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### WILLINGNESS TO PAY FOR THE IMPROVEMENT IN SOLID WASTE MANAGEMENT (SWM) IN SHEIKH COLONY PAF ACADEMY RISALPUR

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## ABSTRACT

A growing quantity of solid waste is one of the most important environmental hazards prevailing in developing countries. It is difficult for the government in developing countries like Pakistan to rectify it properly due to a scarcity of resources. This study was undertaken to quantify public willingness to pay and find its determinants. This paper is based on a household survey conducted in Sheikh Colony in PAF Academy Risalpur in October 2016. Results indicated that the majority of the sampled respondents were willing to pay for better solid waste management (SWM) services. The results further showed that the size of the household, Income, and age of respondents were the important determinants of their willingness to pay for better Solid Waste Management services.

**Key Words:** Willingness to pay, solid waste management, survey, primary data.

### 1. Introduction

Waste management includes all actions from the point waste is generated to when it is disposed of. Solid waste management involves collecting and disposing of solid materials that households find redundant after use or no longer need. Improper disposal of municipal solid waste can lead to unhygienic conditions in communities. Poor waste management can cause many diseases, especially those spread by rodents and insects. Managing solid waste at various levels is a challenging task. Solid waste management competes for limited resources with other community services at the local government level. A clean environment in communities reflects a healthy lifestyle and development (Yedla and Kansal, 2003).

In ancient societies and even today in the less developed countries, solid wastes are left in open areas. Dumping and throwing the solid wastes into the rivers is still posing a huge challenge for many municipalities around the globe. In the late 20<sup>th</sup> century, the consequences of the solid waste were slowly started to be recognized. This recognition of the negative consequences of the solid waste materials resulted in various ways of disposing of them. Machineries like garbage grinders, compaction trucks, and regular collection systems were introduced. It was found that the open dumping and burning of solid waste were causing problems of pollution, endangering public health. This realization led to the development of sanitary landfills. Landfills were developed away from the nearby communities, and they were properly managed and monitored.

Modern solid waste management entails that the solid wastes are separated at the source level and to encourage the recycling. Many factors are responsible for the acceleration of the solid wastes such as urbanization, industrialization, changing consumption pattern and also affluent life style. This trend has

been a big challenge for many underdeveloped countries as they try to minimize the consequences. Solid waste management poses a significant threat to many communities in Pakistan. Although, there are policies that are in place in regards to the safe disposal of solid waste management, yet there is a lack of implementation and many communities still have open dumping practices to get rid of them solid waste management.

Many communities in Pakistan have manual sweepers employed to collect the solid wastes from the streets and others collect in an informal way the household wastes. There is no uniformity of policies in collection the wastes both at the households and firms levels both collect waste at their own choice of bins in Pakistan. There are not standardized waste bins to collect and separate wastes in different types of bins. Huge bins in main cities are placed along the roads. The accessibility of those bins are far from houses and commercial areas making them rarely useful for waste disposal. Garbage bins from municipalities are placed far from the households and usually on major roads, making them inaccessible for common households. Therefore, the wastes ends up either in empty plots or streets.

Solid waste management (SWM) involves many activities. Firstly, solid waste is collected from the source of its production. Secondly, solid waste is loaded into the transport vehicles for disposal at the predetermined landfill sites. Solid waste segregation can be done at the source of production, collection point or right at the landfill site. These stages are not properly supervised or monitored in most of the developing or under developed countries. Many inefficiencies are usually observed in solid waste management system due to lack of coordination in the various departments involved in managing it. Economic approaches based on the market efficiency have been tried as a remedy to the poor efficiency ridden practices (Yedla and Kansal, 2003). Many factors such as high population growth and urbanization, industrialization and high living standards are responsible for the solid waste in developing countries (Minghua et al., 2009). Local governments are usually responsible for the management of solid wastes but they are overstretched due to the lack of human and financial resources (Sujauddin et al., 2008). Their inability of the proper management of the solid waste is due to organizational mismanagement, and complex multi-dimensionality (Burntley, 2007).

Many countries uses different tools to dispose off their solid wastes such as dumping in an open area, landfills, composting and various forms of recycling. landfills are most commonly used which are designed according to solid engineering and environmental standards with a view to get rid of the wastes with a minimum effects on human health and environment. Composting involves aerobic method to decompose solid wastes. Microorganisms existing in the waste bio-stabilizes the organic matter to work as a soil conditioner. Composting helps in reducing

odor, fl to list a few. Composting organic materials also helps in reduction in leaching of the solid wastes and other contaminants into the water resources. Composting also advances soil fertility, the capacity to hold water over a long time. Solid wastes may have a large quantities of recyclables such as paper products, plastics, glass and metals which can be recycled, and later used that can result in reducing the wastes and can also fetch a significant salvage and resale value. It can also results in saving natural resources such as forests, minerals by turning the existing wastes into useful commodities (Elagroudy, Elkady, and Ghobrial, 2011).

### **Objectives:**

1. This study will review the existing municipal solid waste practices to manage the wastes in the town of Risalpur.
2. To estimate the impact of various economic factors on respondent's willing to pay (WTP) for an improvement in the management of solid waste system in the town of Risalpur.

### **2. Review of Literature**

This chapter reviews in detail the existing literature on solid wastes management. This chapter will cover the existing practices of managing solid waste in various countries as well as provide the willingness to pay estimates related to the improvement of solid waste management system.

