carson, 2000). In a contingent valuation (CV) exercise, respondents are given a scenario describing a proposed policy that would alter the environmental quality or provision of a good and are asked to report their WTP to secure such change (Alberini et al., 2008).This method places monetary value on the environmental goods and services not bought and sold in the marketplace (Carson, 2000). It is the reliable instrument for the collection of useful information (Arrow et al., 1993). In contrast to the indirect methods of travel cost and hedonic price, the CVM directly measures the WTP measure prescribed by welfare theory and this method is capable of valuing a much broader range of amenities (Mitchell and Carson, 1988). There are different approaches to elicit the WTP of respondents under CVM: open-ended question approach, iterative bidding approach, payment card approach and dichotomous choice approach. Among them, dichotomous choice question format has been most popular technique among the practitioners of contingent valuation since last few years (Calia and Strazzera, 2000). In the dichotomous choice questions, respondents are asked whether they would pay a fixed amount of money for the item being evaluated (Boyle, 1990). The dichotomous choice approach is incentive-compatible (Hoehn and Randall, 1987). Dichotomous choice approach is preferred over alternative approaches because it reduces the cognitive burden placed on the respondents and mimics the behaviour of the people in regular market places (Food and Agricultural Organization [FAO], 2000). Follow-up questions increase the precision of estimates (Ahmed and Gotoh, 2006). They are necessary for ideal contingent valuation survey (Arrow et al., 1993). WTP of households for improved solid waste management was elicited by employing single-bounded dichotomous choice method, followed by open-ended questions.

In single-bounded contingent valuation method, the interval of values containing WTP of individual is bounded by the bid and the limit of WTP distribution - the upper limit if the answer was positive, the lower limit otherwise (Calia and Strazzera, 2000). Dichotomous choice CVM is based on random utility theory, which assumes that choices are based on the comparisons of utility among the available alternatives and individual chooses that alternative which maximizes the utility (Mcfadden, 1974; Adamowicz et al., 1994; Louviere et al., 2000). Assuming a linear functional form for WTP, the true individual WTP is given by:

$$y_{i} = x'_{i}\beta + \varepsilon_{i} \qquad (1)$$

Where y_i is the true individual WTP for improved solid waste management, which is a latent continuous variable: the observed variable is y_i^*, which takes the answer "yes" or "no" on the question regarding whether the respondent would be willing to pay for the improved solid waste management; y_i depends on $x_{i,}$ which is the vector of socio-economic characteristics of the respondent; β_i is the vector of coefficients to be estimated and ε_i is the error term and is distributed according to the logistic distribution.

Modeling contingent valuation data was based on the method of Cameron and James (1987) and Cameron (1988) as follows:

y_i is unobserved and is manifested through the discrete indicator variable, I_i such that:

$$I_i = 1 \text{ if } y_i > 0$$
$$= 0 \text{ otherwise} \qquad (2)$$

As ε_i has logistic distribution with mean 0 and standard deviation b

$$\Pr(I_i = l) = \Pr(y_i > 0) = \Pr(\varepsilon_i > - x'_i\beta) = \Pr(\varepsilon_i/k > - x'_i\beta/k) = 1 - \Pr(\varphi_i < -x'_i\gamma) \quad (3)$$

where $\gamma = \beta/k$ and φ_i signifies standard logistic random variable with mean 0 and standard deviation $b = \pi/\sqrt{3}$.

This model can be estimated by the method of maximum likelihood, where the likelihood function is:

$$\log L = \sum -I_i \log\{l + \exp[-x'_i\gamma]\} + (l - I_i)\log\{\exp[-x'_i\gamma]/(l + \exp[-x'_i\gamma])\} \quad (4)$$

The mean WTP was computed by following Cameron and Huppert (1989): The fitted value of $logy_i$ was found. The conditional mean of $logy_i$ for the vector of socio-economic characteristics of the respondent is $x'_i\beta$ and exp $(x'_i\beta)$ is the median WTP. The mean WTP was computed by scaling median WTP by exp $(\sigma^2/2)$, where σ is standard error of estimate.

