Willingness To Pay For Improved Solid Waste Management And Associated Factors Among Households In Pakistan

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Abstract

The current study used secondary data of PSLM to collect the information about the household willingness to pay to improve solid waste management and Various factors that are affecting the household willingness to pay in Pakistan. With a growing population solid waste management is a widespread problem in underdeveloped countries. The reason behind this issue is that lack of unawareness of peoples and not used of proper policies to control such solid waste management create many problems for upcoming years. This study used OLR model for data analysis and determine the various factors that are affecting the household willingness to pay for improved solid waste management. The results of this study indicate that occupancy status, time to reach nearest public bin and nearest public bins are emptied affect positively and higher significantly. Furthermore the results indicate that household waste been collected has negative coefficients and higher significantly at the 1 % level of confidence. The study also suggested some important policy recommendations that improve the household willingness to pay and various factors that increase awareness among households for improved solid waste management.

Key words: Willingness to Pay, Solid Waste Management, Ordered Logistic Regression Model, Pakistan.

1. Introduction

Every year in Pakistan due to solid waste management (SWM) different sever diseases occurred that causes more than five million deaths. According to Pakistan annual survey every year twenty million tons solid waste collected that indicate 2.4 percent annual growth rate of SWM. In different districts of Punjab several cities, like Islamabad, Lahore and Peshawar are facing many environmental degradation problems due to solid waste management. Same like situation present in the Sindh district several cities of Karachi collected annually nine thousand tons of SWM. The major reason behind this issue is that lack of unawareness of peoples and not used of proper policies to control such urban solid waste management creates many problems for upcoming years (Lew, 2021; Michel et al., 2021; Ejaz et al., 2010).

Different factors contribute of SWM in poor developing countries of Pakistan. Pakistan rank at world level at sixth form so garbage collected more annually as compared to other countries. But in developing countries of Pakistan the department of municipal committee of solid waste management faced many problems in terms of socially, politically and culturally. But limited facilities are available for poor countries of Pakistan to resolve this issue. Many issues come in this category like no proper functioning to collect waste system because many wastes are kept aside in street corner creates many problems for citizens. Mostly citizen are not well aware that collected garbage brings many serious disorders for families and environmental pollution for upcoming generations (Lew, 2021; Akhtar et al., 2017; Masood et al., 2014; Mahar et al., 2007).

SWM is a widespread issue, not in underdeveloped countries, but also in developed countries. Every year in each developed or underdeveloped nations its ratio increases day by day. These are the form of wastes that waste collectors collected from households, streets & road sides and throw it in an open dump area cities. That waste garbage creates many lungs and respiratory diseases and severe health problems. Every country government makes several policies to get rid of this problem but fails to attain specific goals to reduce this problem (Michel et al., 2021; Chung & Yeung, 2019; Subhan et al., 2014; Awunyo et al., 2013).

Several policies have been adopted in Pakistan to increase ratio of willingness to pay for improve solid waste management, but very few percentage of families that have knowledge about it should brought serious health problems for upcoming generations and more important issue of ozone layer depletion and increase environmental pollution in future are willing to pay as compared to those that have lack of knowledge and awareness of all above issue (Akmal & Jamil, 2021).

Naturally Pakistan environment is good for all investment many investors visited every year for the purpose of good investment. But with the passage of time its ecology is affected by many factors such as larger number of the population and increase number of industries every year may produce larger quantities of waste garbage in Pakistan. Past year 2017 the quantity produced by wastes per day is twenty four thousand, but now eighty two thousand increased day by day. The Tehsil municipal committee is responsible for collecting disposable waste in

every city but with the increasing number of wastes now a day they are facing many severe problems (World Bank, 2021)

According to the current world bank of the report in hilly areas of Pakistan with growing population the problem of SWM is more challenging day by day as compared to plain areas of Pakistan. Several informal and environmental protection policies have been made by the government of Pakistan to reduce this problem of solid waste management and increase willingness to improve solid waste management services.

So, this study will find out the household WTP to improve for SWM and household demographic factors that influence household willingness to pay.

2. Literature Review

Various studies have been conducted on willingness to pay for garbage services management. For example, Mahar et al. (2007) investigated the current situation of waste garbage services in urban areas of Pakistan. For data analysis this study used primary data for five major cities of Punjab. This study finds out that with increasing population the size of wastes increased that showed that poor income households suffered more health problems as compared to higher income household. The final result of the study indicated many factors contributed in collection of solid waste management. So inappropriate policies used in the collection of urban garbage in these five major cities of Punjab. Proper policies should be used to resolve this issue in urban areas of Pakistan.