Khattak and Amin (2013) studied the solid waste management (SWM) in Peshawar city, Khyber Pakhtunkhwa, Pakistan. They used Binomial Logit Model and collected a data from 25 Union Councils in Peshawar city. A total of 225 households were interviewed to illicit data. Approximately 61 respondents were willing to pay Rs. 200/month for solid waste removal. About 22 households were happy to pay Rs. 300 while 17 respondents were willing Rs. 300. The authors concluded that there are several factors affecting the decision of household towards waste removal. Major factors include; education, income, family size and disease history of family. Approximately, 71 percent of the respondents were willing that the services of waste disposal may be provided by private sector rather than public sector.

Yedla and Kansal (2003) found that the city of Mumbai generates 6256 tons of waste on daily basis. Recyclable portion ranges from 17-20% and even a fraction of that is collected by rag-pickers for recycling. A cost-benefit analysis was performed for the solid wastes management for the city of Mumbai while paying attention to implicit costs and benefits. They reported that the existing solid waste management does not encourage private sector participation. It is pertinent that the active participation of the community and private sector may be sought for an improved management of the solid wastes.

Barmon, Mohiuddin, Islam & Laila (2015) studied the correlation between the factors related to socio economic variables of the individuals and their willingness to pay for managing solid

waste in Dhaka city, Bangladesh. They collected data through questionnaire. The total sample size was 120. Their targeted areas were Mirpur, Mohammadpur, Banani and Khilgaon where the income level was varying from area to area. The selection was made purposely to fulfill the study requirement related to income. The study confirmed the positive relation between income of the household and their WTP for waste management. It was concluded that in the Dhaka city, there was willing to pay in order to have improved management of solid wastes as well as its enhanced capacity for future.

Khan and Ahmad (2009) studied WTP of urban citizens of Peshawar fir managing solid wastes there. This study used Binomial logit model. The study found an approximate percentage of 49 for showing willingness for paying in order to avail improved management of solid waste. It was also showed that most of the people (53%) responded to be satisfied with the existing solid wastes management system. They found that the household size, their Income and education were the important factors in their WTP for the improved solid waste management system.

Anjum (2013) studied the Solid waste management for the city of Islamabad. A sample size of 500 respondents was chosen through a random stratified sampling technique. The study used a structured questionnaire in which two choice as well as open ended questions were included for finding willingness to pay values from the respondents. The logistic regression estimation revealed various values. It was found that more than 65% respondents were willing to pay for solid waste management with a mean WTP , of Rs 289 per month. The factor effecting in WTP were all demographic like age, education, household income, and environmental awareness. These were positive in their effect.

Guerrero, Maas, Hogland (2012) studied Solid waste management system in 30 urban areas, 22 developing countries across the four continents. The main objective was to find out the stakeholders' action/behavior and other factors that responsible for the determination of waste management performance there. The used secondary data as well as primary data collected through observations and formal interviews from people of expertise in the area. They also undertook a workshop in which the participants were guided for filling questionnaire.

Adewuyi and Oyekale (2013) analyzed the factors affecting the willingness to pay and also estimated the mean willingness to pay in Ogbomoso North and South Local Government Areas of Oyo state. Data were collected with structured questionnaires administered to 140 randomly selected households. Descriptive and inferential statistics were used for data analysis. The results showed that the average willingness to pay per household per month was N1000.6, N260.8, N626 and N299.1 for air-related, human-habitat-related, water-related and land-related environmental problems, respectively. It was found that as the

income of the household increases, the more people become aware and take care of the urban environmental problems. It was found that the environmental education can be imparted through community members and other functional unions in the form of talk-shop, workshop and lectures.

Roy and Deb (2013) presented an improved waste management scenario to the people in Assam. The target population belonged to Cachar District (Silchar municipality) and elicited their willingness to pay response related a better system. The result showed that a considerable number of people (63%) were willing for paying in order to avail better solid waste management system. The waste management was considered an environmental issue by the people of the area and had shown willingness to pay in order to have appropriate disposal of it. They used Contingent valuation method for this purpose while making an open ended response. Regression analysis was performed with WTP as depended variable. People having more expenditure; used as proxy for income, were found to be willing for paying in order to avail better waste disposal. The result approve of environmental economic theory which states that income is positively related to WTP for improved environmental quality. There was also found a positive relation between willingness to pay and awareness, WTP and education and WTP and presence of working women in the family.

Catherine (2010) carried out research on the difference between WTP and WTA. They based their research on commitment costs theory. The result showed that the combination of the theory of commitment cost and simple behavioral differences gives an understanding of the causes and ruthlessness of the inequality of WTA and WTP. The behavioral differences were found to diminish with market experience. They argued that no value gap exists for those having enough experience.

Ezebilo and Animasaun (2011) worked on the WTP of the households for services of private companies for solid waste management services. They used CVM for collecting data. The sample size consisted of 224 households of Ilorin (South West Nigeria). They used Tobit model as well as least absolute deviations model. It was found that there was willingness to pay (of annual income) of above one percent for private service. The factors affecting this WTP amount were education, income, household occupancy and house types and sanitary inspector's actions. They found that the censored least deviation model is far better than the Tobit model. They suggested following the results of the research for betterment of waste management system in the sampled region as well as where applicable.