2.2 Study Area and Sampling Method

Study was conducted in Banepa municipality of Kavrepalanchok district. It is located 25 KM east of Kathmandu, capital city of Nepal. The area of Banepa municipality is 5.56 square KM. Out of the total population of 24,894; the population of male is 12,446 whereas that of female is 12,448. The population density of the municipality is 4,477 (Central Bureau of Statistics [CBS], 2012). In Banepa municipality, the no. of households who own the house is 3,283; no. of rented households is 2,191 and no. of other households is 21 (CBS, 2014). The study was related to the households owning the houses. Currently, the municipality is collecting garbage fee only from the house owners. In Nepalese municipalities, the house owners make decision on whether to take waste collection service. If they take such service, they share the garbage fee with tenants. Thus, the tenants should pay the garbage fee along with the house rent. This process of additional payment for additional facility is not limited to garbage fee only but is applicable to other facilities, like internet facility, cable television facility, and so on. Thus, the house owner has major role on deciding whether to take such service. In such situation, study becomes effective if the information is collected from owners of the houses only. To collect data, a random sample of 220 households was taken. For this, the record of households was taken from the municipality office. Twenty households were selected randomly from the register containing the information of households in each ward of the municipality. There are eleven wards in Banepa municipality. The heads of the households were interviewed.

2.3 Survey Design and Questionnaire Design

To meet the requirement of study, the survey instrument was developed. The recommendations of Mitchell and Carson (1989) and Arrow et al. (1993) were followed while designing the questionnaire. Before developing questionnaire, scoping survey was conducted. Based on the scoping survey, the draft questionnaire was prepared. In the scoping survey, the discussions were conducted with the authorities of Banepa municipality, authorities of solid waste management technical support centre and with the private solid waste collection service providers of Lalitpur district. The draft questionnaire was subsequently pre-tested in the pilot survey of 20 households. From the result and feedback of pilot survey, questionnaire was finalized. The payment vehicle was monthly garbage fee to be paid to the service provider. Based on the scoping survey and pilot survey, five different bid prices were determined as Rs 150 (USD 1.53), Rs 170 (USD 1.73), Rs 190 (USD 1.94), Rs 210 (USD 2.14) and Rs 230 (USD 2.35). Here, "Rs" represents for "Rupees", which is the currency of Nepal. USD represents for United States Dollar.

The questionnaire was divided into five sections. The first section included the questions related to the identification of the respondent, i.e. name, household identification (ward number and house number) and contact number of respondent. The second section included the questions related to current situation of solid waste management in Banepa municipality. The third section informed the proposed solid waste management service, i.e. this section presented the contingent valuation scenario. The contingent valuation scenario was:
"The waste would be collected by using rickshaw/tractor. Rickshaw/tractor would come in your locality three times a week. The days on which waste would be collected would be pre-determined. Rickshaw/tractor will park for few minutes at each block or road junction in your locality. Then, the waste collectors would come to every house and take the container/plastic bag and put the waste on the vehicle. If you are storing waste on the container, they would empty that container and return it back to curbside neatly but plastic bag would not be returned. Thus, you need not to go to empty the waste on the vehicle. You need to just leave the solid waste at the curbside. To get service you have to pay monthly fee to the service provider".

The forth section involved the demand assessment for proposed service, i.e. the information related to WTP of households was collected in this section. The fifth section incorporated socio-economic and demographic information of respondent. Both quantitative and qualitative information were collected.

2.4 Analytical Model

The logit regression was employed to model the relationship between the explanatory variables (i.e. bid amount, age, sex, household size, education, marital status, present waste

collection service and household income) and WTP of the households.The assumptions of probit model, like normal distribution of error term and homoscedasticity of model were not satisfied. As the assumptions of normality and homoscedasticity were not satisfied, the probit model could not be used. Alternatively, the logit model was employed. The residual plot was also examined. Variance inflation factor (VIF) was estimated to test the multicollinearity among the explanatory variables. As shown in table 1, the VIF values appear to be better. So, there is no multicollinearity among the explanatory variables. The econometric package was used. The following model was estimated:

$$\text{Probability (WTP)} = \alpha + \text{In bid amount} + \beta_2 \text{ age} + \beta_3 \text{ sex} + \beta_4 \text{ household size} + \beta_5 \text{ education} + \beta_6 \text{ marital status} + \beta_7 \text{ present waste collection service} + \beta_8 \text{ household income} + \text{error} \quad (5)$$

Where α is the constant and β_i are the coefficients of explanatory variables.