Rahji and Oloruntoba (2009) Analyzed the different factors that are affecting households, personal preferences of interest toward waste services in Nigeria. The purpose of this study to find different factors that affect the household willingness to pay for private disposal system for solid wastes in urban areas of Ibadan. Primary data have been used to collect this information of five hundred fifty two households of Ibadan the city of Nigeria. For analysis of this study logit model have been used. The final result of this study indicated that education, income, gender, occupation, Wealth owned by household has a positive impact on willingness to pay for private solid waste management services. So, this study provides some important policy implications to improve the behaviors of households payment for private SWP.

Oyawole et al. (2016) from this research analyzed the determinants of household payment to improved SWM services in Nigeria. In poor region a larger number of households suffering many problems of air pollution and as a result people of poor income families faced severe health diseases. The reason behind this big issue is that in developing countries, mostly household are unaware of environment problems and have enough resources to increase willingness to pay to improve for SWM services according to his or her will. So, lower payment to improve SWM services increasing the risk of health diseases. This study is based upon primary data. To collect information questionnaire is developed by using the guidelines of primary data of households. For data analysis a multistage sampling technique is used. Four villages are chosen of five Nigerian districts .The ordered logistic regression model is used to understand this concept. The result of this study indicated that nighty two percent families are fully aware of problem of garbage wastes but only sixty four percent are willing to pay to

improve SWM. The result indicated that household willingness to pay that are affected by various demographic factors like education, gender, age of family head, size of families & employment level of household head in south-eastern regions of Nigeria. This study recommends proper policy implication to improve economic status of household in poor income families.

Thirumarpan and Dilsath (2016) analyzed the willingness behavior of family head toward solid waste in Sri Lanka .This study showed that due to solid waste management environment degradation increased continuously that brings negative impact on human health and caused many severe diseases. This study is based on panel data five division of Batticaloa Sri Lanka are taken in this paper. Different variables are affecting household interest to pay for this purpose, this study used a binomial logistic regression model to understand this concept. The result of this study indicated that lower proportion of population are willing to pay to get rid of this wastes garbage only fifty nine percent and remaining population are not interested to improve wastes services. Average income of household between thirty thousand to thirty five thousand but eighty six percent population are interested to pay on monthly basis not on daily basis. But quantity of garbage produced by each household on daily basis is three kilogram it means monthly payment ratio by each household is only sixty rupees but at very low rate they are not interested to increase pay rate for improved solid waste management services. The result of this study showed that positive relationship between number and spending activities of household and negative relationship between genders, amount of wastes produced on daily basis & disposal services of wastes garbage. So, this concluded that higher educated families attain a higher value of pay for solid waste management as compared of these families that comprised of lower education families. In the end this study suggests some policy recommendation to increase the socioeconomic status of poor educated families in this way we increase the household desires to improve SWM services.

Akhtar et al. (2017) investigated the household WTP to improve solid waste management services in Lahore. The main purpose of this study to know the views of the Guldberg community, of Lahore that considered most densely populated area of Lahore toward household WTP. Primary & secondary data have been used in this paper. In this study a questionnaire survey is carried out by two hundred randomly selected households have been included in this study. And secondary data have been collected through demographic survey of SWM from tehsil municipal committee of Lahore. For analysis of this study ANOVA method is to understand this concept. The result showed that only rich number household has more interested to WTP to improve for SWP as compared to poor number of families. For reduction of this problem among household and increased household WTP to improve for SWM we need some measure and policy suggestion to get rid of this problem in future.

Alhassan et al. (2017) examined different demographic factors that affecting households WTP in Ghana. The study to explained the important factors that are affecting household WTP for SWM because many studies have been conducted to know the variables that are affecting household WTP to improve for SWM, but due to some limitations they do not find out important factors that affect households WTP. This study is based upon primary data. For data

analysis a stratified sampling technique is used. Two urban areas of Ghana districts Accra & Temple are chosen. The Tobit model is used . The result of the study showed that positive correlation present between marital status, education, income, occupancy status of household head and negative relationship between gender and household head age. So, final result concluded different socioeconomic factors affecting positively household WTP to improve for SWM.