Mustafa, Ahmed and Haq (2014) worked on willingness to pay as a proxy for household' demand for better environmental services. They followed contingent valuation method for finding WTP. The main objective of their study rested on finding those

factors which effect willingness to pay of households in order to attain improved services for solid wastes management. The study applied regression methodology by logit approximation in binomial form.

The CVM was applied in order to know what the household prefer for living better life and its standards. It also directed at finding the factors that determine WTP by households in order to acquire better environmental services via SWM services. It was found that awareness, Education of HHs, income of HHs, location of the households and HH size significantly affects willingness to pay be the households. It was concluded that household's willingness to pay was conditional upon adequate services.

Elagroudy, Elkady and Ghobrial (2011) undertook a study in Basrah to find out the situation of solid wastes there. The management of solid wastes was not uniform there. Only some wastes were disposed properly while the rest was dumped in uncontrolled manner. The research focused on not only economical aspects but its focus was also on technical and environmental aspects as well. These aspects were compared to know which is the most appropriate. They selected three other scenarios. The first scenario disposing wastes in a sanitary landfill. The other scenario was the transportation of wastes and then falling in water fall. In the scenario three wastes will be sorted, recycled and composted after which is disposed in landfill as an integrated treatment. They considered the present scenario as a baseline. They found that the economic analysis did not show any improvement in ranking of scenario 3 because of the benefits of the revenue gained by selling of produced recyclables and compost. The benefits of waste recycling from environmental perspectives resulted in positive recognition for scenario 3 and hence scenario 3 was finally recommended. This scenario was also recognized by UNICEF.

IEARN (2011) undertook a study to know the solid waste management systems in Otukp. The target population was households and they studied a case of Wisley high school locality. They used face to face interviews for data collection. The sample consisted of one hundred households. It was revealed that households in majority were concerned about the situations at hand. The environmental condition related to non satisfactory solid waste management there. There was low awareness among residents related to composting and recycling. The satisfaction level was low from the services of Environmental Health Protection Authorities.

Awunyo-Vitor, Ishak and Jasaw (2013) researched the willingness for paying for attaining better waste management services. They selected six hundred respondents via multistage sampling procedure. Regression analysis was employed in logistic format for the determination of willingness to pay amount services for solid waste management. Similarly Tobit modeling was applied for finding the money amount that the households were willing to

pay in order to get better services. It was revealed (by logistic model results) that age, number of children, income, amount of waste and education are the significant factors towards willingness to pay decisions. Similarly, in monetary terms, the WTP amount was affected by income, amount of waste, house ownership, education and number of children. It was asserted that waste collection fee can be increased (from 3GHC to 5GHC) which will result in the waste management systems of the sampled area. It was suggested that while imposing additional charges, income level and location must be kept in mind.

Carson, Flores, Meade (2000) approved of contingent valuation method. They termed it a good mechanism for valuing non marketed goods. They termed it more flexible for estimating total value. But the use of CVM has become debatable in the areas of environmental litigation and benefit cost analysis as a passive use value. They discussed on the validity of a passive use valuation. Their study suggested that CVM method has not complicated issues and can be overcome if study is designed carefully and it is implemented with accuracy. Their research also showed that the claims that the findings of CVM were inconsistent theoretically were not having any support from literature. Their research gave a very good guidance to all those who may use CVM as practitioners and as final users of CVM results.

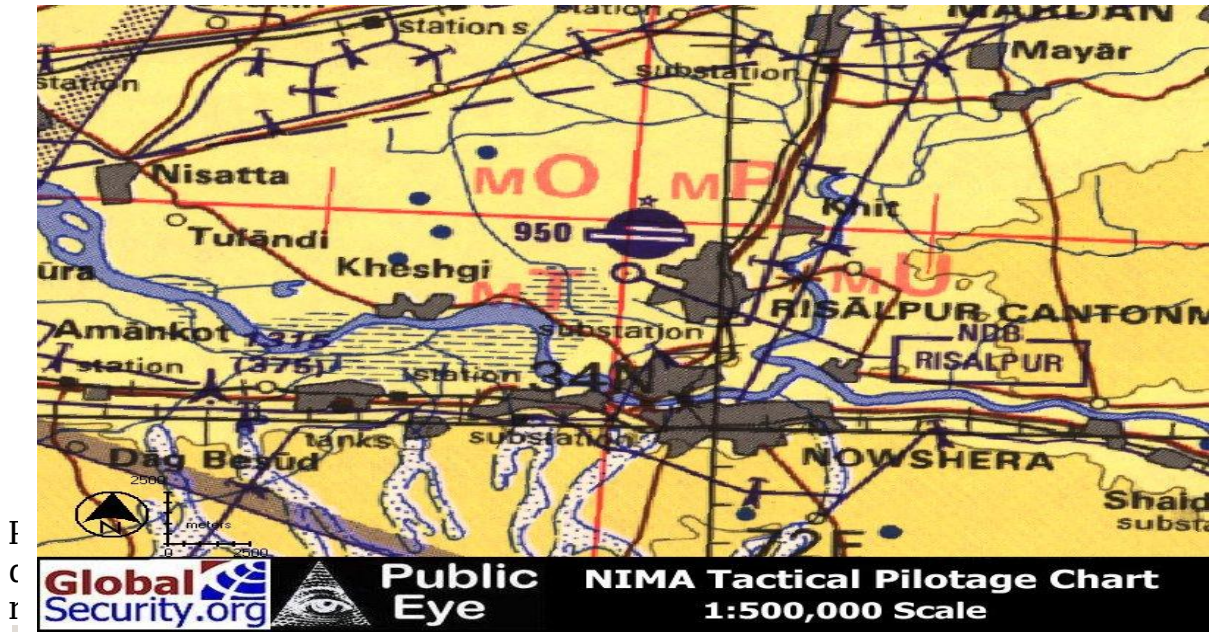
Ojo, Ogoble and Ojo (2015) carried out their research on improved household solid waste management system. The area of the study was Minna metropolis situated in Niger state. Data was collected from 155 respondents using multistage sampling technique. The respondents were divided into two income groups i.e A and B based on the quality of their houses. It was found that about 81.90 percent of the respondents were aware of how to collect cans as the method of waste disposal. Among this about 32.90 percent considered that this method is highly reliable. Multiple regressions were used for estimating the factors which affect the willingness of respondents to pay for waste removal in the study area. About 76.10 percent of the households were willing to pay for waste removal. The result reveals that the majority of the respondents in the study area were willing to pay for their immediate environment. The multiple regression results revealed that income, age, environmental awareness and household expenditure had a positive and significant relationship with the willingness of households to pay for waste disposals in the study area. Household size has insignificant effect on willingness to pay. It was recommended that more waste management services should be provided for the residents of Minna. Further it was also recommended to privatize the waste collection services in order to make it more effective and also the participation of community was recommended.