Table 1: Description of explanatory variables used in the model

Variable	Description	Mean	VIF
Bid amount	Respondents were offered monthly garbage fee ranging from Rs 150 (USD 1.53) to Rs 230 (USD 2.35) per month	Rs 190 (USD 1.94)	2.78
Age	Age of the respondent in years	47 years	3.21
Sex	Sex of the respondent (Male = 1; otherwise = 0)	0.536	2.51
Household size	Household size of the respondent, i.e., total no. of people living in respondent's household	6	2.91
Education	Highest level of education attained by the respondent measured on 7-point scale: no degree achieved = 1, secondary education = 2, higher secondary education = 3, bachelor degree =4, master's degree = 5, M. Phil. degree = 6 and doctorate degree = **7**	1.85	2.62
Marital status	Marital status of respondent; married = 1 otherwise = 0	0.977	2.57
Present waste collection service	Waste collection service received by respondent; yes = 1, otherwise = 0	0.51	3.22
Household income	Monthly household income of respondent in Rs	16,480 (USD 168.15)	2.78

The study computed the mean WTP as well as median WTP and identified the determinants of WTP. The reliability of contingent valuation estimates can be inferred by checking their consistency with economic theory and priori expectations (Baral and Dhungana, 2014). The economic theory suggests that there should be positive relationship between age, household size, education and household income with WTP whereas negative relationship between bid amount and present waste collection service with WTP. Similarly, male were expected less willing to pay than female. Married respondents were expected more willing to pay than unmarried. The description of variables included in the model and their mean values are given in the table 1.

2.5 Data Collection and Analysis

This study mainly relies on the primary sources of information. However, secondary sources of information, like research reports, research articles, and reports of Banepa municipality were also used to describe the existing situation of solid waste management and validate the findings of the study. Data were collected in October 2014. Permission was taken from the municipality office to conduct study and collect necessary information. Study used the structured questionnaires. To collect the data three enumerators were used. They went to the field and interviewed the respondents. Among the enumerators, two had completed master's degree in economics. Another was retired staff of Central Bureau of Statistics, Nepal. To ensure that enumerators as well as respondents were understood of questions, the questionnaires were translated into Nepali language, the national language of Nepal. A bid vector of Rs 150 (USD 1.53), Rs 170 (USD 1.73), Rs 190 (USD 1.94), Rs

210 (USD 2.14) and Rs 230 (USD 2.35) was offered and varied randomly across the respondents. While collecting data, the scenario was presented to the respondents. Then, they were asked whether they were willing to pay for the improved solid waste management. If the response was "yes", particular bid price was offered. If that bid price was accepted, follow-up question was asked on the maximum amount they were willing to pay. If the bid price was rejected, follow-up question was asked on at what monthly fee they would be willing to pay. On the other hand, if the response was "no" on the WTP question, follow-up question was asked behind not willing to pay.

3. Results

3.1 Socio-economic and demographic features of respondents

In the survey, male respondents were 55 percent whereas female respondents were 45 percent. Among male respondents, 76 percent were willing to pay whereas among female respondents 91 percent were willing to pay. The average age of respondents was 47 years. Average household size was six. The average monthly income was Rs 16,480 (USD 168.15). However, there was big difference on the level of monthly income among households. The lowest level of monthly income was Rs 7,000(USD 71.42) whereas the highest level of monthly income was Rs 60,000 (USD 612.18). Out of 220 respondents, 56.36% had not received formal educational degree, 17.27% respondents had completed secondary education, 13.18% respondents had completed higher secondary education, 11.36% respondents had completed bachelor degree and 1.82% respondents had completed master's degree. All the sampled households gave response on the questionnaires. Most of the respondents were married. Only 2.73 percent respondents were unmarried.

3.2 Current Situation of Solid Waste Collection Service

This study shows that 51 percent households were getting solid waste collection service. Similarly, 16 percent households were throwing the waste on the open pile of solid waste on their neighborhood, 26 percent households were burning the waste on the fire, 1 percent households were using waste to make compost and 6 percent were managing waste in other ways. It was found that those respondents who said that they were managing waste in other ways were throwing out the waste on the local river or nearby kulo (an infrastructure made for small scale irrigation). Figure 1 shows the current situation of solid waste management by households in Banepa municipality. Respondents were also asked about the frequency of getting waste collection service. Among them, 47 percent were getting service daily, 4 percent three times a week, 3 percent two times a week, 9 percent once a week and 8 percent once within 15 days. Similarly, 23 percent respondents said that there is no any fixed time for the waste collection service. Furthermore, within the remaining 6 percent respondents, some of them were getting service once within 10 days, once a month and so on. This fact shows the situation of insufficient provision of solid waste collection service. On one hand only 51 percent households are getting waste collection service; on the other hand most of the households, among them, are not getting service daily. Out of total households who were getting solid waste collection service, 70 percent households were willing to pay for improved solid waste collection service whereas remaining 30 percent were unwilling to pay.

