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**Willingness to Pay for Solid Waste
Management Services: A Case
Study of Islamabad**

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ABSTRACT

Solid waste management remains a serious problem in most of the developing world, although it consumes a larger portion of municipal budgets. In the current project, a number of solid waste management studies were conducted for Islamabad city mostly focusing on the generation, collection and disposal of waste. Moreover, a contingent valuation survey approach was applied for the project. A stratified random sampling technique was applied for sample size selection of five hundred respondents. A double bounded dichotomous choice questions followed by an open ended question format was used to elicit willingness to pay and maximum willingness of the respondents.

The logistic regression estimation reveals that 65.4 percent of the total respondents are willing to pay, while multiple regression reveals a monthly mean willingness to pay of Rs 289.15 which is greatly affected by age, household income, education and environmental awareness i.e. respondents with higher levels of education and income show higher willingness to pay. These collected data can specifically help in formulating the solid waste management services while in general can add up its role for the improvement of environmental quality.

1. INTRODUCTION

Urban population growth is highly correlated with increased solid waste pollution. Extensive research is needed on pollution problems and peoples willingness to pay for their reduction. According to Schubeler, Wehrle, and Christen (1996) municipalities in developing countries spend a large proportion of their budgets on management of solid wastes materials. This problem is growing due to inappropriate planning by waste management authorities, inadequate governance, lake of resource availability and ineffective management in rapidly growing cities of the developing countries.

There are a number of problems associated with inappropriate waste management machanism in the densly populated localities. The open waste piles create health problems and leachhate pollutes the underground water, ultimately causing waterborn diseases. According to Sarraf (2004) the cost of leakage of leachate from unsanitary landfill sites in Morocco was about US \$ 25 Million per year. According to Mustafa, *et al.* (2007) the World Bank report criticised that situation of solid waste in Pakistan is neglected and greater threat to environmental degradation. The annual estimated cost of environmental and resource degradation is about six percent of the GDP.

According to Abedullah (2006), waste management has become serious environmental and public health problem worldwide, particularly in developing countries. Changing economic trends, greater expansion of urban agricultural and industrial activities stimulated by rapid population growth produce solid and liquid wastes that pollute the environment and destroy resources and complicate solid waste management. Consequently, solid waste is not only increasing in quantity but also changing in composition.

According to the thoughts of Mahar, Malik, Qadir, Ahmed, and Khan (2007) in new settlements like Islamabad, Lahore, Faisalabad and Peshawar due to rapid urbanisation growth rate and natural high growth rate of population and rising per capita income would take for granted an increased demand for the provision of required infrastructure and public services. Pak-EPA, Guidelines For Solid Waste Management, (2005) growing urban cities in Pakistan lack financial and institutional capacity to provide basic infrastructure and services including solid waste management. However, with the increasing volume of solid waste, the Islamabad city administration is unable to manage it. Pak-EPA (2004) on average 387.6 tons/day waste is generated in Islamabad city and the coverage for collection is very low that is below 60 percent. The uncollected waste is a threat for the residents and poses environmental hazards.

The collected waste is dumped in Sector H-12 on an open space surrounded by residential sectors. Pak-EPA (2006) waste piles are put on fire to reduce accumulated waste, which adds to the air pollution causing greenhouse effect and ultimately global warming. Cost recovery of solid waste management is serious problem in the city because it is financed by government and there is not any proper mechanism of waste management charges and its collection from the residents.

To improve this pressing problem the government and other stakeholders have to put maximum efforts to look for the possibility of cost sharing by households, and for this we need to analyse the demand side for improved solid waste management. Therefore, this study is designed to generate demand side information, which is vital for the planning process.

There is immense potential to convert waste into resource for the economy, as private firms and non-governmental organisations have started projects based on the concept of organic and in-organic waste management in some cities. Recycling facility in Lahore is engaged to produce a refuse-derived fuel (RDF) based on the concept of waste-to-energy. "Citizens for a Better Environment" an NGO in Karachi is operating to convert organic waste to fertiliser and soil conditioner. However operations of these organisations are limited in size and scope. Although there has been commitment on part the government to create opportunities of converting waste in to energy and other useful purposes, lack of adequate infrastructure is inhibiting its growth. The same program is adoptable for Islamabad city as mentioned in Pak-EPA (2006) that the major portion of waste is bio-degradable and compostable, even the remaining waste can be used to generate electricity. However there is a need for a more pro-active approach, likely to be based on public private partnership to help this industry provide a cleaner environment while adding value to the economy.

The main purpose of the study is to fill in the gap by applying the double bounded dichotomous choice Contingent Valuation Method (CVM). The CVM technique is superior to other methods because it is able to capture use and non-use values¹, and analyse the willingness to pay for improved solid waste management of households in Islamabad city. More specifically, the objectives of this study are:

Firstly, we examine whether households are willing to pay for improved solid waste management service and determine their mean WTP² for solid waste management services and improved environmental quality i.e; to derive the demand line for improved solid waste management; Secondly, we identify the determinants of willingness to pay as well as the amount that households are willing to pay for improved solid waste management service. Finally, we draw implications for policy and suggest alternative solutions for the existing problems of solid waste management in the city.

These research questions were raised as;

- How price responsive the respondents are to changes in the price for solid waste management services.

¹Advantages and disadvantages of CVM are discussed in next Section.

²Willingness to pay

- Whether households are willing to pay for solid waste management services.
- What are the basic determinants of demand for waste management services? Environmental awareness, income of the household and education of the household, age composition and size of the household affect willingness to pay for environmental services.

The rest of the study is organised as section 2 provides data description and methodology, section 3 provides methodological framework, section 4 contains results and discussion while the last section provides conclusion and policy implications.