### **3. RESEARCH METHODS**



### 3.1 BACKGROUND OF THE STUDY AREA:

PAF Academy Risalpur is administered by Air Officer Commanding (AOC). Officer commanding (OC) admin-wing is responsible for managing overall planning, proper sanitation, and garbage disposal within a territorial limit. In this regard, a board of officers is composed and the same is communicated to Air Headquarters Islamabad. The map below represents the geographic location of the study area.



The personnel involved in managing the solid waste is provided in table 3.1. The solid waste is managed by using two tractors trolleys in two shifts (morning and afternoon shift) to collect garbage from almost 250 points in officer's residential area, domestic camp,

class four colonies and technical area. The employees are two supervisors, four drivers for the two tractors shifts. There are 20 labors, 10 work in the morning shift with both tractors and 10 in the afternoon shift with five each with a tractor. Total of 16 labors are utilized for the cleaning of sewage nalas in residential area in two groups. In case of VVIP function the said staff is utilized for the preparation of function as well.

Table 3.1: Sanitary staff in PAF Academy Risalpur:

OC Amin-wing	01
Supervisors	02 (01 for each shift)
Drivers	04 (02 for each shift)
Tractors or trolleys loaders	20 (10 for each shifts)
Nalas cleaners	16 ( in two groups)
Total	43

#### THEORITICAL FRAMEWORK:

Utility is a satisfaction or pleasure derived from consumption. It is a fundamental concept for studying demand and consumer choice. Economics also assumes consumers are rational, means that the consumers use their monetary resources for buying goods and services (in any combination) which leads them to attain highest possible satisfaction.

Marginal utility is the additional amount of satisfaction that an individual derived from consuming an additional unit of a good or service, holding consumption level of other good or service constant. As utility is a fundamental concept for studying demand and demand curve actually shows the consumer willingness to pay (WTP) for various good or services e.g. safe drinking water, improved solid waste etc.

#### WILLINGNESS TO PAY (WTP):

An important concept for studying demand and choice is consumers' willingness to pay. WTP is a measure of how consumer evaluates the worth of various good and services. It uses the monetary amount that an individual is willing and able to pay for a good or services as a measure of the value of good or service to an individuals. WTP assumes that if an individual is willing to pay more for service X than service Y, than service X provides more value to the individuals. Suppose a person provide an opportunity of safe drinking water or live healthy life style by having a low level of solid wastes, than how much a person is willing and able to pay for it is individual's WTP.

There is a direct relationship between WTP and demand. In fact the area under demand curve is a representation of quantities that a rational consumer is willing to procure at each price. This area shows total willingness to pay for a given quantity of the good. The consumer pays for a quantity at a price P which constitutes

total cost of on that product. The consumer had surplus out of the difference between WTP and consumer cost.

The study is based on primary data which has been collected from class four colonies of PAF Academy Risalpur. A detailed questionnaire was developed to take into account all the important variables of public willingness to pay (WTP) for better solid waste management service. In order to achieve the objectives of the study contingent valuation method (CVM) is proposed to be used. The detailed explanation of the CV method is provided as follows:

#### **Contingent Valuation Method (CVM)**

CVM is a methodology that has been used to value goods or services which are not generally traded in the market such as environmental quality, good health, safe drinking water etc. In this approach people are directly asked about their willingness to pay for a good or they are asked that either they are willing to accept it or give it up.

In initial stages of CVM, the mainly asked questions from the respondents were about their WTP. The questions were mostly open-ended. The sample of the open-ended question was, "For what you will be willing to pay the most? **Then the plan** is to create a point estimate for the respondent's WTP. Another approach was Iterative Binding Approach which starts by questioning individuals about the value expressed in money units until a point reaches where the consumer refuse to pay. **This methodology has inherent starting point bias due to which its use has been almost stopped.**

Another Approach called Payment Card Approach was formalized by Cameron and Huppert (1988). This approach is based on opposing a chosen amount based on the point that it is the lower limit for WTP amount of the responding person. This approach does not find WTP directly. WTP is not found directly in this approach. In order to estimate the parameters of WTP and also to predict about respondent expected WTP statistical models were used. The criticism for this method is the mentioned values on the card which may resort respondents to these values only. Though Rowe et al. (1996) showed that needs not to be a concern since the payment card approach remained a popular approach of estimating WTP.