Among the households who were getting solid waste collection service, 31 percent households were getting such service exactly

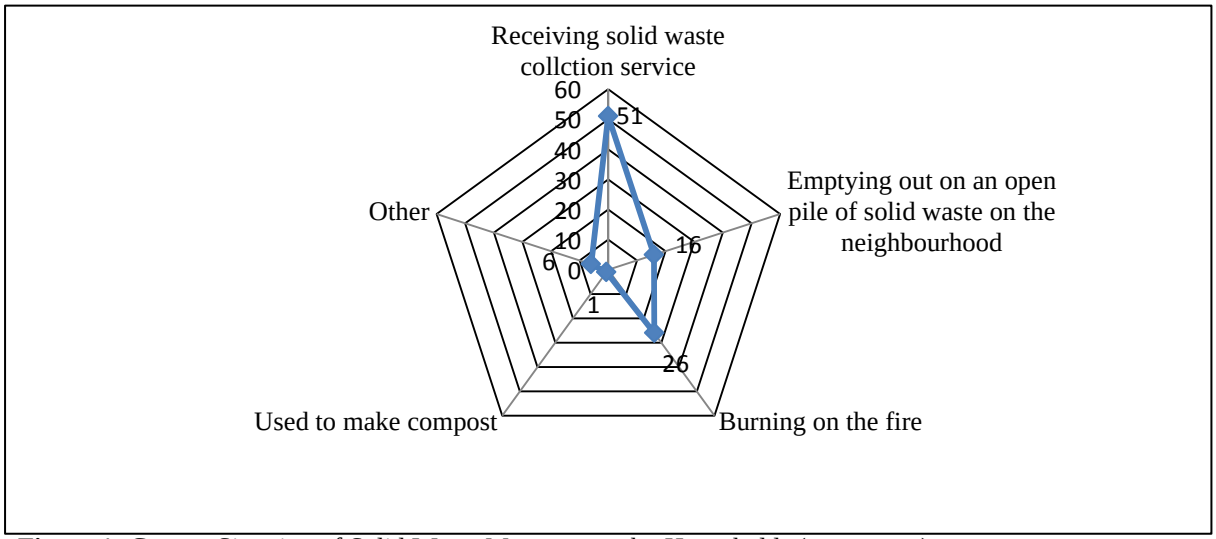

Figure 1: Current Situation of Solid Waste Management by Households (percentage)

in front of their house, i.e. collectors had collecting waste from just before their house whereas 69 percent households had not getting such service just in front of their house so that they had to move some distance to throw the waste. On average, households were walking for 7 minutes to drop the waste. On average, households were getting service since 5.5 years.

3.3 Type of Solid Waste Formed and Material Used to Store

This study found that households' waste was in the form of plastic bag; leftover food; plastic bottles; broken glasses; small bottles of glass (like bottles of medicine); vegetable and fruit peel; pieces of papers; useless clothes, shoes and sandals; covers of biscuits, chocolates and noodles; and dust collected while sweeping the house. Out of total respondents, 36 percent were using durable metal or plastic container, 17 percent were using basket or cartoon container, 30 percent were using plastic bags and remaining 17 percent were storing waste in other ways. Regarding the people who said that they were storing waste in other ways, most of them said that they were using plastic sack (like, the sack they could get while purchasing rice from the shop) to store waste, some of them were dumping waste before their houses to burn on the fire, some of them said that they dump waste every day before their house and next day the sweepers take the waste, and remaining households were using waste to make compost.