Dika et al. (2019) examined the payment of household's willingness to improved solid waste management in Addis Ababa. For data analysis of this study secondary data have been used to collect information on household willingness to pay by contingent valuation method. This study used logistic regression model to understand this concept. The result showed that larger number of families are fully aware to the problems of garbage wastes but not ready to pay more than seventy eight percent and seventy six percent households are willing to cooperate only to improve solid waste management services but not ready to pay. The final result of this study showed that positive relationship between income of household, number of family size, age of household head and negative relationship between gender and education. This study recommends proper policy implication to improve economic status of household and increase household willingness to pay to improve the solid waste management.

Boateng et al. (2019) examined household payments for improved SWM in four major cities Accra, Takoradi, kumasi and Tamale in Ghana. This study showed that globally two billion households are shortages approach to solid waste management. Primary data have been used to collect this information. IN this study a questionnaire survey is carried out by cluster and simple random sample where fifteen hundred and sixteen households ethnically different in four region of Ghana have been included in the data analysis. In descriptive statistics, logistic regression analysis are used, but the survey did not show the good results only fifty three point seven percent households showed motivation of willingness to pay to improved solid waste management services. The result of this study showed that household willingness to pay is affected by many factors such as education of household head, income and employment level of households, Gender & occupancy status of household. Social influences are best presented by using financial services but some needs of efforts and expertise to improve household sustainable WTP for SWM in Ghana. It is also emphasized that we need some efforts to improved measurement tool for better assessment of household WTP for SWM.

Mulat et al. (2019) examined different factors that affect household WTP for improved SWM in Etopia. This study used primary data of Addis Ababa town Injibara. sample size selected randomly from total population of 7169 families. Systematic sampling technique was used for data analysis. The result of this study indicated that there is a positive relationship between education and WTP for improved SWM and negative relationship between gender and willingness to pay for solid waste management decrease with increased population size of families. Occupancy status indicated positive relationship with cost of solid waste management. If homeowner have not personal place then he had to pay more cost for SWM as compared to those families that have personal land for living. This study recommended that proper policies should be adopted that improve household WTP for SWM.

The summary of this literature review provides the knowledge about household WTP. Now this study will bridge the gap in respect and make a valuable addition to the body of knowledge. So, this study will find out the household WTP to improve for SWM and household demographic factors that influence household willingness to pay.

3. Data and Methodology

3.1. Data description

This study used secondary data of Pakistan Social and Living Standards Measurement (PSLM) 2019-2020. The study examined the various variables that are affecting the household willingness to pay (WTP) to improve solid waste management (SWM) in Pakistan, such as gender of household head, household occupancy status, household waste been collected, time to reach nearest public collection point and nearest public bin emptied. In this study our dependent variable is dichotomous (binary) zero meaning not WTP and one means WTP to improve SWM.

3.2. Econometric Model

This study used the ordered logistic regression model (OLR) for the estimation of regression coefficient that represent the true value relationship of the variables that are used in our model. (Dika et al., 2019; Oya wole et al., 2016).

3.3. Estimation of Ordered Logistic Model

The estimation principal of this model

$$\Pr(Y \leq j) = In\left(\frac{\Sigma pr(Y \leq j \mid Z)}{1 - \Sigma pr(Y \leq j \mid Z)}\right) = a_j + B_1 Z_{i1} + B_2 Z_{i2} + B_3 Z_{i3} + \ldots B_k Z_{ik}$$

$$j = 0,1$$

Where

- Y = Explained variable
- Z_i = Explanatory variables
- i = indicates the number of observation 1,……k

In our model $Y_i = j$ indicates thresholds of the dependent variable. We have made to cut -off (categories), number one category indicates household more desires to pay and zero level indicates household have not desired to pay. So, one level category indicates household more interested to pay and zero level showed households are not interested to pay. In our above equation cutoff aj-0 is lower than aj and same like aj is greater than aj-0. In our OLR model our slope coefficients of the predictor variables are same in each category, but cutoff ratio is different in intercept terms.

3.4. Statistical Analysis

For data analysis this study used Stata software of 14.1.