Dichotomous Choice Format is the most widely used approach for estimating a respondent willingness to pay. In this approach a respondent is asked that whether he will pay \$x for a good or not. This is based on either yes or no response. This amount is not uniform for all the people responding. This is termed as bid value. The approach is functional in regular form of the market where prices are expressed in money units and people are free to decide whether to Take the product or leave it. The proposition on ballot in a political market is similar approach. The attribute of this approach is named as incentive compatible on the notion that the people/respondents thinking is about the provision

of goods are dependent upon votes and its frequency. Although individual own vote cannot encourage the provision of a good.

The dichotomous choice doesn't find best willingness to pay amount, in fact it is compared with **the bid value of whether the WTP is lower or higher than that forming intervals between different WTPs. It is evident that the WTP value is resulted from some statistical estimation.** Moreover in order to improve the accuracy of WTP estimates researches use another round of questions in a follow-up manner after the original two choice questions (Hanemann, 1991). In order to clarify this statement considers a person whose willingness to pay for a dollar 10 offer is negative. This offer may be followed up by another offer of may be dollar 5. the answer may still be negative which may result is assuming that the WTP amount is somewhere between 5 and 0. on the other hand a negative response for ten dollars and a positive for five dollars will show that the WTP falls between these two values from five dollars to ten dollars. In this case the bid value will be greater than 5. Cropper et al. (1999) suggested that the statistical efficiency is gained mostly in the estimation of WTP which comes from first follow-up question. It is important that follow-up bid should be different from that of initial bid. It was found in some recent studies done by Alberini et al (1997) that in order to estimate WTP for government programs the mean WTP is estimated after the follow-up questions which can be lower than that implied by the responses to the initial payment question. The contingent valuation method has also been applied since last few years which examine the valuation of environmental quality and variety of public programs in developing countries. It can be used for estimating WTP target at avoiding diseases resulted from using unhygienic food and polluted water. CVM is also used in a situation in which cancer development risks are reduced by estimation of WTP amount for the application of pesticides on crops.

Willingness to pay (WTP) is a measure of how the consumer evaluates the worth of various services. It uses monetary amount that an individual is willing and able to pay for a service as a measure of that service's value to the individual. WTP assumes that if an individual is WTP more for service X than service Y, the service X provides more value to the individual.

The municipal of Risalpur cantonment residents were offered two scenario of the services regarding the SWM. The existing waste collection system was explained to them. Also, they were presented with an improved waste collection system scenario in which the number and size of the dustbins be larger than the existing dustbins, and the trash collector will collect trash on regular basis. The trash collector will collect the trash directly from the houses.

This research followed Freeman (1993) and Hobky and Soderqvist (2003) for measuring WTP. The main reason is that the methodology has been used very well by these two researches. This research assumes a utility maximization approach. An individual

consumer is supposed to maximize his utility as determined by consuming goods on private basis ( vector of  $x$  values) as well as public goods (the amount of solid wastes in this case). In order to simplify the public good it is labeled as  $z$ ; as a single environmental service. It means that the nature of  $z$  is such that no market value exists for it. To follow a CVM a value is given to the  $z$  notation and responses are elicited either in preferences or in simple terms. There is no real exchange of goods and money. It cannot be taken for granted the change of the hypothetical market place into a real-world market and hence the obtained responses as its representative behaviors. The view that there may be a hypothetical bias was also presented in some other research Neill et al. 1994; Cummings et al., 1995; Carson et al., 1996; Frykblom, 1997; Boyle & Bergstrom, 1999; Khan 2006). The research in hand has not attempted to correct this kind of any bias. It is assumed about CVM market set up that it has the ability to allow quantity price combination in such a manner as to allow the individual to maximize his utility

Mathematically

$u = u(x, z)$  which is subjected to budget constraint

$y = qx + pz$

Where

$q$  Represents market prices of private goods as  $n$  vector

$p$  is a representation of virtually set price for solid wastes

$y$  represents income of the respondent

This maximization problem on its solution results into various situations of Marshallian demand function. It includes  $z$ :  $z = Dz(q, p, y)$  as one example. When the value of  $z$  is added in original utility function, the resultant equation is an indirect utility function (utility function) i.e.

$v = v(q, p, y)$ .

**Here  $v$  refers to an indirect utility function.**

Considering for budget and methods poses restrictions for environmental services' market in a CVM approach. In such a case provisions are provided for studying only one change in particular. As a result (of constraint) the utility cannot be maximized in  $z$  making it a point of concern for utility function in an indirect manner. Here the focus becomes a typical welfare effect of change provided. This change in welfare is estimated as willingness to pay in CVM studies. This change from  $z_1$  to  $z_2$  is then defined as a change in indirect utility function  $v$  such that

$v(x, z - WTP, z_1) = v(q, y, z_0)$

And hence WTP refers to compensating variation (Johansson 1993; Hobky & Soderqvist 2003). The estimation of WTP is done by responses to questions related to WTP. It may be in a discrete form in which respondents are questioned whether they agree or disagree to pay given amount/price in order to obtain change of  $z$ . There is another alternative approach which consists of open-ended questionnaire. It consists of stating maximum WTP in order to avail