2. DATA DESCRIPTION AND METHODOLOGY

This section discusses the sample selection and survey methodology adopted for the study. The descriptive analysis of the collected data is organised on the bases of offered bid prices to different respondent's samples. SPSS software is used to analyse the data through cross tabulation of the variables to check the percentage responses of the variables.

2.1. Profile of the Study Area

The city of Islamabad is administered by Capital Development Authority. The authority is held responsible to manage overall planning, proper sanitation and garbage disposal within the territorial limits. A number of studies are carried out by the environment ministry, CDA and international firms about waste generated and its composition, to figure out a properly managed disposal in the city. Pak-EPA (2004) waste amount survey was conducted in five sectors i.e., F – 7, G – 6, I – 8, I – 10 and I – 11 in September 2004 for six days with the help of an international cooperation JICA³ which showed that 2,325.3 tons of waste was generated in those six days from the mentioned sectors, which gives an average of 387.6 tons per day. Pak-EPA (2006) a waste categorisation survey was conducted with the help of an international firm to find out the composition of the waste and propose a material recovery facility. This survey was conducted for five sectors of Islamabad i.e., F-7, G-9, H-8, I-9 and G-5 this study showed that about 425 tons of waste is generated in the city. The composition of the waste is such as about 91 percent of total waste generated in Islamabad is comprised of green and household waste, which gives a viability of compost plant and the remaining waste can be used as recyclable material. CDA (2008) the directorate of sanitation published standard operation procedure for management of sanitation services in Islamabad which showed that the volume of solid waste generated within the municipal limits of Islamabad ranges between 500 ~ 550 metric tons per day, with an average of 0.283 kg/capita/day to 0.613 kg/capita/day or from 1.896 kg/house/day to 4.29 kg/house/day with a particular trend to socio-economic conditions.

³Japan international cooperation agency

2.2. Sample Selection and Survey Methodology

The study is conducted in Islamabad, the capital city of Pakistan. The Islamabad Capital Territory is divided into different sectors by the city administration. So far the residential and commercial allocation is in sector E, F, G, H and sector I. By using this allocation as a guide line a sample of 500 respondents was selected from sector E-11, F-11, G-11, I-8 and I-9 by using systematic random sampling technique. This study uses contingent valuation technique for the estimation of average willingness to pay that individuals place for improvement in waste management system. The respondents are explained with the terms of new system as their waste will be daily collected at a specified time of the day for a monthly fee. The respondents are asked to response in “YES” or “NO” for the payment of specific amount per month.

An iterative discrete choice type question is offered, in this the respondent is asked, “Are you willing to pay Rs “X” per month for solid waste management services?” If the respondent accepts the first bid the same respondent is asked with a higher price than the first bid. If he rejects the first bid the same question is repeated with a lower price than the first bid offered. At the end an open ended question is asked about the maximum amount the respondent is willing to pay. Five different bid sets are selected as Rs 50, Rs 100, Rs 150, Rs 200, and Rs 250 per month. The analysis of the discrete choice question’s response is done through logit regression, and multiple regression analysis is conducted for the response of open ended maximum willingness to pay question.⁴

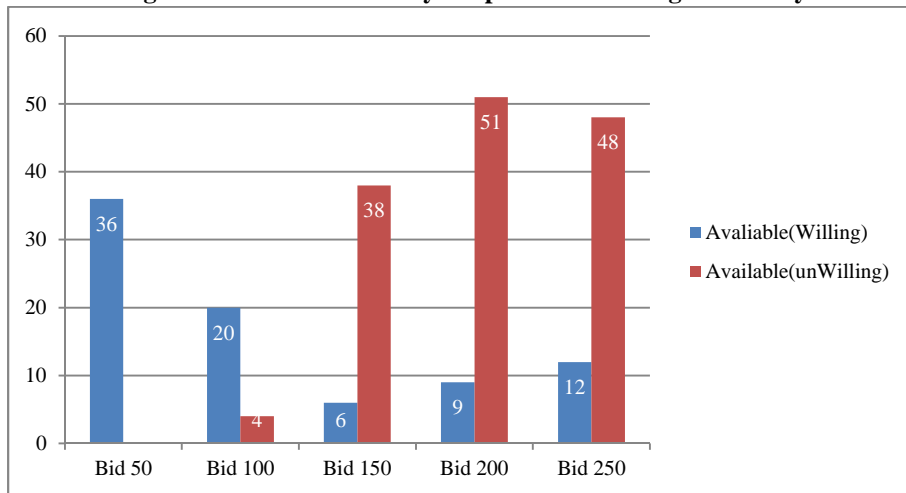
2.3. Data Analysis

The data collected through survey from the field is analysed to see the responses of some variable to the corresponding socio-economic characteristics of that particular individual. For this purpose SPSS software is used for analysis and graphical representation and their explanation is given.

Services Availability Response for Willingness to Pay:

This graph shows percentage of respondents currently provided with waste management services or not at the time of survey and their willingness or unwillingness to accept the improved services. The Y-axis shows the percentage of services availability and respondent’s willingness and unwillingness to pay for the bid prices offered to them shown on the X-axis.

⁴Despite the advantages of CVM it is criticised on the bases of different biases: starting point bias, to remove this bias the pilot survey was conducted; Strategic bias, for this purpose the service provider is mentioned as a private firm; Hypothetical bias, for this the provision of daily collection service at a specific time of day and monthly charges are explained.