Table 1: Description & Measurement of the Variables

Variables	Description & measurement
Household willingness to pay improved solid waste management (WTP)	0= Household are not willing to Pay 1= Household are willing to Pay
Explanatory variable	
Gender	1= Male 2= Female 3= Jointly 4= Don't Know
Household head occupancy status	one= Owner occupied (Household head are not owner of the house) two= Owner occupied (Household head are owner of the house) three= On rent four= Subsidized rent five= Free of rent
How your household waste been collected or disposed of?	1= Collected by Municipality van from door step =1 2= Collected by Private van/cart from door step 3= Public Bin/ Collection point 4= Road/ street 5= Lake/River/Nullah 6= Open space 7= Other Specify…
Time to reach nearest public bin/ collection point (**TPB**)	1= 1 to 5 min, 2= 6 to 10 min, 3= 11 to 15 min, 4= 16 to 20 min 5= 20 to 25 6=26+ min 7= Bin is not available/accessible
If household have public dust bin facility available then how many times it would be cleared?	1= On daily basis 2= Once in a week 3= Two times a week 4= Thrice a week 5= Don't Know 6=Other……
Source; PSLM Survey 2019-20 Questionnaire	

4. Empirical Results

This section presents the empirical results and their interpretation for various economic models. Section 4.1 and 4.2 shows the descriptive statistics and correlation of variables and demographic information of households willing to pay improved SWM used in the empirical analysis. Section 4.3 presents the regression results of OLR.

4.1. Descriptive Analysis and Correlation

Table 2 and 3 presents the descriptive analysis and matrix of correlation that all the variables are used in data estimation.

Table 2: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
Y Order	0.101	0.302	0	1

Z1	1.183	0.613	1	4
Z2	1.535	1.16	1	5
Z3	5.142	1.602	1	7
Z4	3.912	2.846	1	7
Z5	2.232	2.487	0	6

Table describes the descriptive statistics and a mean score of WTP for improved SWM. The average value of the predictor variable is 0.101, while the minimum value is zero and the maximum value is one. The mean value of Z1 is 1.183 with the lowest value is one and the maximum value four. The mean value of Z2 is 1.535 while the smallest value one and highest value five. The mean value of Z3 and Z4 are 5.142 and 3.912 respectively, while the minimum value of both zero and maximum seven. The mean value of the variable Z5 is 2.232 while the minimum value of being zero and the maximum value is six.

Table 3: Matrix of Correlations

Variables	(Y)	(Z1)	(Z2)	(Z3)	(Z4)	(Z5)
Y Order	1.000					
Z1	-0.003	1.000				
Z2	0.006	0.125	1.000			
Z3	-0.717	0.001	-0.004	1.000		
Z4	-0.163	-0.001	-0.002	0.301	1.000	
Z5	-0.031	0.002	0.002	0.025	-0.796	1.000

Table indicates correlation between Y order (willingness to pay improved SWM) and Y order and it is always 1. The correlation between Y order and Z1 is negative and it showed that a 1 unit increase in Z1 is correlated with a decrease in Y. Z2 relationship with y is positive and showing positive correlation. The range of correlation coefficient from negative one (showing a negative perfect correlation) to positive one (perfect positive correlation) and zero indicating no correlation to all. Other findings indicate that the negative correlation between Y (order) and Z3, Z4 and Z5 showing that as one unit increases the other decreases.

4.2. Demographic Information of WTP to Improved SWM in Pakistan

Fighter A indicates the relationship between demographic information and region of households. In KPK and Punjab 87.87 and 68.76 percent respondents live in rural and 12.13 and 31.24 live in urban regions respectively. While the 49.32 percent and 81.52 percent respondents are live in rural areas and 50.68 percent and 18.48 percent urban households lives from Sindh and Balochistan, respectively. Fighter B shows the demographic relationship between Y (willingness to pay improved SWM or not) in Pakistan. In Punjab, Sindh, KPK and Balochistan 48.52, 21.8, 19.63 and 10.04 percent respondents are not willing to pay and 59.12, 34.58 1.76 and 4.542 percent respondents are WTP to improve SWM, respectively in Pakistan.

Fighter C indicates the relationship between region and Y order. In rural area 75.49 percent households are not WTP and 10.25 % households are WTP to improve SWM While 24.51

percent urban households not willing to pay and 89.75 percent respondents are WTP to improve SWM.

