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Research Article

Determinants of Willingness to Pay for Improved Solid Waste Management System in Lekhnath, Kaski, Nepal

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Abstract

Solid waste management is one of the developmental challenges facing city authorities worldwide, especially in most developing countries. Rapid urbanization has made solid waste management a serious problem in poor and developing countries. This study aims to analyze the determinants of willingness to pay for improved solid waste management system. For this purpose, two hundred and seventeen Households were selected in Lekhnath, Kaski, Nepal. Pre-structured questionnaire was used to collect the data. Data was collected by using systematic random sampling techniques.Multiple Linear Regression analysis was used to find the determinants of willingness to pay for improved solid waste management system. The tentative average wastes produced per day from their house is one kilogram with minimum one hundred gram and maximum ten kilogram per day. Main disposal method/site for solid waste management of majority of the respondents is Burn followed by cannal, near open places, send in waste management vehicle, road side and rivulets. Almost all of the respondents are not satisfied with the community responsible for solid waste management in the study area. The average amount that the respondents have willingness to pay for solid waste management system is Rs 56.84 per month. Further, it is found that Having any member abroad, Remittance received in last one year and House ownership are the major determining factors for willingness to pay for improved solid waste management system in the study area. However, other factors like Sex of the respondents, age of the respondents, family size, Family type,

Caste/ethnicity, education of the respondents, Total number of employed person at home, Total number of literate person at home, Major occupation of the respondents, tentative weight of accumulated solid waste per day, Monthly Income of household, Visit at any hotel/restaurant during last 12 months, and Having any livestock at household do not have any significant impact on willingness to pay for improved solid waste management system.

Keywords: Determinants, education, remittance, solid waste, willingness

Introduction

Solid waste management is one of the developmental challenges facing city authorities worldwide, especially in most developing countries (UNEP, 2013). Poor solid waste management, coupled with inadequate financial resources, has led to indiscriminate dumping of solid waste into open spaces and drainages, choking drains and causing flooding, environment pollution and public health issues (UNEP, 2013; Perera, 2003).

Rapid urbanization has made solid waste management a serious problem in poor and developing countries (Bahauddin and Uddin, 2012). Waste management is becoming a very serious problem in Nepal also. For this, we need to examine households' willingness to pay for this service. The information can be used to increase people's welfare by introducing cost recovery by tapping into households' willingness to pay.

Hagos (2003) also used CVM in his study to elicit individual willingness to pay for improved solid waste collection and disposal services for Mekele town. He employed an open-ended with the iterative bidding game format and selected a total of 164 households using stratified sampling based on the smallest administrative unit 'Kebele' thereby applying systematic random sampling for selecting households from each stratum. He employed Ordinary Least Squares (OLS) in estimating the bid function where the Willingness to Pay (WTP), is function of sex, age, education, household size, household income, house ownership, household awareness about SW problem, household satisfaction with the existing level of SW service. Of these variables, household's income, awareness about SW problem, age,

size of the household, were found to significantly influence the dependent variable (WTP).The remaining explanatory variables were found insignificant.

Household size is another factor that influences WTP for waste management. Chuen-Khee& Othman (2002) pointed out that the more the number of people in the household, the more willing the household will appreciate a clean environment. Tamura (2005) in analysing the individual attributes of the demand for solid waste collection in Accra, Ghana found that the more income people have, the more willing they are to pay for solid waste collection.

Afroz et al. (2009) pointed out that holding all other factors constant, older people are willing to pay more than younger people. The quantity of waste generated by a household also influences WTP for waste management. Aggrey and Douglason (2010) pointed out that, the higher the generation of waste, the more the household faces the challenges of waste disposal and the greater the willingness to pay. Satisfaction on waste collection services also influences WTP for improved waste management. People who are more satisfied with waste collection services are willing to pay more than dis-satisfied people (Afroz et al., 2009 and Kassim & Ali, 2006).

Aggrey and Douglason (2010) hypothesized that the higher the level of education the more people would appreciate the consequences of mishandling of solid waste and the more value the individual would give in order to avoid the risk of being a victim of unclean environment.

Banga et al. (2011) found in Kampala that both the decision to pay and the amount households are willing to pay for improved solid waste collection services are influenced by income, education, age, and home ownership.