Fig. 1. Services Availability Response for Willingness to Pay

For the first bid price offered for services 64 percent comprised of those who did not had availability and were willing to pay while 36 percent respondents had availability of services unhappy with current services and wanted to improve. In this group all the respondents were willing to pay for solid waste management services. The second bid prices slightly higher price for which 20 percent respondents had current services availability and were willing to pay for improvement and 4 percent of them were unwilling to pay for improved services. While 56 percent did not had the current availability of services but were willing to pay for this improved services, and 20 percent were unwilling to pay. For the third bid price only 6 percent respondents had availability and were willing to pay and 38 percent were unwilling for improved services, they wanted to continue the old services. On the other hand 56 percent respondents did not had services availability but they were willing to pay for improved services, for the fourth bid of Rs 200 per month only 9 percent had availability and were willing for improvement in the services and 51 percent of the respondents had availability of services and they were unwilling to pay for an improvement. The rest 40 percent did not had services currently and were willing to pay for the improved services. The highest bid price of Rs 250 per month there was only 12 percent respondents willing to pay for an improvement in services than they were currently availing and 48 percent were unwilling for improvement in their services. While those who did not have services provision but were willing to pay comprised of 29 percent and the rest 11 percent did not bothered provision of services at the highest cost.

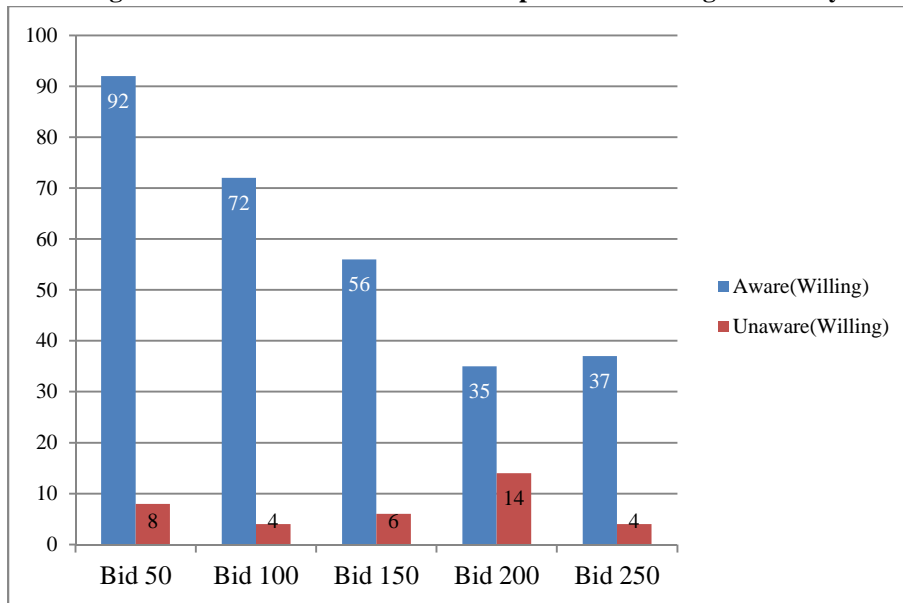
The negative sign of the variable and reduction in adoption for services depends on the perception of the respondents who believe that the available service provider is good will be less willing to pay than those who perceive the available services as bad. By an overview of the graph one can easily draw the conclusion that the respondents to whom the services are available they are willing to pay the lower

bids for improvement up to a certain price but as the price increases for the average bid price the response of unwilling for improvement increases. This verifies the law of demand for solid waste management services. Altaf and Deshazo (1996) verified that households consider solid waste services as a normal economic good with its consequences for household welfare.

Environmental Awareness Response for Willingness to Pay:

This graph shows percentage of people who are environmentally aware and willing to pay the proposed bids, and those who are unaware but are willing to pay for better environment surrounding them. The environmental awareness⁵ means a bit of knowledge regarding the issues of environment and individuals concerns and response to those problems solution. The Y-axis shows two bars one showing the percentage of respondents environmentally aware and WTP, while the other one shows the percentage of respondents environmentally unaware but WTP for the offered services. The X-axis shows the offered bid prices for the services.

Fig. 2. Environmental Awareness Response for Willingness to Pay



This graph about the environmental awareness and willingness to pay for waste management services show that for the lowest bid of Rs 50 per month the response of willing persons is fairly large 92 percent are aware and willing to pay, and the rest 8 percent unwilling to pay are environmentally unaware. When the

⁵In your opinion is waste management an environmental problem?
Do you know how your service provider disposes your collected waste?
Are you concerned about the disposal methods of the service provider?

second bid of Rs 100 per month is offered the percentage of willing and aware people is 72 percent, only one percent of the aware respondents are unwilling to pay, while the rest unaware 4 percent of the respondents are willing to pay for the services, but 23 percent of them are unwilling to pay. For the next bid of Rs 150 per month the percentage of aware and willing respondents remained 56 percent and only 2 percent are unwilling to pay. The rest in unaware respondents 6 percent showed willingness to pay, while 36 percent of them are unwilling to pay for those services. For the second last bid of Rs 200 per month offered as services charges 35 percent of the respondents are aware and willing to pay, and only 4 percent are unwilling. The remaining are the unaware respondents from these 14 percent are willing to pay, while 47 percent refused to pay. The final bid of Rs 250 per month the percentage of aware and willing respondents is 37 percent and 11 percent of these aware respondents are unwilling to pay. The unaware respondents comprise of 52 percent, out of them only 4 percent are willing to pay and the rest are unwilling to pay.

The graph clearly shows that the percentage of even aware respondents drops as the bid price increases, there is another process going on that the percentage of aware but unwilling to pay respondents increases by a smaller proportion but this shows a negative relationship of willingness to pay with increase in price for charges. If the respondents are more aware about the environment then they would know the benefits of such provision of services, and it is anticipated that they will have more environmental demand.