Fighter D indicates the relationship between waste been collected and Y (order). 46.5 percent household waste collected are free of cost and 53.6 percent are WTP to improve SWM and collected by municipality van from the door step. 99.96 percent households waste collected by private cart that are WTP to improve SWM collected from the doorstep, while one hundred percent households are not WTP for wastes been collected by the collector like Pubic bin, road, lack, open space and other specify. Figure E showed that when time to reach nearest public bin is shorter 87.07 percent household are not WTP to improve SWM. But when time to reach near public dust bin is larger 34.1 percent household is willing to pay for improved SWM. When 96.13 percent households have not facility of public dust bins they are not willing to pay and only 3.87 % are WTP to improve SWM.

Figure A: Demographic relationship between Province and Region of Households
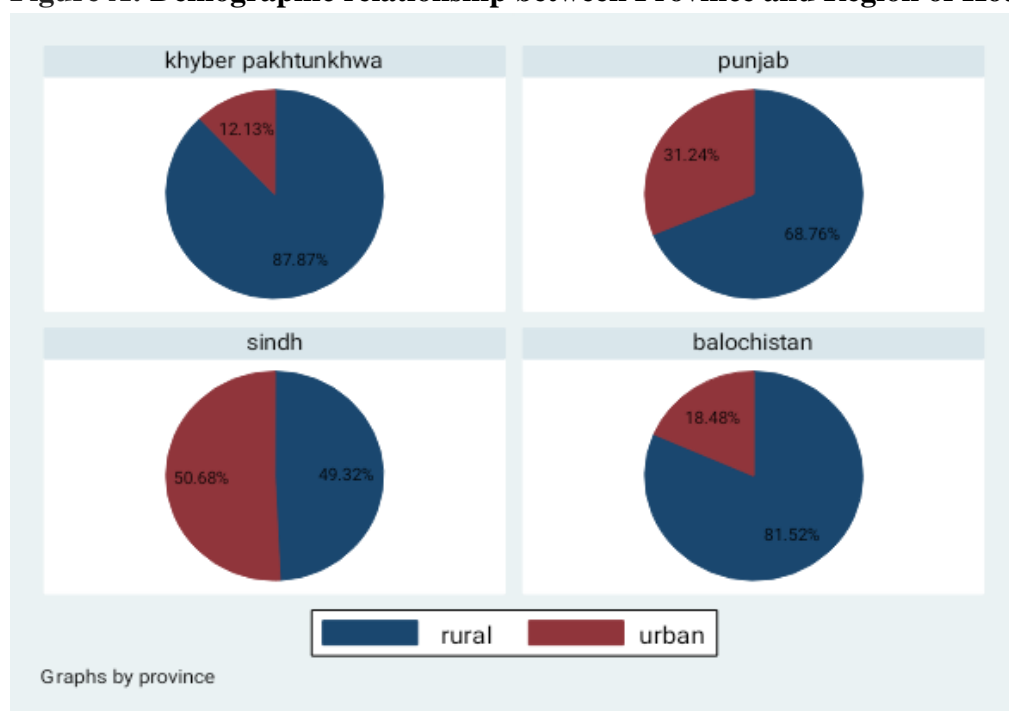

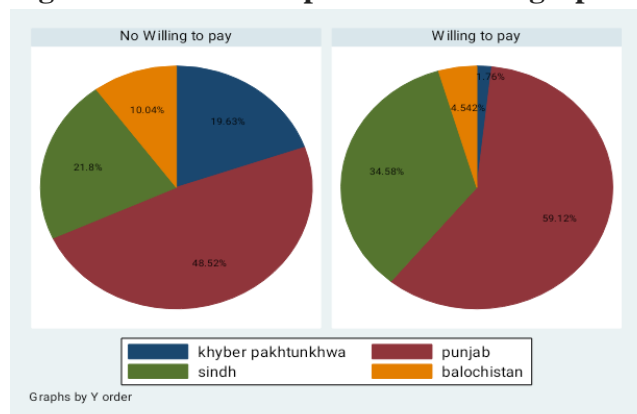**Figure B: Relationship between Demographic information and Y-Order**

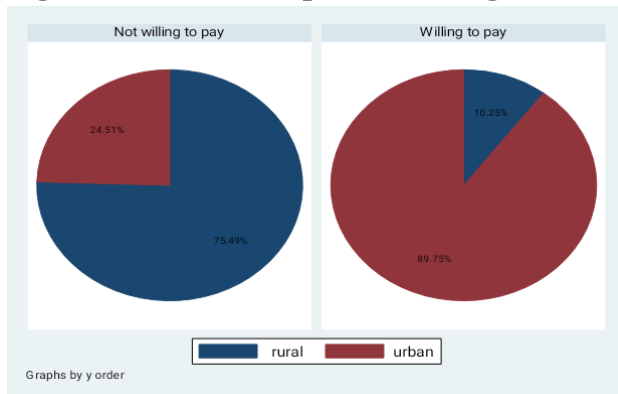**Figure C: Relationship between Region and Y-Order**