The issue of households' willingness to pay for improved solid waste management have been extensively researched into in most developing countries. But the findings from these studies are rather inconsistent and mixed. In most studies (Assa, 2013; Awunyo-Vitor, et.al. 2013; Afroz&Masud, 2011 and Rahji&Oloruntoba, 2009;), education and income

have positive effects on WTP. However, while Alhassan& Mohammed (2013) and Oteng-Ababio (2010b) found that women were more willing to pay for solid waste services, Afroz, (2011) and Assa, (2013) found no statistically significant relationship between willingness to pay and gender in their studies in Bangladesh and Malawi respectively. Similarly, in the studies by Awunyo-Vitor, et.al. (2013), Assa (2013) and Afroz, (2011), older people were more willing to pay for improved solid waste services than younger people. In contrast, Rahji&Oloruntoba (2009), Amiga, (2002), Banga, et.al. (2011) and Hagos, et.al. (2012) found that younger people were more willing to pay for improved solid waste services.

However, the determinants of willingness to pay (WTP) for solid waste management has not been analyzed yet in the proposed area. Therefore, this paper attempts to analyze the determinants ofwillingness to pay (WTP) for improved solid waste management (SWM) system in Lekhnath, Kaski, Nepal.

Data and Methods

For this research, primary data was used and quantitative data was collected to find the determinants of willingness to pay for improved solid waste management system. Both descriptive as well as exploratory research design was applied during the study. For this purpose, at first Lekhnath Municipality was selected purposively. The total number of Household in Lekhnath Municipality is 11,830. At second stage, as ward no. 1, 3, 5, 7, 11 and 12 have some dense areas and some more observable solid waste, so these wards were selected purposively. So, 1204, 730, 603, 393, 795 and 922 i.e. total 4647 households of these selected wards is the population of the study. From these population, 217 respondents (at 6.5 percent margin of error and 5 percent level of significance) are proportionately distributed in wards 1, 3, 5, 7, 11 and 12 as 56, 34, 28, 19, 37 and 43 respectively. At final stage, the information was collected from 217 households using systematic sampling technique. For this, we have N = Total study population = 4647, n = sample size = 217, k = N/n= 4647/217 = 21.4 ≈ 22. Then the information was collected by using systematic random sampling

techniques in the interval of 22 households. So, multistage sampling technique was used for this study.

Data was collected through field survey using pre-structured questionnaires following the interview technique with the respondents. For the reliability of data, based on the reviewing of literatures, the variables were identified and questionnaire was designed so as to include all these variables. Verbal consent was taken from the respondents before conducting the interview. Then questionnaires were pre-tested in a similar setting with twenty two (10% of the total sample size) respondents in Pokhara Valley and necessary correction were made, collected data were checked for errors and omission on consistency of data was maintained. Multiple Linear Regression analysis was carried out to find the determinants of willingness to pay for solid waste management systems.

The multiple linear regression model

$$Y_{\text{willingness to Pay}} = b_0 + \sum_{i=1}^{16} b_i X_i \ldots\ldots(i)$$

Where, $Y_{\text{willingness to pay}}$ = Willingness to pay (WTP) for improved solid waste management system, it is the maximum price that the people want to pay per month for the improved solid waste management system. X_1, X_2, ……, X_{15}, and X_{16} are the independent variables i.e. Sex of the respondents, age of the respondents, family size, Family type, Caste/ethnicity, education of the respondents, Total number of employed person at home, Total number of literate person at home, Major occupation of the respondents, house ownership, tentative weight of accumulated solid waste per day, Monthly Income of household, Visit at any hotel/restaurant during last 12 months, Any member go abroad, Remittance received in last one year and Having any livestock at household respectively. b_0= Constant or intercept made of regression plane. Similarly b_1, b_2, ……, b_{15}, and b_{16} represents the regression coefficients of the independent variable as defined.

Results and Discussion

Based on the data collected from 217 households, social, economic and demographic characteristics of the respondents are explored (table 1).

Majority of the respondents are above forty years age. The minimum age is 20 years and the maximum is 75 years with average as 44.95 years. Similarly almost three fourth of the respondents are male. It shows the existence of the majority of the male.

Majority of the respondents are married. More than two fifth of the respondents are from nuclear family. Majority of the respondents are Brahmin/Chhettri followed by Janajati and Dalit. Most of the respondents are with the educational level as SLC. More than two fifth of the respondents have their major occupation as business followed by foreign labour, service, agriculture and wage labour. Majority of the respondents have been living in their own house. More than three fifth of the respondents have livestock in their house whereas almost two fifth does not have any livestock in their house. Majority of the respondents have at least one member at abroad from their household. Further majority of the respondents have visited any hotels and restaurant within last twelve months. Further, more than three fifth of the respondents do not have livestock in their house. The tentative average wastes produced per day from their house is 1 kg with minimum 0.1 kg and maximum 10 kg per day.