Income Groups Response for Willingness to Pay:

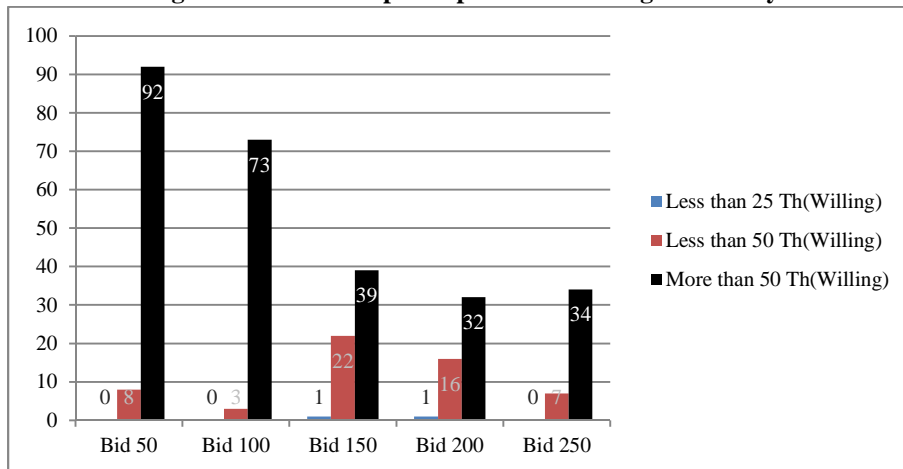
The descriptive analysis of income group and willingness to pay for solid waste management services has a vital position in the analysis because we are dealing with the price of a service that is being offered and respondents shows their willingness and unwillingness regarding their income position and other characteristics. No doubt other characteristics influence the respondents willingness to pay, but regarding our study area the economic situation of the region is extremely unstable and there exists double digit inflation rate, and low employment rate. Due to these factors the respondents choose the best option insight, because a low income earner and owner of a large family would think twice to pay for solid waste management services despite the fact that he can buy something of greater value to him.

In this graph the per month income of the respondents are divided into three different levels⁶, those earning less than or equal to 25 thousand are included in the first income level, the respondents earning more than 25 thousand and less than or equal to 50 thousand are included in the second income level and those earning more than 50 thousand are included in the third income level.

⁶ First income group: Earning less than or equal to 25 Th.

Second income group: Earning more than 25 Th. and less than 50 Th.

Third income group: Earning more than 50 Th.

Fig. 3. Income Groups Response for Willingness to Pay

For the first bid of Rs 50 per month there is not any respondent from the first income level willing to pay for the services, there are 8 percent respondent from the second income level willing to pay for these services, regarding the third income level the elite class of the society 92 percent respondents of this income level are willing to pay this price. The second bid price offered of Rs 100 per month the response from the first income level respondent received as 10 percent of the respondents are unwilling to pay and no one is willing in this group. From the second income level only 3 percent respondents are willing to pay and 14 percent are unwilling to pay this price. And the rest 73 percent forming the third income level respondents are willing to pay this price also. For bid price of Rs 150 per month the first income level responded that 1 percent are willing to pay and 27 percent are unwilling to pay, the second income level responded that 22 percent of the respondents are willing to pay and 10 percent of them are unwilling to pay, the remaining 40 percent forming the third income level of these 39 percent are willing to pay and only one percent are unwilling to pay this price for solid waste management services. For the bid offered Rs 200 per month from the first income level there is only one percent willingness and 33 percent respondents are unwilling to pay, from the second income level there are 16 percent respondents willing to pay and 18 percent are unwilling to pay for such services, the rest 32 percent comprising the third income level respondents and all of them are willing to pay this price. The highest bid offered of Rs 250 per month for this the response of first income level is that 7 percent responded unwillingness to pay and none willing, from the second income level 7 percent respondents are willing to pay while 45 percent responded unwillingness, from the third income level 34 percent respondents are willing to pay this highest bid and only 7 percent showed unwillingness to pay for such services.

The graph shows that the respondents from the first income group are mostly unwilling to pay and they do not prefer such services, regarding the second income level overall for all bids there are only 11.6 percent respondents willing to pay, and

from the third income level for all the bids overall 54 percent respondents are willing to pay. This analysis shows the positive relationship between income and willingness to pay, as income level increases the percentage of respondents willing to pay also increases.

The responses for other important variables in Table 1 are shown with overall percentages which are discussed as; the response of willingness to pay was found against male and female respondents which showed that 46 percent males were willing to pay while 18 percent were unwilling to pay, and 19.6 percent females showed willingness while 16.4 percent showed their unwillingness. The environmental awareness of the respondents was checked as 42.2 percent males were aware and 21.8 percent were unaware, for females 19.8 percent showed awareness and 16.2 percent showed their unawareness, this means that the community has overall environmental awareness. The percentage values for house ownership and willingness to pay shows that house owners are willing to pay for improvement because of the fringe benefits of improvements. The percentage values for different age groups⁷ and willingness to pay shows that the first age group is more likely to pay for the improvement in environmental quality because of their awareness about environmental threats posed by improper waste management than the other age groups and aged group is more unlikely willing to pay because of the perception they may have that these services should be provided by the government free of charge.

Table 1

Cross Tabulation of Variables

WILLINGNESS TO PAY			
% Male WTP	46	% Female WTP	19.6
% Male Un WTP	18	% Female Un WTP	16.4
ENVIRONMENTAL AWARENESS			
% Male Aware	42.2	% Female Aware	19.8
% Male Unaware	21.8	% Female Un-aware	16.2
HOUSE OWNERSHIP			
% Owner WTP	49.4	% Non-owner WTP	16.2
% Owner Un WTP	10.6	% Non-Owner Un WTP	23.8
WILLINGNESS TO PAY			
1 st Age Group WTP (20-30)	44	1st Age Group Un WTP	19
2 nd Age Group WTP (30-40)	10.6	2 nd age Group Un WTP	11
3 rd Age Group WTP (40-65)	11	3 rd age Group Un WTP	4.4
ENVIRONMENTAL AWARENESS			
1 st Age Group Aware	41.8	1st Age Group Unaware	21.2
2 nd Age Group Aware	10.8	2nd Age Group Unaware	10.8
3 rd Age Group Aware	5.4	3rd Age Group Unaware	10

⁷First age group: 20 – 30 years of age.