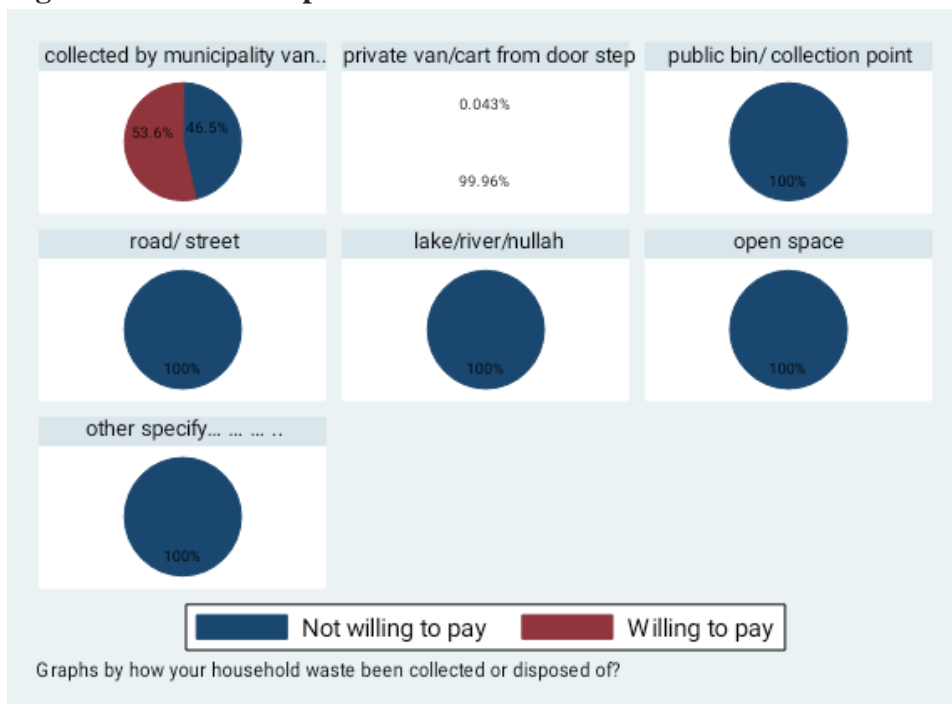**Figure D: Relationship between waste been collected and Y-Order**

Figure E: Relationship between TPB and Y-Order

Graphs by Time to reach nearest public bin/ collection point (TPB)
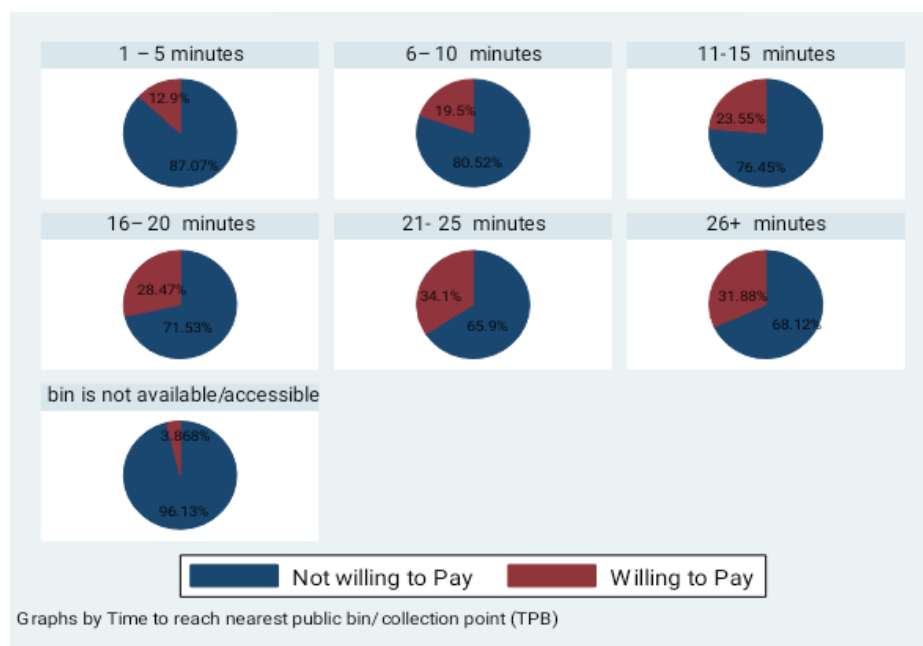
4.3. Ordered logistic Analysis