3.4 Solid Waste Management as a Problem of Municipality

Eighty two percent respondents considered solid waste management as one of the major problems of Banepa municipality. Remaining 18 percent did not take solid waste management as a major problem of the municipality. Among the respondents, 75 percent in ward no. 1, 2, 3 and 8; 85 percent in ward no. 4; 90 percent in ward no. 5, 6, 7 and 10; 60 percent in ward no.9; and 95 percent in ward no.11 took solid waste management as one of the major problems of municipality. It should be noted that there are eleven wards in the municipality. Thus, vast majority of the respondents considered solid waste management as one of the major problems of the municipality.

3.5 Level of Satisfaction from Existing Waste Collection Service

Respondents were asked whether they were highly satisfied, reasonably satisfied or not satisfied at all from the existing provision of waste collection service of municipality. Only 23 percent households were highly satisfied from the existing delivery of service whereas 40 percent were reasonably satisfied and 37 percent were not satisfied at all. Questions were asked to the respondents who were not satisfied at all regarding the reasons behind not being satisfied at all. Among them, 39 percent respondents said that service was not reliable. The major reason behind this was that there was not uniform time for the arrival of tractor to collect the waste. Similarly, 39 percent respondents said that service was not frequent. Furthermore, 8 percent said that they should walk long distance to get emptied out the waste. Ultimately, 14 percent respondents said that sometimes they go to get emptied the waste but the vehicle already goes out before they reach there; tractor puts so big amount of waste that while moving it waste falls on the road; and sometimes sweepers collect the waste and put that before the house but tractor does not come to collect that waste so that waste remains uncollected for some days.

3.6 Environmental Awareness

Environmental awareness was measured in terms of a bit of knowledge of respondents on the environmental issues. Typically, the study asked two questions for this purpose: where the collected waste is finally disposed? Is the present final disposal environmentally safe and acceptable? The study shows that 66 percent respondents were environmentally aware whereas 34 percent were environmentally unaware. Among the environmentally aware respondents, 83 percent were willing to pay whereas 89 percent of environmentally unaware respondents were willing to pay for improved SWM service.

3.7 Valuation Results

Among the respondents, 83 percent were willing to pay for improved solid waste management whereas 17 percent were not willing to pay. Clearly, the percentage of households willing to pay for improved solid waste management is very high in Banepa municipality. Similar results of high level of willingness to pay for improved solid waste management was found by researchers in different countries, like Banga et al. (2011), where 79.8 percent households were willing to pay; and Hagos et al. (2012), where 92 percent people were willing to pay. Table 2 shows that the mean WTP is Rs 166 (USD 1.69) per household per month whereas the median WTP is Rs 160 (USD 1.63) per household per month.

With the increase in bid amount offered, the percentage of "yes" response declined. When the lowest bid amount of Rs 150 (USD 1.53) was offered, 100 percent respondents accepted that amount. Regarding the bid amount of Rs 170 (USD 1.73), 93 percent respondents accepted. Similarly, in case of bid amounts of Rs 190 (USD 1.94), Rs 210 (USD 2.14) and Rs 230 (USD 2.35) respectively, 87 percent, 77 percent and 56 percent respondents accepted. Thus, with the increase in price offered, the demand for improved solid waste management service has decreased, which confirms the law of demand. Figure 2 shows this.