Solid waste is a factor that negatively affects the environment by deteriorating the living conditions of the public living around. Improper SWM have negative implications on the area like environmental degradation, health hazards and have other potential problems. The perpetual link between quality of life in the underdeveloped countries especially South Asia and state of water and sanitation and hygiene is well established in Malik and Jahangir (2008).

$$U(w, g) \dots\dots\dots (1)$$

$g$  = composite of all market goods

$$E(p, w, u) \quad \dots \quad \dots \quad \dots \quad (2)$$

Equation (2) the expenditure function dealing the lowest sum of cash the buyer essentially spend to attain the agreed level of utility. This is cumulative function of 'p' and 'u' and diminishing function of 'w'.

$$\text{WTP} = \mathbf{X}\beta + u \quad \dots \quad \dots \quad \dots \quad (3)$$
$$\text{Prob (I=1)} = 1 - \phi (-[t \ X] [\alpha \ Y]), \quad (4)$$

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estimated. Cameron and James (1987) show that  $\alpha = -1/\sigma$  and  $Y = \beta/\sigma$ , so that  $\beta = -Y/\alpha$ . If  $X$  is simply a vector of ones, then  $\beta$  equals median WTP and by the symmetry property of the normal distribution  $\beta$  also equals mean WTP. If  $X$  consists of constant plus other variables, then WTPt is estimated by  $X_t \beta$ . Cameron and James (1987) derived expression for obtaining the correct standard error for  $\beta$ .

While this approach is intuitive and easy to implement, it tends to obscure the importance of the normality assumption on  $u$  (and hence WTP). This assumption is much more important than is typically the case of probit regression, particularly if  $X$  consists of only a constant term. If, for instance, WTP is distributed log-normally, as often appears to be the case, then  $\log(t_j)$ , rather than  $t_j$ , should be used as a regressor. When  $\log(t_j)$  is used, mean and median WTP may diverge quite dramatically as  $\sigma$  (of which mean WTP is a function) become large.

Hanemann (1984c) has examined the take-it-or-leave-it elicitation question from the perspective of the indirect utility function rather than the valuation function. Here it is clear that assumptions about the random component drive the estimate of mean WTP. A few respondents who are willing to pay the largest proposed  $t_j$  may almost completely determine mean WTP.

Median WTP is much less sensitive to distributional assumptions. With a large sample size and the right choice of the  $t_j$ , median WTP can be calculated accurately using a response surface approach, thus avoiding, for all practical purposes, the need to make assumptions about the nature of valuation or indirect utility function.

In this study we wanted to see the impact of depend various factors such as income, education, size of family, awareness, gender, age etc on the respondents willingness to pay (WTP). WTP is a dependent variable, which measures that how the consumer evaluate the worth of various services. It uses monetary amount that an individual is willing and able to pay for a service as a measure of that service's value to the individual. We postulate that the income have a positive effect on WTP, the more the income of the household is, the more they are willing to pay. Education has a significant effect on WTP. The more years an individual spent in school, he more aware of the diseases and health hazards from solid waste. The age of an individual affects WTP negatively. Aged people do not WTP more for solid waste. As compared to aged people, youngsters are more WTP for solid waste. as people are more aware of the diseases and health hazards from solid waste, they are more WTP. It is expected that as compared to males, females are more willing to pay because it is the role of women to clean the house and dispose of the waste.

#### **4. Results and Discussion**

#### 4.1 Major issues in solid waste management faced by the locals:

It is evident from the table 4.1 that a greater percentage of respondents (52.0 %) considered sewage pollution to be the major issue that effects the environment. This was closely followed by household garbage (48.0 %). In regards to the effect of individuals on the environment, majority of the respondents (34.0 %) indicated that they don't have effect on environment.

TABLE: 4.1 THE NATURAL ENVIRONMENT

1.What is being considered as the major issue that effects the environment	Household garbage (%)	Automobile exhaust (%)	Factories (%)	Cutting down trees (%)	Fishing (%)	Sewage pollution from pile and toilets (%)
	48.0	0.0	0.0	0.0	0.0	52.0
2.Individual effect on the environment	No effect (%)	Less effect (%)	Neutral (%)	Moderate effect (%)		A lot of effect (%)
	34.0	22.0	4.0	22.0		16.0

#### 4.2 Disposal methods of the various types of solid waste management:

Majority of the respondent (76.0%), reported that most of their household garbage are stored in open container, while some (16.0%) stores theirs in closed container, few (4.0%) in plastics bags. Methods of disposal of the various wastes are also reported in the table 4.2. Plastic, metal and card board were described by the majority of respondents to be existing in the community. The recycling was mostly done through selling to the local vendors.



TABLE 4.2: HOUSEHOLD SOLID WASTE MANGEMENT

1. Method of household garbage storage	Closed container (%)	Open container (%)	Plastics bags (%)	Pile in the yard (%)	Other (%)
	16.0	76.0	4.0	0.0	4.0
2. method of household garbage disposal	Reuse (%)	Burn (%)	Bury (%)	Recycle (%)	Other (%)
Food waste	4.0	0.0	6.0	4.0	88.0
Paper or card board	0.0	26.0	0.0	36.0	38.0
Plastics	0.0	0.0	0.0	60.0	40.0
Metal	0.0	0.0	0.0	90.0	10.0
Glass	0.0	0.0	2.0	2.0	96.0

### 4.3. Concerns of the respondents about the solid waste management:

Generally, the majority of respondents showed concern about issues of solid wastes. Majority of the respondents (68.0%) were concerned about the diseases related to improper waste storage and disposal and only a few (2.0%) were not concern about the health risks related to solid wastes. Also, majority of the respondents reported that the solid waste was responsible for creating flooding and blockages. Similarly, majority of the students were concerned about the services provided in the area.

