Willingness to Pay for Improved Solid Waste Management in Major Residential Areas of Lahore, Pakistan

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Abstract
The discarded material that no doesn't add any value to the life can be referred to as solid waste. Handling of solid waste is one of the major problems that developing cities have to deal with. The increasing population and urbanization have changed the rate of generation of solid waste and its composition. Improper management and handling of solid waste results in harmful impacts on human health and on ecosystems as well. Present study was conducted in Shadman and Shahjamal which are two major residential areas of Lahore. The study was conducted to determine the present conditions of solid waste management in the selected areas and to estimate the willingness of the households to pay for improvement of solid waste management by a questionnaire survey. The research revealed that the current service of solid waste management in the area is improper and residents are willing to pay for improved SWM services. The survey suggested that majority of the respondents were willing to pay PKR 100-500 for improved SWM services therefore there is need for an up-gradation in the services. The statistical analysis showed that there was a direct relation between income level and WTP for improved SWM facilities.

1. Introduction
The discarded material that no doesn't add any value to the life can be referred to as solid waste. It can be generated in result of any commercial, agricultural or domestic activity. Municipal Solid Waste (MSW) mainly consist of household waste from urban areas (Rafigue M et al., 2017). The nature of MSW is not same in all regions. Handling of solid waste is one of the major problems that developing cities have to deal with. Efficient solid waste management is becoming a challenge with the growing population especially in urban areas (Kaza S et al., 2018). The increasing population and urbanization have changed the rate of generation of solid waste and its composition. This is a challenge not only for developing countries but developed countries as well. The growth rate of amount of solid waste is more than the rate of urbanization globally. 1.3 billion tons of solid waste per year was generated in 2012 in cities around the world (Kassahuun T et al., 2020).

With the increasing number of people, the challenges for the local government to manage the waste also increase. The migration rate of people from rural to urban areas in the last decade has increased from 3.7%-7.4% in Pakistan. Waste generation rate in Pakistan by the end of 2014 was 71,000 tons per day. It is increasing day by day with the increase in population. In different cities of Pakistan, only 60% of the waste is collected. 90% of the collected waste is disposed in open dumps along the roads. In open dumping. 75% of the waste needs to collect for cities to be clean (Masood M et al., 2014). Improper management of waste has been considered as one of the main reasons of environmental degradation. Improper management and handling of solid waste results in harmful impacts on human health and on ecosystems as well. The untreated waste not only affects the public but

it also impacts the overall environment as well (Niringiye A, 2010). Lack of capital and resources makes it difficult for the responsible authorities to cope with this issue. Poor institutional arrangements and non-compliance of laws are some other major reasons for improper management of solid waste (Ilyas H et al., 2017)

It is easy to observe the negative environmental impacts of improper solid waste management in the developing world. Due to lack of resources, this issue in Pakistan is getting out of hands (Subhan M et al., 2014). When municipal solid waste is disposed in open dumps, it becomes the place for flies to breed. Bulk of the household waste is constituted in plastic materials and due to low degradability, the residence time increases. The dumps are then responsible for spread of epidemic diseases. There are a lot of problems that are linked with improper handling of waste, specifically in over populated regions (Banerjee et al., 2015). The untreated and un-collected waste that remain along roadsides for a long time directly effects public health. It enters in groundwater by leaching and disrupts ground water quality. Consumption of contaminated results in water borne disease. The open burning of waste present along roadside poses a serious threat to the health of people. The smoke that is generated by open burning causes serious respiratory issues to people and the air quality is deteriorated (Bhattarai K, 2015). The dust and filth from the open dumps are spread due to strong winds. The communal solid waste becomes a habitat for rats. There is a constant release of toxic gases from the dumps that is harmful for the residents of the area. The big and developed cities of Pakistan like Lahore and Karachi are responsible for more waste production as they have higher population than rural areas (Ejaz at al., 2010).

A study was conducted in urban and rural areas of district Abbottabad for household's HH's) demand in order to improve environmental settings over esteeming their willingness to pay (WTP) for better solid waste management facilities. The research followed assessment method for evaluating the HHs preferences for better living standards. The primary data used in the research was collected via questionnaire from both type of regions of district Abbottabad, Pakistan at HHs premises. The aim was to discover the factors of HH's WTP for improved environment through better SWM services. Education, income, awareness, location and HH were seemed to be influencing HH's WTP. The research determined that HHs were WTP, if sufficient services were provided to them (Mustafa et al., 2014)

A research was done, in the residential area of main (Boulevard Gulberg, Lahore) to assess the present approaches and efficacy of current solid waste management facility in order to measure the willingness of the households to pay for the upgradation of solid waste management via questionnaire survey. It was concluded that present solid waste management system in the area was reasonable yet needed more enhancement in terms of better collection efficiency as well as rates, recycling baskets, and separation of waste at storage. In questionnaire survey, the majority of the residents regardless of their background, middle-class households were eager to pay an amount less than (USD 4.8) in order to upgrade the waste management capacity in the area. Thus, there was a requirement for improvement of storage and collection facilities in order to increase in collection efficiency and rates (Akhtar et al., 2017).