Second age group: 30 – 40 years of age.

Third age group: 40 – 65 years of age.

The percentage values for environmental awareness and different age groups shows that the young age respondents have more environmental awareness than the others this may be the reason because of the literature available to them on current environmental issues, the percentage of aware respondents is very low in the third age group as they may not consider it important.

We can conclude from the explanation of the graphs and percentage values indicate a specific relationship between the variables and change in the socio-economic characteristics of the respondents. The values for sex and willingness to pay show that for the initial bid prices a large percentage of females are willing to pay than males. But, at higher bid prices male respondents are more willing than female respondents. This may be because our society is male dominant society and at most they are the earning hands in the households, they may have the dominancy in ultimate decision for adoption of permanent services. This may be because a large portion of the respondents are male being a religious society females avoided interaction or response in such surveys.

The values for house ownership and willingness to pay clearly show that those living in their own house are more willing to pay than those who are living temporarily in the locality. This may be because people living permanently in a locality wish a cleaner and healthier environment for themselves and future generation. Such an activity also increase the property value of that area and the surrounding area, they may also enjoy increase in their property value and wealth. The figure for income groups and willingness to pay clearly shows that the greater percentages of the higher income group are willing to pay in each bid price than those of the lower income group. The results for higher income groups are consistent with economic theory that income is positively related with demand in general and the same is for demand of an environmental goods or services, and the demand for services decreases as the bid price increases. Altaf and Deshazo (1996) verified that households consider solid waste services as a normal economic good with its consequences for household welfare.

3. METHODOLOGICAL FRAMEWORK

This section briefly discusses the effect of socio-economic factors on willingness to pay of the respondents. The prior objectives in willingness to pay survey are to calculate mean willingness to pay and estimating parametric model to allow inclusion of respondent's socio-economic factors in to WTP function. Inclusion of individual's socio-economic characteristics into the CVM helps to gather the information on validity and reliability of the CVM results and increase confidence in practical application of results obtained from the CVM empirical analysis.

3.1. Logit Model

Accordingly, the logit regression function for willingness to pay as used by Lal and Takau (2006) to estimate willingness to pay in Tonga and Arene and Mbata (2008), Chuen-Khee and Othman (2010) used logit regression analysis for capturing

the effects of determinants of the farmers for their willingness to pay for the use of metropolitan organic waste as manure. Logit regression analysis is specified as considering WTP as dependent variable and other variables being independent variables are explained as under;

$$WTP = f(S_BIDS, AGE, EDU^*, M_STAT, H_SIZE, SEX, H_OWN, W_SER, INCOME, E_AWR)$$

Where;

(WTP) Willingness to pay, the dichotomous choices of the respondents taking value “1” for yes and “0” otherwise. The independent variables of the model includes (S_BIDS) Starting bids, bid prices are offered i.e.; Rs 50, Rs 100, Rs 150, Rs 200, Rs 250 per month. This variable is expected to have inverse relation with WTP. (AGE) recorded in years and is expected to have a negative relationship with willingness to pay. (EDU*) Education level, this is further specified as bachelor, master or higher level of education. (M_STAT) Marital status, for respondent being married “1” and otherwise “0”. This is expected to have a positive sign with willingness to pay as the married couples may be more concerned about the health of their offspring’s and family members. (H_SIZE) House hold size, this variable is expected to have a negative sign with WTP. (SEX) The entries for this variable are made by coding the response as “1” for male and “0” for female. It is expected that females would be more willing to pay than male respondents. H_OWN House ownership, as “1” for owning the house and “0” for non owners. A positive sign is expected for the owners for that of willingness to pay. (W_SER) Waste collection services, this variable is to extract the data for currently availability or non-availability of services as “1” for availability and “0” for non-availability of waste collection services. It is expected that those respondents who already have collection services and are satisfied from their services will not be willing to pay. (INCOME) in thousand rupees per month, a positive sign is expected as the income of the respondents increase they will be willing to pay even a higher price for such services. (E_AWR) Environmental awareness, this variable is to show that is the respondent environmentally aware or not as “1” for aware and “0” for environmentally unaware based on different questions to show the awareness of the respondent. It is expected to have positive result with WTP because the society is investing more on education and as the environmental awareness increases the respondents will be willing to pay more for such services.

$$WTP = \frac{1}{1 + e^{\ln zi}}$$

$$\ln zi = \alpha + \beta_0 S_BIDS + \beta_1 AGE + \beta_2 EDU + \beta_3 M_STA + \beta_4 H_SIZE$$

$$+ \beta_5 SEX + \beta_6 H_OWN + \beta_7 W_SER + \beta_8 INCOME$$

$$+ \beta_9 E_AWR + ui$$

3.2. Multiple Regression Model

Multivariate analysis used by Chodhury (1999), Begum, Siwar, Pereira, and Jaafar (2006) for willingness to pay, the multiple regressions function was specified

as the maximum willingness to pay amount mentioned by the respondents is function of the socio-economic characteristics of the respondent, as

$$\begin{aligned} Max_{WTP} = & \alpha + \beta_1 AGE + \beta_2 EDU + \beta_3 M_STAT + \beta_4 H_SIZE + \beta_5 SEX \\ & + \beta_6 H_OWN + \beta_7 W_SER + \beta_8 INCOME + \beta_9 E_AWR + ui \end{aligned}$$

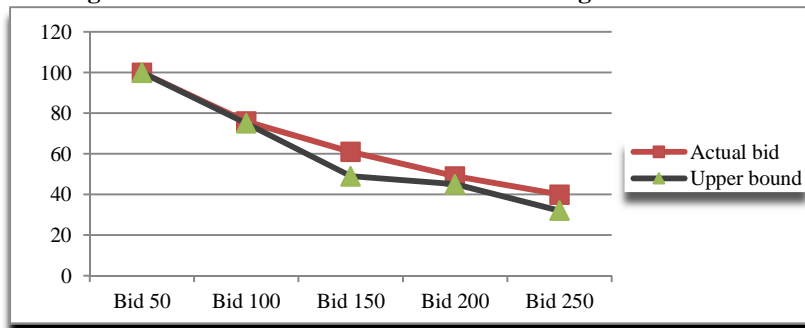
Max_{WTP} = Maximum willingness to pay, this variable is used for the open ended question in questionnaire, which accounts for the maximum amount the respondents are willing to pay for waste management services. Other variables as AGE, EDU, and M_STAT are already defined and the expected signs of the variable are also discussed earlier.