Table 1
Social, Economic and Demographic Characteristics

Characteristics	Number	Percent
Age		
Up to 40 years	81	37.3
Above 40 years	136	62.7
Minimum= 20 years , Maximum = 75 years, Average = 44.95 years		
Sex		
Male	159	73.3
Female	58	26.7
Marital status		
Married	209	96.3
Unmarried	8	3.7

Characteristics	Number	Percent
Age		
Up to 40 years	81	37.3
Above 40 years	136	62.7
Minimum= 20 years , Maximum = 75 years, Average = 44.95 years		
Sex		
Male	159	73.3
Female	58	26.7
Family type		
Nuclear	140	64.5
Joint	77	35.5
Family Size		
Average (less or equal to 5)	160	73.7
Large (More than 5)	57	26.3
Caste/Ethnicity		
Brahmin/Chhetri	127	58.5
Janajati	69	31.8
Dalit	21	9.7
Educational status		
Illiterate	14	6.5
Just Literate	12	5.5
Primary	16	7.4
Secondary	41	18.9
SLC	91	41.9
Intermediate and Above	43	19.8
Major occupation of the household head		
Agriculture	31	14.3
Business	91	41.9
Service	38	17.5
Foreign labour	53	24.4
Wage labour	4	1.9
House ownership		
Own	203	93.5

Characteristics	Number	Percent
Age		
Up to 40 years	81	37.3
Above 40 years	136	62.7
Minimum= 20 years , Maximum = 75 years, Average = 44.95 years		
Sex		
Male	159	73.3
Female	58	26.7
Rented	14	6.5
Visited any hotels and restaurant during last 12 months		
Yes	185	85.3
No	32	14.7
Having any member at abroad		
Yes	66	30.4
No	151	69.6
Having any Livestock		
Yes	83	38.2
No	134	61.8

Source: Field Survey, 2016

Further the existing situation of solid waste management system in the study area are explored (table 2). Most of the respondents responded that they do not have the community to manage the solid waste management. Almost all are not the member of the community. Almost all of the respondents are not satisfied with the community. Very few of the respondents pay for the solid waste management. Almost nine tenth of the respondents responded that there is solid waste management system in the study area. Main disposal method/site for solid waste management of majority of the respondents is Burn followed by cannal, near open places, send in waste management vehicle, road side and rivulets. Majority of the respondents responded that the best method for solid waste management is recycling followed by burning and landfills. Almost all has durable container for storing solid waste in their household. Majority has plastic container. Some has metal container while others have paper and rug

containers. More than eight tenth of the respondents have separate containers for renewable and non-renewable solid wastes. Almost all households have plastic as solid waste produce. Half of the households have paper, one third of the households have food wastes, one fourth of the respondents have glasses as the solid waste produced while very few has other solid waste produced like clothes. Around ninety percent of the respondent responded health as one of the impact of solid waste produced. Nearly two third of the respondents said air pollution is another impact of solid waste produced. Water pollution, foul smelling and soil pollution are other impact of the solid waste produced.

Table 2

Existing Situation of Solid Waste Management

Characteristics	Number	Percent
Having any community to manage solid waste management		
Yes	27	12.4
No	190	87.6
Any member belong to the community		
Yes	4	1.8
No	213	98.2
Satisfaction from community for SWM		
Yes	23	10.6
No	194	89.4
Any pay for SWM		
Yes	24	11.1
No	193	88.9
Any system of SWM		
Yes	27	12.4
No	190	87.6
Main disposal site used for SWM		
Near Places(Open Places)	29	13.4
Road Side	6	2.8
Cannal	47	21.7
Rivulets	2	0.9

Burn	116	53.5
Send in Waste Management Vehicle	17	7.8
Best method for solid waste disposal		
Recycling	131	60.4
Landfills	20	9.2
Burning	66	30.4
Having durable container for storing solid waste at household		
Yes	211	97.2
No	6	2.8
Types of container at household		
Metal	6	2.8
Plastic	195	89.9
Others	16	7.3
Having Separate container for renewal and nonrenewal solid wastes		
Yes	177	81.6
No	40	18.4
Type of solid waste produced*		
Plastic	213	98.2
Food wastes	79	36.4
Paper	107	49.3
Glasses	52	24.0
Others	9	4.1
Impact of solid waste produced*		
Health	195	89.9
Foul smelling	41	18.9
Air pollution	134	61.8
Water pollution	85	39.2
Soil pollution	53	24.4

*Based on multiple responses
Source: Field Survey, 2016

Further, determinants of willingness to pay for solid waste management system are analyzed. For this purpose, multiple regression analysis was performed taking the dependent variable as willingness to pay for improved solid waste management system i.e. maximum price that the respondent

want to pay per month for improved solid waste management system and the independent variables as mentioned above. The average amount that the respondents have willingness to pay for solid waste management system is Rs 56.84 per month with Rs 500 as highest amount. It may be useful for making policies for local authorities to fix money from the people for collecting solid waste in the study area.