A number of solid waste management studies mostly focusing on the generation, collection and disposal of waste have been conducted for Islamabad. A contingent valuation survey approach and stratified random sampling technique was applied. The sample size was five hundred respondents. A double bounded dichotomous choice questions were there in the questionnaire. Open-ended question format was followed by it and the willingness to pay and maximum willingness of the respondents was assessed. It was revealed by logistic regression estimation that 65.4 percent of the total respondents were willing to pay, while it was revealed by multiple regression that 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 (Balasubramanian M et al., 2019).

To investigate the urban community's WTP for the improved SWM in Malaysia, 190 households were selected. Majority of the households directed that current SWM is very poor. According to the econometric results, the mean and total WTP for improved services was 16 USD per household per year. (Subhan M et al., 2014). A study was performed on 240 households in Paynesville, Liberia, to assess the residents' fondness over waste collection services. The results showed that he households favored home-based and unsorted waste collection services. This was built on results from a mixed logistical mode (Almazán-Casali S et al., 2019). A research was conducted in 2019, in Shashemene Town, Ethiopia, on randomly selected sample of 190 households. On an average, the households were willing to pay 1,328,564.75 ETB/month for better waste collection services (Ayenew B et al., 2019).

2.2 Materials and Methods
2.1 Study Area
Lahore City located between 31°15′-31°45′ N and 74°01′-74°39′ E is the second largest city of Pakistan with a population of 11.13 million. Lahore has semi-arid climate with 5 different seasons. The weather conditions of Lahore comprise extremely hot and long summers (months of May, June and July) when temperature ranges up to 40-48 °C (104-118 °F); with monsoon and dust storms (rare) (Shirazi et al., 2016) (Figure 1).

Shadman and Shahjamal are residential areas of Lahore. They are one of the oldest residential areas and have become major commercial areas. There are 6-8 branches of different schools and academies located on Shadman Road which connects to Jail Road with other major institutions of Lahore including 3 universities. Heavy traffic load in this area is due to these educational institutions in the early morning and in afternoon.

2.2 Profile of Selected Study Area and Waste Management

The study is conducted to assess the enthusiasm of household to pay for improved waste management systems. It was conducted in Shadaman and Shahjaamal, two known areas of Lahore. Both of these areas are located near Jail Road. Both of the areas are highly populated. Type of families include medium and lower class. Houses are of almost of common size, including 5 marla, 10, and 1 kanal mostly. Since the area is highly populated and commercial, and residential as well, thus a great amount of waste is generated on daily basis. The poor handling, unskilled workers and public awareness, all leads to improper waste management and which ultimately results in harmful diseases in human. Collection systems were not appropriate and this indicates that the system needs high attention and to be advanced.

Lahore Waste Management Company and other private companies have taken the responsibility of waste collection. The company send trucks, carts in order to collect the waste everyday by 11 am. Door to door collection of waste is done. Some households discharge their waste in communal bins which are then taken by large trucks which are then taken to the final disposal site. Since the area contain a lot of waste, mostly unaware public keep throwing waste into the roads and sometimes in water channels which make it over loaded creates bad odor and creates harmful disease in residents. Although a responsible authority is working yet improvement is required in waste collection, handling and disposal.

Primary data was collected by online sources while secondary data was collected by a questionnaire survey through simple random sampling. Questionnaire was distributed in 400 houses randomly in Shajamal and Shadman. The respondents were randomly selected for the study regardless of their age, educational status, sex, and occupation. The questionnaire was divided into three sections. The demographic information of the respondents was collected, the current SWM system in the area was questioned about and the participants of the study were asked about their willingness to pay for improved SWM. The data was analyzed by performing statistical test including Pearson correlation, chi square, crammers V and ANOVA using IBM SPSS version 20.