μi = The random error term, also known as disturbance term is used to capture the unobservable affect of particular variables. This also accounts for the data errors, no doubt how good the model is specified, there always exists chances of error. This error term is normally distributed with 0 mean and has a constant variance.

4. RESULTS AND DISCUSSION

While estimating the demand for the solid waste management services the responses for five proposed bids for improvement project are mentioned. To evaluate whether the increase in price for services affect demand for these services or it is non-responsive to such price increase. The graph presented shows the stating bids offered to the sets of respondents on x-axis while the percentage of “yes” and “no” responses are represented on y-axis of the graph. This clearly shows that the yes response for the waste management services decreases with each successive increase in price offered. Karen and James (2004) and Adamowicz, Dupont, and Krupnick (2005) also varified that by this means we get the conventional downward sloping demand curve. As this can also be verified from our logit model estimation result as the variable introduced as “S_BIDS” (starting bids) is negatively related to willingness to pay, and is significant. The following graph shows the demand curve for solid waste management services. The X-axis of the graph shows the Starting bids offered to the respondents, while the Y-axis of this graph shows the percentage of respondents willing to pay the specified bid price offered.

Fig. 4. Demand Curve for Solid Waste Management Services



When the bids starts from the lower price at Rs 50 per month the whole set of respondents i.e.; 100 percent of the respondents are willing to pay this lowest amount for solid waste management services. Then the bid price is increased to double the inertial amount previously offered the next set of respondents are asked for Rs 100 per month, so in this set 76 percent of the respondents showed their willingness for paying this amount while 24 percent were unwilling to pay Rs 100 per month. Further, the bid amount is increased to find the percentage of respondents willing to pay an amount of Rs 150 per month for management services, in this set 61 percent of the respondents showed their willingness while 29 percent showed their non willingness for this offered price. Once again the offered price was increased to Rs 200 per month, at this increased price the percentage of respondents willing to pay dropped to 49 percent and the percentage of respondents unwilling to pay rose to 51 percent, showing that people are unwilling to pay a high price for solid waste management services. For further analysis the price was increased to Rs 250 per month and with this increase in price the percentage of respondents willing to pay dropped to 41 percent and the percentage of respondents unwilling to pay rose to 59 percent. This confirms that an increase in the price for waste management services will substantially reduce the demand for such services. The upper bound demand curve shows the response for the upper bound that is double the initial offered price for which the response is even less willing rather than the offered price. This phenomena is also in line with the theory of demand as the price for (solid waste management services) increases, demand for these services reduces.

4.1. Determinants of WTP Using Logit and Multiple Regression Model

The factors responsible for willingness to pay and maximum monetary amount peoples willing to pay for solid waste management services are presented in subsequent section. Variables along with their significance level are shown in Table 2. Gujarati (2004) interpreting the given regression results each of the slope coefficient shows the partial slope coefficient and measures the change in the estimated logit for a unit change in the value of the given regressor while holding other regressors constant. A more meaningful interpretation is in terms of odds, which are obtained by taking antilog of the various slope coefficients.

Thus in the regression results the E_AWR (environmental awareness) has coefficient value of 51.084, which shows that if the E_AWR within the respondents increase by one unit, on average the MAX_WTP increase by 51 units. This variable shows positive relation between environmental awareness and maximum willingness to pay and is also significant at 5 percent and 1 percent level of significance. A more meaningful interpretation in terms of odds is, by taking antilog of the coefficient of E_AWR which gives us 6.6726. This suggests that if respondents are environmentally aware are more than 6 times likely willing to pay for such services if they are environmentally aware than those who are not aware.

This show that the environmentally aware people are willing to pay and it also increase concern about their surrounding environment and esthetic beauty. In accordance to theory and logic they will be aware of all the threats, diseases and damages that are caused because of improper management. To have such sort of activities we need to aware our population.

Table 2

Logit and Multiple Regression Results for the Determinants of Willingness to Pay

Dependent Variable: WTP					
Variable	Logit Results			Multiple Regression Results	
	Coefficient	Odds Ratio	Prob.	Coefficient	Prob.
AGE	-0.064958	0.937107	0.2531	-0.315618	0.7067
B_A	4.055121	57.69214	0.0036*	56.68003	0.0084*
M_A	7.082819	1191.322	0.0001*	97.44190	0.0003*
SER	-1.474161	0.228971	0.0803	-16.11761	0.2502
SEX	1.684247	5.388392	0.0781	-1.768804	0.8879
E_AWR	1.898011	6.672609	0.0393*	51.08488	0.0052*
H_OWN	0.568964	1.766436	0.4735	-13.73659	0.2959
H_SIZE	-0.822832	0.439186	0.0039*	-11.95707	0.0055*
M_STAT	3.391103	29.69869	0.0352*	-30.61121	0.0776
INCOME	0.000144	1.000144	0.0006*	0.004363	0.0000*
S_BIDS	-0.049299	0.951896	0.0000*	-----	-----
C	1.395239	4.035939	0.6681	94.08432	0.0202*
Logit Mean dependent variable	0.654000	Mean dependent variable	289.1500	R-squared	0.577792
McFadden R-squared	0.897780	Durbin-Watson statistics	1.992912	Adjusted R-squared	0.569157

As Hagos and Mekonnen (2009) also revealed that awareness of the respondents has a significant positive relationship with willingness to pay for solid waste management, this show that the variable of environmental awareness is effective in this study which is highly significant and positively related with willingness to pay for solid waste management services.