TABLE 4.3: CONCERNS ABOUT SOLID WASTE MANAGEMENT

S. No	Issues for concern	Strongly concerned (%)	Concern ed (%)	Neutr al (%)	Not concern ed (%)	Strongl y not concern ed (%)
1	Health risks related solid wastes	54.0	38.0	0.0	8.0	0.0
2	Disease related to improper storage and disposal	68.0	0.0	26.0	2.0	4.0
3	Flooding due to garbage blocking drains and gullies	34.0	46.0	4.0	6.0	2.0
4	Service	10.0	54.0	6.0	24.0	4.0

	provided in the area					
5	litters	24.0	36.0	16.0	16.0	8.0

#### 4.4. Views about the solid waste management in the locality

It is obvious that 100 % of the households receive a collection service. The majority of the respondents (54%) usually take out to empty their containers daily. About 70% of households would provide a service for more than five years. Mostly children (48%) usually take the container out to be emptied. The majority of respondents (88%) take the container to be emptied in a container placed beside the road. 100 % of the respondents agreed that local government collect waste from the communal container.

TABLE 4: Views about the solid waste management in the locality

1. Does your household receive a collection service of any type?	Yes (%)	No (%)		Don't know (%)		
	100.0	0.0		0.0		
2. frequency of waste container emptied	Several time a day (%)	Daily (%)	Three time a week (%)	Twice a week (%)	Once a week (%)	Don't know (%)
	22.0	54.0	20.0	4.0	0.0	0.0
3. length of time of waste collection	Less than 1 year (%)	1 year (%)	3-5 years (%)	More than 5 years (%)		Don't know (%)
	6.0	14.0	10.0	70.0		0.0
Responsibility of waste container of the household for emptying	Children (%)	Mother (%)	Self (%)	Servants (%)		Others (%)
	48.0	6.0	34.0	0.0		12.0
place where container is emptied	The container is placed beside the road for emptying in a collection vehicle. (%)	The container is emptied into a large container in the same building. (%)		The container is emptied onto an open pile of waste in the neighborhood. (%)		Don't know (%)

	88.0	12.0		0.0	0.0
responsibility of the communal container emptying.	Local governm ent (%)	Local public authori ty (%)	Private compa ny (%)	Neighborhood group (%)	Don't know (%)
	100.0	0.0	0.0	0.0	0.0

#### 4.5. Opinion of the locals about the solid waste management collection

While majority (62%) were not at all satisfied from the service. Some of respondents (38%) were reasonably satisfied from the service. Many of households (48%) states the primary reason for not being satisfied was the is lack of clean appearance, odor, files or fires at the communal container. While 34% states that the collection of communal container or pick-up point unsatisfactory, other 12% states that the service is not reliable while only others stated that the interval between the collection was too long. All the respondents were willing to pay for an improved collection method. About 46% of respondents were willing to pay 100 Rs per month while 44% were willing to pay 50 Rs per month; other 10% were willing to pay 200 Rs per month.

**Table 5: Opinion of the locals about the solid waste management collection**

What is your opinion of the service for collection of solid waste from your household?	Very satisfied (%)	Reasonably satisfied (%)	Not satisfied at all (%)	Don't know (%)	
	0.0	38.0	62.0	0.0	
Reasons for displeasure from the garbage disposal	The service is not reliable (%)	The interval between the collection is too long (%)	The collection of communal container or pick-up point unsatisfactory (%)	Lack of clean appearance, odor, files or fires at the communal container. (%)	Other reasons (%)
	12.0	6.0	34.0	48.0	0.0

Willingness to pay for the improved collection of solid waste.	Yes (%)		No (%)	Don't know (%)
	100.0		0.0	0.0
How would your household be willing to pay per month for improved collection method?	50 (%)	100 (%)	150 (%)	200 (%)
	44.0	46.0	0.0	10.0

#### 4.6. Willingness of the locals in the solid waste management practices:

The various tools of managing the solid waste was explained to the respondents and their responses are reported in the table 4.6. It is evident from the table that majority of the respondents were concerned about the solid waste implications and indicated their strong willingness to participate in the various types of recycling.

TABLE 4.6: WILLINGNESS TO PARTICIPATE

S.NO	Willingness	Yes (%)	No (%)	Don't know (%)
1	Compositing	0.0	98.0	2.0
2	Recycling	12.0	88.0	0.0
3	Willingness to separate material for collection	88.0	12.0	0.0
4	Willingness to for pickup for recycling materials	50.0	50.0	0.0
5	Willingness to participate in compositing programs	54.0	46.0	0.0
6	Willingness to return plastic bottles to stores	84.0	16.0	0.0
7	Willingness to purchase less throwaway products	80.0	20.0	0.0
8	Willingness to carry garbage to skiff	100.0	0.0	0.0
9	Willingness to maintain skiff	90.0	10.0	0.0

#### 4.7. Opinion of the respondents about society role in managing solid wastes:

While most of the respondents (46%) agreed that they individually play important roles in garbage management, a greater percentage of the respondents (42%) believe that the local

government is not doing enough to fix the garbage problem. A greater number of respondents (56%) agreed that: recycling laws and problems should be put in place in the community; that purchases decision should be controlled; and that regular collection of garbage is the only solution to the garbage problem. The majority of respondents (70%) also agreed that environmental education should be taught in schools and that public education about proper garbage management is a way to fix the garbage crises. When asked about whether other personal issues were more important than a garbage-free community, a greater percentage (46%) agreed. Majority of the respondents (34%) were against the burning of garbage.