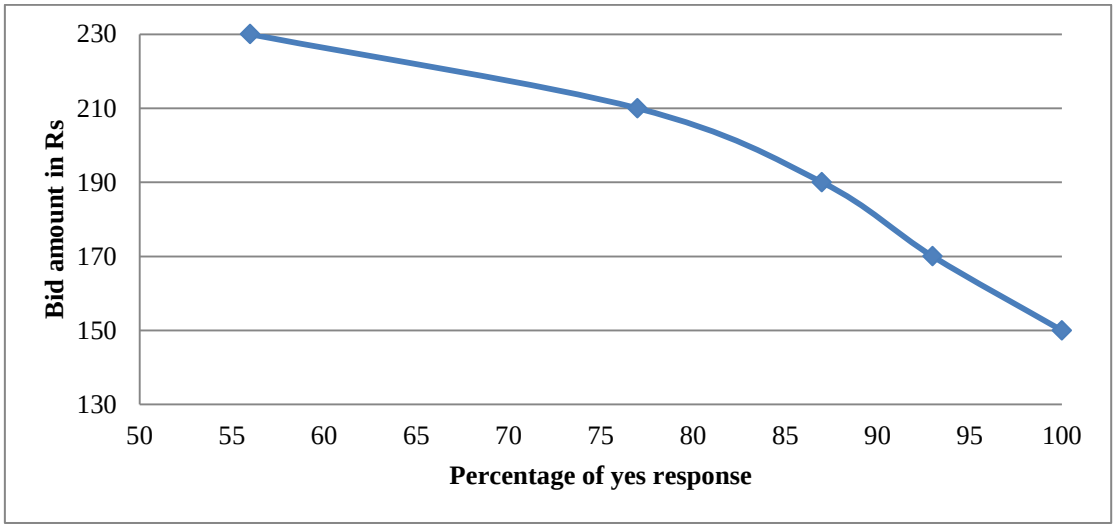

Figure 2: Effect of increase in bid amount on the demand for improved solid waste management

The respondents who were unwilling to pay for improved solid waste management gave different reasons behind their choice as follows:

- It is the responsibility of municipality to provide better waste collection service to the people. Municipality should provide such service without any fee. As they pay tax to the municipality, it should use the collected tax revenue to provide service to the people.
- They can dispose waste by making a deep hole on the compound of their house.
- They can dispose waste in the nearby river.
- They do not have sufficient income to pay for the waste collection service.

4. Discussion

Table 2 shows logit regression result. The Pseudo R-squared is 0.6455, which shows that the model has good fit. The log likelihood ratio (LR) statistic is highly statistically significant. The sign of all coefficients of variables in the model is consistent with the intuition. The maximum likelihood estimation process of the model has taken 6 iterations. Thus, the logit model employed has integrity and is appropriate.

The result of estimation shows that bid amount, age of the respondent, sex of the respondent, household size, level of education of respondent, present waste collection service and household income are the factors that determine the households' decision of whether to pay or not to pay for improved solid waste management in Banepa municipality. There is negative and significant effect ($p<0.01$) of bid amount on the WTP. It shows that "yes" response to the improved solid waste management service decreased with each successive increase in bid

Table 2: Logit regression result

Variable	Coefficient	Standard error	Marginal effect
Costant	257966	3801164	
Bid amount	-.035076***	.0132058	-.0170192
Age	.0616189*	.0369952	.0139522
Sex	-1.736919**	.6800806	-.0671046
Household size	.3875067*	.2265305	.0253649
Education	.1752936**	.0719484	.0921076
Marital status	.4899194	1.415658	.0003172
Present waste collection service	-1.979609**	.8146495	-.0530172
Household income	.3214166***	.0025431	.0201002
	Goodness of fit measures		
Log likelihood	-35.8859		
LR chi2(8)	130.71		
Prob > chi2	0.0000		
Pseudo R2	0.6455		
Iteration	6		
	Mean and Median WTP		
Mean WTP	Rs 166 (USD 1.69)		
Median WTP	Rs 160 (USD 1.63)		

***p<0.01, **p<0.05, *p<0.1

amount offered. This result supports the findings of Afroz et al. (2009) and Hagos et al. (2012). The marginal effect shows that an increase in bid amount by Rs 20 (USD 0.20) reduces the willingness to pay by 1.7 percent.

There is positive and significant effect ($p<0.1$) of age of the respondent on WTP. It shows that older people were willing to pay more for the improved solid waste management than the younger people. This may be due to the mature decision of the older people on the environmental issue. This result supports the findings of Afroz et al. (2009) and Ojok et al. (2012). The marginal effect shows that when the age of individual increases by one year, the willingness to pay increases by 1.4 percent.

Sex has negative and significant effect ($p<0.05$) on the WTP, which shows that female have higher WTP for solid waste management than their male counterparts. This is because, in Nepal, female are more responsible in the management of household activities including waste than male. Similar conclusion was found by Awunyo-Vitar et al. (2013) and Alhassan and Mohammed (2013). The result shows that male respondents were 6.7 percent less likely to pay for improved solid waste management than female.

Household size has positive and significant effect ($p<0.1$) on the WTP. This shows that the larger household size respondents were willing to pay more than small household size respondents. The result seems reasonable because in the larger size households more waste is generated and it is relatively difficult to manage the big amount of waste. So, they opt for paying more amounts for the solid waste management. Similar type of result was found by Ojok et al. (2012). The marginal effect shows that when the household size increases by one, the WTP increases by 2.5 percent.