3. Results and Discussion

The demographic information suggested that majority of the respondents of the survey belonged to the age group of 25-34 years (30%) followed by the category of under 18 years old (27.5%), 18-24 years old (25%) and more than 35 years old (17%). The respondents of the study included 200 males (50%) and 200 females (50%). The educational status of the participants revealed that 17% of the respondents had education up to matric, 20% had education up to intermediate, 30% of them were from undergraduate background and 30% were graduated while 3% had a post graduate background. An eminent point was the absence of illiterates. The employment status of 72% of the respondents was employed and the remaining 28% were unemployed. Out of the 72% employed people, 10% had the income range of below 20,000 pkr, 40% belonged to the category of 20,000-50,000 pkr income. 35% of the employed people had income in the range of 50,000-100,000 and the remaining 15% had income more than 100,000 per month. 8 percent of the respondents of the study lived in flats whereas 23% were living in a portion and 69% were living in a house. Out of the 69% of participants who were living in a house, 2% had household area of 3 Marlas, 3% had household area of 5 Marlas, 40% had household area of 10 marlas and 55% owned household of area 1 Kanal or more (Table 1).

It was observed that 213 out of 400 households that metal or plastic containers in households and the other 136 houses didn't have the containers whereas 51 respondents did not know about the presence of containers. Waste collection service was available for 268 households while 102 of the households didn't have the service. 30 of the respondents were not aware of the presence of waste collection service. When questioned about the authority responsible for waste collection in the area, it was concluded 40% took the services of local/government authority and 30% were taking the services of public authority. Furthermore, 20.5% were taking the services of a private company and the other 9.5% did not have idea about it. The respondents were questioned about frequency of emptying of containers and 68% of them agreed that the containers are emptied on daily basis while 20% were of that fact that the containers are emptied once a week. 8% were agreed that the containers are emptied several times a day and 4% were of the opinion that they are emptied less frequently. 239 respondents (59.8%) revealed that they utilize scrap collection service and the remaining 161 respondents (40.3%) indicated that they don't use any scrap collection service. 21% of the people utilizing waste collection service were very satisfied whereas 44% were reasonably satisfied and 35% were not satisfied. There were different reasons for not being satisfied with the waste collection service. 12% were not satisfied due to unreliable service, 49% weren't satisfied due to unsatisfactory waste collection frequency, 165were not satisfied due to unsuitable location of communal bin, 6.3% weren't satisfied due to expensiveness and other 6.8% found

improper disposal unsatisfactory. The respondents were asked abput the rates they were paying for utilization of the service which revealed that 2% were not paying any amount, 5% were paying less than 100 PKR, 75% were paying 100-500 PKR, and 18% were paying more than 500 PKR. Numerous studies have indicated that major factors contributing to the poor management of waste are the lack of environmental concern and recognition (Tarq M et al., 2014) (Ejaz M et al., 2012). (Table 2)

From the total 400 respondents, 260 (75%) were willing to pay 100-500 PKR for cleaning of neighborhood while 60 respondents (5%) were willing to pay less 100 and 72 respondents (18%) were agreed on paying more than 500 PKR. 2% of the total respondents were not willing to pay any amount for cleaning of neighborhood. The respondents were asked about their willingness to pay for improved collection and disposal of waste where 2% were not willing to pay any amount but 5% of the respondents were agreed on paying less than 100 PKR, 75% were agreed on paying 100-500 PKR and 18% were willing to pay more than 500 PKR. The participants were questioned about the reason for not willing to pay the amount and which 12% did not believe in the service, 8% didn't consider the service important enough to pay, 68% believed that government should be responsible to cover the cost of service and 12% had other reasons. 292 of the 400 respondents preferred local government service for waste collection, 68 respondents (17%) preferred private company and 40 respondents (9%) had no preference or didn't have knowledge (Table 3).

4. Statistical Analysis

The Pearson chi square is mainly used for the testing of relationships between categorical variables. In this present study chi square test shows significant relationship between income and willingness to pay for improved solid waste services as $P > 0.01$ ($x2 = 524.4$, $df = 9$). Similarly, Cramer's V test also shows the direct relationship between income and WTP for improved SWM facility as Cramers V value (shown in Table 4) is .703

Pearson correlation coefficient (denoted by r) is the measure of strength of direct relationship between the two variables. Pearson correlation test (Table 5) indicate the strong correlation between the income levels and willingness to pay for improved SWM facility in the study area which means higher the income level, higher the amount will be paid for the improvement of solid waste management facility in the area.

Anova Test was performed which (Table 6) shows the significant relationship of between WTP and occupation education (p.0.05), income level (p>0.01) and household type. The results are consistent with the studies conducted by Ashish and Uttam in India, Tariq and Rasid in swat, Pakistan and S.Akhtar et al. in Lahore and that shows significant relationship between occupation, education, income level and household type (Tariq M et al., 2014)(Akhat A et al., 2017)(Asish T et al., 2013).