TABLE 7: SOLID WASTE MANAGEMENT ATTITUDE SCALE:

S. no	Statements	Strongly agree (%)	Agree (%)	Don't know (%)	Disagree (%)	Strongly disagree (%)
1	I play an important role in the management of garbage in my community.	44.0	46.0	2.0	6.0	2.0
2	Teaching of Environmental education in schools.	70.0	20.0	2.0	2.0	6.0
3	The consumption decisions can increase or decrease the amount of solid waste from my household.	6.0	16.0	4.0	30.0	44.0
4	Burning garbage is detrimental for my health and health of others.	4.0	34.0	6.0	40.0	16.0
5	People throw garbage on the streets and in the drains and gullies because they have no other means of getting rid of (disposing of) their garbage.	2.0	4.0	4.0	28.0	62.0
6	The local government is not doing enough to fix the garbage problem.	34.0	42.0	4.0	16.0	4.0
7	Correct garbage management should not be taught in schools.	10.0	6.0	0.0	38.0	46.0
8	Other personal issues (like crime, unemployment, and cost of living) are more important to me than a	22.0	46.0	2.0	14.0	16.0

	garbage free community.					
9	Regular collection of garbage is the only solution to garbage problem.	40.0	56.0	2.0	2.0	0.0
10	Picking up garbage around my community is my responsibility as academy resident.	40.0	48.0	2.0	8.0	2.0

#### 4.8 Impact of factors affecting the willingness to pay for the waste disposal services

The results presented in the table 4.8 provides the results from estimation of the WTP on various socio-economic factors. The value of the coefficient of determination ( $R^2$ ) is 26.82% which indicates that the model fit the data better as low value of  $R^2$  is not uncommon. It is also evident that the education is the only variable which turned to be significantly affecting the WTP for solid waste management. Other variables included in the model did not affect the willingness to pay which could be due to the limitation of the data and restriction the data collection to a single neighborhood.

TABLE 4.8: Regression results for factors affecting the respondents' willingness to pay for waste disposal service in the study area

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	83.75121	39.58720	2.115613	0.0405
Gender	0.427583	21.45387	0.019930	0.9842
Marital status	-33.73764	34.04233	-0.991049	0.3275
Education	34.75785	14.94531	2.325669	0.0251
Employment	0.936948	24.08492	0.038902	0.9692
Dummy for Income (<10K)	-22.26010	28.36658	-0.784730	0.4371
Dummy for Income (10K-20K)	-21.77752	16.81951	-1.294778	0.2026
Family Size	-0.068096	3.767524	-0.018075	0.9857
Age	0.653809	0.800427	0.816825	0.4187
R-squared	0.27			

#### 5. Conclusions and Recommendations

This research study mainly looked into explaining the current practices of the solid waste management in the city of Risalpur, district Nowshehra, Khyber Pakhtunkhwa, Pakistan. Also, we were interested in estimating the willingness to pay for an improvement in the management of the solid wastes. Solid waste was found to be a major environmental concern for the majority of the population. We discussed the major concern and opinions of the respondents in

detail and then estimated the WTP through a contingent valuation method. Among the solid waste consequences, sewerage blockage and flooding was reported to be very serious issue as the plastic bags and other non-biodegradable products are thrown into the sewerage system. As per the current practice of storing the garbage, it was reported that majority used open lid containers causing foul odor and attracting diseases carrying mosquitoes, flies, rodents and other animals such as cats. In the community there does not exist a proper recycling mechanism, and most of the metals, card boards and other recyclable materials are either sold to streetvenders or becomes a part of the existing garbage. As for the concern relating to the improper management for wastes, 68% mentioned that the wastes could cause spreading the diseases as a carrier whether be it through mosquitoes, flies and rodents. Also, majority of the respondents reported that the solid waste was responsible for creating flooding and blockages. Similarly, majority of the students were concerned about the services provided in the area.

It was reported that all the households received collection service on regular basis although majority were not satisfied from the service owing to the lack of clean appearance, odor, flies or fires at the communal container. All the respondents were willing to pay for an improved collection method and it was found that 46% of respondents were willing to pay 100 Rs per month while 44% were willing to pay 50 Rs per month; other 10% were willing to pay 200 Rs per month. It was suggested that environmental education could be quite useful in the community as awareness campaigns may be run periodically about the solid wastes disposal. Willingness to pay (WTP) estimation indicated that the education is the major variable which was significantly affecting the WTP for solid waste management. Other variables included in the model did not affect the willingness to pay which could be due to the limitation of the data and restriction the data collection to a single neighborhood.

We find that the respondents are not satisfied with the services. They also indicated that there is a willingness to pay for the solid waste management. This can be implemented through an increase in local taxes/property taxes, to pay for the increased expenses for better management of solid wastes. Similarly, it is recommended that awareness about the solid waste management may be introduced in both formal and informal education. Also, various media tools may be used such as TV, local newspapers, radio and society may also be engaged through local religious and cultural places to inform the community.

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