The variable ladled as H_SIZE (Household size) has a coefficient value of – 11.957, which show that if the household size increases by on unit, on average the MAX_WTP reduces by 11.96 units and is significant with negative relationship the effect of H_SIZE is significant at 1 percent and 5 percent level of significance. In terms of odds interpretation antilog of the coefficient is 0.4392 this result suggests that if the respondent's household size increases they are 0.43 times unwilling to pay if such services are offered. This shows a negative relationship between household size and willingness to pay; as the household size increases their willingness to pay reduces. This could be because the responsibility of proper management of their produced waste may be the responsibility of a member and they do not need the services of a private organization. The other reason can be that their disposable income may only fulfil their day to day needs and they do not have enough money to higher such services.

The M_STAT (marital status) in terms of odds interpretation antilog of the coefficient is 29.6986 this result suggests that if the respondent is married are more than 29 times likely willing to pay for such services than those respondent who are unmarried. These results can also be interpreted in form of percentage change in the odds⁸ but here only the odds are explained to avoid confusion. The significance level of this variable is also high. This show a positive relationship between marital status and willingness to pay, the respondents who are married are willing for such services than those who are unmarried. This may be the reason for their concerns about their family's health; they may not have the enough time to properly manage their waste.

Flex and Olorunfemi (2009) found that marital status have affect on willingness to pay but that affect was insignificant in their study, this shows that the positive and significant effect of marital status is sound in this study.

The variable of household monthly income laded as INCOME has coefficient value of 0.004363, if all other variables are kept constant it shows that if income of the respondents increase by one unit, on average the MAX_WTP increase by 0.004363 units. This effect of this variable is significant at 1 percent, 5 percent and 10 percent level of significance but its contribution is very low. In terms of odds interpretation antilog of the coefficient is 1.00014 this result suggests that if the income of the respondent increases they are more than 1.00014 times likely willing to pay. This shows that respondents with higher incomes are willing to pay and higher such services.

The results by Khorshiddoust (2004), Hagos and Mekonnen (2009), Viniegra *et al*, (2010), Lal and Takau (2006) showed a positive correlation between income and willingness to pay in their study, verifying the validity of this variable's result in this study. Begum *et al*, (2006) showed that contractors with higher paid up capital i.e., having high income returns showed a higher willingness to pay for solid waste management. This shows a positive relationship between income and willingness to pay for solid waste management services.

The variable in the regression results labelled as S_BIDS (starting bids) is an important variable for this study as five different levels of starting bid were offered to sets of respondents and their responses were recorded, as the hypotheses are formulated on this variable. This variable has the coefficient value of -0.04929 , this shows that if other variables are kept constant and S_BIDS increase by one unit the willingness to pay will reduce by -0.0493 units. This shows a negative relationship between starting bids and willingness to pay. This verifies that as the value of the bid increases the ratio of people willing to pay decreases. And the effect of this variable is also highly significant. In terms of odds interpretation antilog of the coefficient is 0.9518 this result suggests that if the value of bid offered increases the respondents are 0.9518 times unwilling.

⁸For percentage change in odds, if we take the antilog of the j th slope coefficient, subtract 1 from it, and multiply the result by 100, we will get the percent change in the odds for a unit increase in the j th regressor.

Similar response also shown by Belhaj (2003) and Gunatilake, *et al.* (2006) confirm that WTP for improved water services will decrease as the monthly water bill increases. Similarly, higher connection costs reduce WTP.

Regarding the education of the respondents this variable was split into different levels of education as otherwise the effect of highly qualified and low qualified respondents could not be differentiated. So two levels of education were specified as, variable B_A specified for respondent who responded as 13 – 14 years of education. The level of education M_A specified for respondents having 15+ years of education. education⁹ as B_A and M_A in order to capture the effect of lower and higher education on the maximum amount of respondent's willingness to pay. The first level of education B_A has coefficient value of 56.68003 this shows that if all other variables are kept constant, as respondents with B_A level of education increases by one unit, on average the MAX_WTP goes up by 56.68 units. And this variable is significant at 1 percent level of significance. Likewise M_A has coefficients of 97.441, showing that as the respondents with M_A levels education increases by one unit, on average the MAX_WTP increases by 97.44 units. Both the variables are significant at 1 percent level of significance. These results show that education level is an important determinant of willingness to pay. In terms of odds interpretation antilog of the coefficients of B_A and M_A are 57.69214, 1191.322 respectively this result suggests that as the respondent's level of education increases the ratio of their willingness to pay also increases. As the second level of education M_A with coefficient of 1191.322, showing if this level of education increases by one unit willingness to pay will increase by 1191.322 times. And this variable has a high significance value.

In the studies conducted by Khorshiddoust (2004), Lal and Takau (2006) also showed a positive correlation between education and respondents willingness to pay. Rahman, *et al.* (2005) theoretically explained that the participation of people for solid waste management in higher income areas is high while the participation in lower income areas is low, which shows correlation of income with participation for solid waste management. This shows that as a whole the level of education has a positive relationship with willingness to pay, as the level of education increases the people are willing to hire such services. This result is also in line with the theory and other research results.