The coefficient of level of education is positive and significant ($p<0.05$). It shows that higher the level of education of respondent, higher the amount he/she is willing to pay for improved solid waste management. The finding is reasonable because educated people know the importance of better environment and want to pay more than the uneducated people. This finding is supported by Caplan et al. (2002), Zerbock (2003), Basil et al. (2006), Danso et al. (2006), Jin et al. (2006) and Banga et al. (2011). Result shows that when educational attainment increases by one level, the WTP increases by 9.2 percent.

The coefficient of marital status is positive but insignificant. It is unexpected result. The expectation was that the coefficient would be positive and significant because it was expected that the married people make mature decision on environmental issues. However, the insignificant relationship between marital status and WTP was also found by Niringiye and Omortor (2010), although the coefficient was negative.

The coefficient of present waste collection service is negative and significant ($p<0.05$). It implies that the households that were getting waste collection service currently were willing to pay less than the households that were not getting such service. The reason is that when people are managing their waste under currently available service, they may be unwilling for improved waste management service because improved service requires more payment. Now, people are paying very low garbage fee per month. The marginal effect shows that respondents who were getting waste collection service were 5.3 percent less likely to pay for improved SWM than those who were not getting such service.

There is positive and significant ($p<0.01$) relationship between monthly household income and WTP. This implies that households with larger monthly income were willing to pay more than the households with smaller monthly income. The reason is that higher income households can afford more garbage fee than lower income households. Similar types of results were found by Afroz et al. (2009), Banga et al. (2011) and Hagos et al. (2012). The marginal effect shows that Re 1 (USD 0.01) increase in monthly income of respondent is likely to increase WTP by 2 percent.

Clearly, as a large portion of the households considered SWM as major problem of Banepa municipality, the municipal authorities should take steps to solve this problem. Only 51 percent households are getting solid waste collection service and among them only 47 percent households are getting such service daily. This situation reflects the lack of sufficient resources with the municipality for SWM. However, as the households are willing to pay for improved SWM, there is the opportunity for managing the problem of resource constraint. A big portion of the households is not satisfied at all from the present practice of waste collection service. By taking this situation as feedback from the people, on the present waste collection service, municipality should make plan to improve the quality of service as soon as possible. Similarly, the environmental awareness on the people should also be increased as 34 percent respondents seemed to be environmentally unaware.

5. Conclusions and Policy Implication

This study shows that a vast majority of the respondents (i.e., 83 percent) were willing to pay for improved solid waste management. So, people are interested for the improved service. The mean WTP of households was Rs 166 (USD 1.69) per household per month. Currently, municipality is charging Re 1 (USD 0.01) per household per day as garbage fee. Thus, present garbage fee is far below the mean WTP of households. So, there is the opportunity of increasing garbage fee. As there is the opportunity of collecting sufficient funds for the provision of better solid waste management service, municipality may encourage the private sector to initiate such service. However, municipality itself may also initiate the improved solid waste management service. As

only 47 percent households are getting waste collection service daily, there is the necessity of increasing the frequency of waste collection service. Similarly, the emphasis should also be given on the environmental education on the people. While charging for the service, it's not mandatory to charge according to the mean WTP. For this, socially acceptable fee should be determined. The mean WTP may be a guide to municipal authorities to determine appropriate garbage fee. The bid amount, age of the respondent, sex of the respondent, household size, level of education of respondent, present waste collection service and household income are the determinants of households' willingness to pay for improved solid waste management in Banepa municipality. The collected waste seems to be in the form of plastic bag; leftover food; plastic bottles; broken glasses; small bottles of glass (like bottles of medicine); vegetable and fruit peel; pieces of papers; useless clothes, shoes and sandals; covers of biscuits, chocolates and noodles; and dust collected while sweeping the house.

The service provider can charge higher garbage fee for larger household size as the study shows that household size has positive and significant effect on WTP. Garbage fee can also be charged on the basis of amount of waste generated by the households. However, there should be different provision for the poor people. They should be either charged with relatively lower garbage fee or exempted from garbage fee. The negative and significant effect of bid amount and present waste collection service on WTP shows that such garbage fee should be carefully determined. The monthly garbage fee should be so designed that more and more households would take the improved solid waste collection service. To maintain the environmental cleanliness, there should be joint effort of citizens and municipality. Thus, there is the responsibility of both residents of Banepa municipality as well as municipal authorities.

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