Table 3
Determinants of Willingness to Pay for Improved Solid Waste Management System

Predictors	**B**	**T**	**Sig.**
(Constant)	-60.350	-1.290	.199
Sex of the respondents	4.314	.546	.586
Age of the respondent	-.006	-.015	.988
Family Size	-.159	-.120	.905
Family type	11.953	1.514	.132
Caste / ethnicity	-6.833	-1.294	.197
Educational level of the respondents***	5.047	1.714	.088
Total number of employed person at home	-.366	-.082	.934
Total number of literate person at home	-1.499	-.673	.501
Major occupation of the household	-4.217	-1.092	.276
House ownership**	34.751	2.510	.013
Tentative amount of solid waste per day	2.646	.736	.463
Monthly income of the household	2.601×10^{-5}	.415	.678
Visit to any hotels restaurants in last one year	7.542	.762	.447
Having Any member abroad*	45.495	3.969	.000
Remittance received in last one year*	8.876×10^{-5}	7.076	.000
Having any livestock	-1.561	-.225	.822

**significance at 1% level of significance; **significance at 5% level of significance; ***significance at 10% level of significance*

Source: Field survey, 2016

Having any member abroad and Remittance received in last one year have positive significance on willingness to pay. Further, it is also found that

Having any member abroad and remittance received in last one year have significant impact on willingness to pay for improved solid waste management system ($p<0.01$). House ownership has significant impact ($p<0.05$) which is supported by Banga et. al (2011) whereas educational level of the respondents has significant impact at ten percent level of significance ($p<0.1$) which is supported by Aklilu (2002); Banga et. al (2011) and Dhungana (2016). Although Family size, Having any livestock in household and total number of literate person in household show the negative impact on willingness to pay, they are not statistically significant. Further, the other variables also do not have significant impact on willingness to pay for improved solid waste management system.

The multiple linear regression model for the estimated willingness to pay for improved solid waste management system is

Maximum amount that the respondents want to pay for improved solid waste management system

$$=-60.350 + 4.314\ X_1 - 0.006\ X_2 - 159X_3 + 11.953\ X_4 - 6.833X_5 + 5.047X_6 - 0.366X_7 - 1.499X_8 - 4.217X_9 + 34.751X_{10} + 2.646\ X_{11} + 2.601*10^{-5}X_{12} + 7.542\ X_{13} + 45.495X_{14} + 8.876*10^{-5}X_{15} - 1.561X_{16}$$

$R^2 = 0.355$, Standard error = 45.499, F-ratio= 6.439*

*significant at 1% level of significance

Where, X_1, X_2, ……, X_{15}, and X_{16} are the independent variables i.e. Sex of the respondents, age of the respondents, family size, Family type, Caste/ethnicity, education of the respondents, Total number of employed person at home, Total number of literate person at home, Major occupation of the respondents, house ownership, tentative weight of accumulated solid waste per day, Monthly Income of household, Visit at any hotel/restaurant during last 12 months, Any member go abroad, Remittance received in last one year and Having any livestock at household respectively.

As evident from the amount that the respondent has willingness to pay for improved solid waste management system, the coefficient of multiple

determinations (R^2) of the estimated linear function is 0.355. This shows that 35.5 percent variation in the dependent variable (Maximum amount that the respondent has willingness to pay for improved solid waste management system) is explained by the variation in independent variables taken under consideration. The F-value is found to be highly significant which indicated a "good fit" of the estimated equation. The intercept is found to be negative but not significant.

Conclusion

The tentative average wastes produced per day from their house is 1 kg with minimum one hundred gram and maximum ten kilogram per day. Main disposal method/site for solid waste management of majority of the respondents is Burn followed by cannal, near open places, send in waste management vehicle, road side and rivulets. Almost all of the respondents are not satisfied with the community responsible for solid waste management system in the study area. The average amount that the respondents have willingness to pay for solid waste management system is Rs 56.84 per month. Further, it is found that Having any member abroad, Remittance received in last one year and House ownership are the major determining factors for willingness to pay for improved solid waste management system in the study area. However, other factors like Sex of the respondents, age of the respondents, family size, Family type, Caste/ethnicity, education of the respondents, Total number of employed person at home, Total number of literate person at home, Major occupation of the respondents, tentative weight of accumulated solid waste per day, Monthly Income of household, Visit at any hotel/restaurant during last 12 months, and Having any livestock at household do not have any significant impact on willingness to pay for improved solid waste management system in the study area.

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