The AGE coefficient of -0.3156 indicates that with the influence of other variables held constant, as AGE increases, say, by a year, on average, MAX_WTP goes down by 0.3156 units. This variable shows a negative relationship between age and maximum willingness to pay for services. In terms of odds interpretation antilog of the coefficient is 0.9371 this result suggests that if the respondent's age increases they are 0.93 times unwilling. This shows a negative relationship between age of the respondents and their willingness to pay. This may be because these services were not priced before and they are of the opinion that even now these should be offered free of cost. Or the aged people may not be aware of the severity of the environmental and health problems caused by miss management of such waste.

⁹B_A = Bachelors, M_A = Masters.

As evident from Niringiye and Omortor (2010), Hagos and Mekonnen (2009), Viniegra, *et al.* (2010) also suggests a negative relationship between age of the respondents and willingness to pay for solid waste management suggesting validity of this variable.

The variable SER (services availability and non availability) has the coefficient value of -16.117 , if all other variables kept constant it shows that if services availability to the respondents increase by one unit, on average the MAX_WTP reduces by 16.11 units. But the affect of this variable is insignificant. In terms of odds interpretation antilog of the coefficient is 0.22897 this result suggests that if the respondent already has the availability of collection services are 0.22 times unwilling to pay if collection services are already available. This could be the reason because the respondents who have these services some of them are satisfied and some are not satisfied. The negative relationship of services availability to that of willingness to pay is reasonable but the insignificant effect may be due to the respondents to whom services are available but they are not satisfied with the existing services quality and they are also willing to pay or hire such improved services.

The other variables included in regression analysis like SEX (sex of the individual) and H_OWN (house ownership) has the coefficient value of 1.6842 and 0.568964 respectively; these variables have insignificant effect but shows positive relationship. The major reason behind is that majority of the respondents are male and the female respondents are very less because we have a strict religious society and women are not allowed to interact with outsiders. Another restriction is our cultural values which are unavoidable. This may be due to the reason that some of the respondents who do not own the house they are living in are also willing to pay for such services because they have some environmental awareness and are concerned about the problem.

While interpreting the intercept of the logistic regression estimate when all variables in the model are evaluated at zero, the log-odds for willingness to pay for services and improvement in environmental quality is 1.395. If the values of other predictors were mean-centred, the intercept would have a natural interpretation: the expected log-odds for willingness to pay for services and improvement in environmental quality with an average value of other predictors. And the intercept of OLS estimates is the predicted value of MAX_WTP when the values of other predictors are set at zero, as in this case, if the values of all other predictors are set to be zero we would have value of 94.08 for MAX_WTP.

The Durbin–Watson d value is closer to 2 suggesting that there is no issue of “autocorrelation” in the model. The value of coefficient of determination i-e 0.58 indicates that the fit is good, and 58 percent of the total variations in willingness to pay are explained by the included explanatory variables.

The model estimated mean MAX_WTP is Rs 289.15 per month, this suggest that if this amount is charged in the city from population mentioned in 1998 census that was 805,235 and projected increase estimated population in 2011 that of 1.70 million (1,700,000) the household average size is 4 households per house, that leave

us with 425000 households. So the private organisation would collect fair revenue of Rs 122,888,750 (one hundred twenty two million, eight hundred eighty eight thousand, seven hundred fifty) per month. The authority is charging a flat rate of disposal charges which needs to be revised through proper research technique by covering the whole city to figure out the proper waste disposal fee by ensuring a proper visible improvement in the locality and proper disposal of the collected waste. Even the current budget document does not offer any improvement for the waste management problem in the city.

5. CONCLUSION AND RECOMMENDATIONS

Due to the enormous growth of educational sector, ease for education and continual information people are more aware and concerned about their waste disposal and environmental quality. However, there always exist loop holes in the provision of services for provider. A contingent valuation survey was conducted in Islamabad for people's willingness to pay for improved waste disposal services and improvement in their environmental quality. The estimation results for logit regression showed that 65.4 percent of the respondents are willing for the proposed scenario, through which the environmental situation of the region can be improved. The second regression model results showed a mean willingness to pay of Rs 289.15 per household per month and the determinants like age, services availability, and household size of the respondents showed negative relationship, while other variables like education, environmental awareness and income of the respondents showed a positive relationship with MAX_WTP. These results precisely answer our stated research questions and verifying evident theoretical background. The logit results shows people's concern about the environment while the regression results show a potential for cost recovery and revenue generation through provision of such services.

Recommendations

Based on the findings of the study, the following points are recommended:

- The logit regression result reveals that 65.4 percent respondents of the sample population are willing to pay for solid waste management services and an improvement in environmental quality. So the services should be provided to improve the environmental situation in the region.
- With the existing poor infrastructure and low charged waste management services provision, it is extremely difficult for authorities to recover the cost of provision and maintain the bench mark waste management practices in Islamabad. Active participation of the community is of prime importance.
- The regression estimated MAX_WTP gave an average willingness to pay value of Rs 289.15 per month per household. If such charges are properly collected the government would be able to properly handle the situation. This process would be cost recovery and revenue generating for the government.

- Our study reveals that there is positive relationship between the respondent's incomes, education levels, environmental awareness and willingness to pay for solid waste management services and improvement in environmental quality; any policy targeted to improve willingness to pay will be ineffective until these socio-economic characteristics are not improved. The policy makers should target these agents to gain required enhanced results.
- The solid waste management services can easily be privatised as those like water and sanitation services. By announcing the privatisation of the sector and bidding process of contracting for specific period will create competition in the market and improve efficiency.
- The privatisation should be tested through a pilot project by involving a few sectors and closely monitoring the projects efficiency. This can easily be expanded all the way for the whole city.
- There is greater urgency to overcome organisational problems, enforcement of such projects and incentives for the employees and households to make the project successful.
- Collection of solid waste through community participatory approach that is the responsibility is mutually shared by the community; this will reduce operational cost, ensure timely collection, transportation in general and specifically proper waste management.

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