Various factors are responsible for household willing to pay SWM including demand and supply side factors and many more. The demographic factors of households are crucial affecting a household WTP. Regression results for a household approach to improved SWM in residential areas of Pakistan are presented in table 4.3.

Table 4: Ordered Logistic Regression

Y	Coefficient
Z1	-0.031 (0.022)
Z2	0.031*** (0.012)
Z3	-1.842*** (0.014)
Z4	0.188*** (0.007)
Z5	0.093*** (0.008)
Number of observation: 16064	LR Chi-square(5): 69587.18
Prob > chi2: 0.000***	Pseudo –squared: 0.661
*** one % level of significance; figures in the Parenthesis are standard Errors.	

Above table 4 presents the estimated coefficients of OLR of households. The value of chi-square test in our model is 69587.18 and probability value is 0.0000 highly significant at the one percent level that indicates our model is good and fit. So, we reject the null hypothesis, and accepts our alternative hypothesis that is more effective and our model is considered an overall good model.

The independent variables gender of the household head (Z1) is insignificant while occupancy status (Z2), household waste been collected (Z3), time to reach nearest public bin (Z4), nearest public bin emptied (Z5) are found significant. The value of R^2 is 0.66. In other words, we can say that 66 % variation in the predictor variable is explained by the explanatory variables & remaining 34 % are explained by outside factors. The pseudo- R^2 value is 0.661 that indicates our model is good.

The OLS result shows Z1 has negative coefficient but it is insignificant. Rahji and Oloruntoba (2009), Oyawole et al. (2016).and Dika et al. (2019) have reported the similar result. The Z2 has a positive value of the coefficient and highly significance and indicates 1 unit increase in Z2 will bring 0.031 unit increase in higher log odds of category. Rahji and Oloruntoba (2009) and Mulat et al. (2019) have reported the same result about occupancy status WTP to improve SWM.

The value of Z3 coefficient has negative and highly significant at the 1 % level and indicates 1 unit increase in Z3 will bring 1.842 unit decrease in the category of y, and the remaining variables are held constant that are present in our model. This result is in line Rahji and Oloruntoba (2009). Z4 coefficient has positive value and significant at a level of 1% and indicates 1 unit increase in Z4 will bring 0.188 units increase in log odds of category. This result is in line Mulat et al. (2019). Z5 affects positively and highly significant at the 1% and indicates 1 unit increase in Z5 will bring 0.093 unit increases in log odds of category y. This result is in line Oyawole et al. (2016) and Boateng et al. (2019).

5. Conclusion and Recommendations

This study provides a theoretical framework to identify the different factors that affect household WTP to improve SWM in Pakistan. The findings of our study concluded that when the occupancy status of household head increases, they are more willing pay improved SWM. In our study household waste collected has negative coefficients and it indicates mostly respondents are not WTP to improve SWM.

Furthermore, final results of OLR, Time to reach nearest public bin has positive coefficients and it indicates that households with more distance are WTP to improve SWM and This paper concluded that nearest public bins cleared has positive coefficients and indicate that household more prefer to use of improved SWM

The findings of our study concluded that these associated factors, not influence the household WTP, but also affects the status of poor household and indicates that the urban household are more interested of WTP (89.75%) than the rural household. In Punjab, Sindh, KPK and Balochistan 48.52, 21.8, 19.63 and 10.04 percent respondents are not willing to pay and 59.12, 34.58 1.76 and 4.542 percent respondents are willing to pay improved SWM, respectively in Pakistan.

Furthermore, this study concluded that when time to reach near public dust bin is larger 34.1 percent household are WTP to improve SWM. When 96.13 percent households have not facility of public dust bins they are not WTP and only 3.87 % are WTP to improve SWM. So,

this study suggested that several environmental protection policies have been made by the government of Pakistan to reduce this problem and increase willingness to improve SWM.

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