5. Conclusion

SWM is important as improper management and handling results in reduction of harmful impacts on human health and on ecosystems as well, however improves life. The untreated waste not only affects the public but it also impacts the assets of area. Current results showed that that service of solid waste management in the area is improper and residents are willing to pay for improved SWM services. The survey suggested that majority of the respondents were willing to pay PKR 100-500 for improved SWM services therefore there is need for an up-gradation in the services. The statistical analysis showed that there was a direct relation between income level and WTP for improved SWM facilities. The recommendations for improved SWM system can be done by training of personnel, improving the collection frequency, satisfactory pickup point and well maintained and properly covered waste containers.

References

Kaza S, Yao L, Bhada-Tata P, Van Woerden F. What a waste 2.0: a global snapshot of solid waste management to 2050. *The World Bank*; 2018.

Rafiq M, Ali S, Khan M, Atiq M. Willingness to Pay for Private Solid Waste Management: Insights from Peshawar. *Pakistan Business Review*. 2017 19;19(2):374-93.

Niringiye A. Determinants of willingness to pay for solid waste management in Kampala City. *Current Research Journal of Economic Theory*. 2010 31;2(3):119-22.

Masood M, Barlow CY, Wilson DC. An assessment of the current municipal solid waste management system in Lahore, Pakistan. *Waste Management & Research*. 2014 ;32 (9):834-47.

Kassahun Tassie & Birara Endalew | Kourosh Behzadian (Reviewing editor) (2020) Willingness to pay for improved solid waste management services and associated factors among urban households: One and one half bounded contingent valuation study in Bahir Dar city, *Ethiopia, Cogent Environmental Science*. 2020. 6:1

Ilyas, H., S. Ilyas, S. Ahmad and Muhammad Nawaz Ch. "Waste Generation Rate and Composition Analysis of Solid Waste in Gujranwala City Pakistan." *International Journal of Waste Resources* 7. 2017: 1-6.

Bhattarai K. Households' willingness to pay for improved solid waste management in Banepa municipality, Nepal. Environment and Natural Resources Journal. 2015 Dec 28;13(2):14-25.

Subhan M, Abdul Ghani AB, Joarder MH. Urban community willingness to pay for improved solid waste management in a Malaysian municipality: A choice modeling approach. *Asian Social Science.* 2014;10(18):122-36.

Almazán-Casali S, Alfaro JF, Sikra S. Exploring household willingness to participate in solid waste collection services in Liberia. *Habitat International.* 2019 Feb 1;84:57-64.

Ayenew B, Tilahun A, Erifo S, Tesfaye P. Household willingness to pay for improved solid waste management in Shashemene town, Ethiopia. *African Journal of Environmental Science and Technology.* 2019 Apr 30;13(4):162-71.

Ejaz, Naveed & Akhtar, N. & Hashmi, Hashim & Naeem, Usman. Environmental impacts of improper solid waste management in developing countries: a case study of Rawalpindi City. 2010. 379-387.

Banerjee S, Aditya G, Saha GK. Household Wastes as Larval Habitats of Dengue Vectors: Comparison between Urban and Rural Areas of Kolkata, India. PLoS One. 2015. 8;10

Mustafa, Usman & Miraj, Ahmad & Haq, Ul & Ahmad, Iftikhar. Capturing Willingness to Pay and Its Determinants for Improved Solid Waste Management.2014.

Akhtar, S., Ahmad, A., Qureshi, M., Shahraz, S. Households willingness to pay for improved solid waste management. *Global Journal of Environmental Science and Management*, 2017; 3(2): 143-152.

Balasubramanian M. Household Willingness to Pay for Improved Solid Waste Management Services: Using Contingent Valuation Analysis in India. 2019

Shirazi, S.A., Kazmi, J.H. Analysis of socio-environmental impacts of the loss of urban trees and vegetation in Lahore, Pakistan: a review of public perception. *Ecol Process* 5. 2016. Volume 5.

Tariq, M., & Rashid, M. Solid Wastes Management and its Willingness to Pay in Mingora, Swat. *Civil and Environemental Research*. 2014. 6(8):1-9.

Ashish T.,R,; Uttam D. Household willingness to Pay improved waste management in municipal area : A case study in Cachar district . Asaam. IOSR J. *humanities social sci*. 2013. 6(5) 21-31

Ejaz, N.; Janjua, M.S.. Solid Waste Management Issue in Small Towns of Developing World: A Case Study of Taxila City. *Int. J. Environ. Sci. Develop*., 2012. 3(2): 1-6

Tables

Table 1: Demographic Information of respondents

Variables	Category	Frequency
Gender	Male	50.0
	Female	50.0
Age	Under 18 years old	110
	18 to 24 years old	100
	25 to 34 years old	120
	> 35 years old	70
Education	Matric	68
	Intermediate	80
	Undergraduate	120
	Graduate	120
	Post-Graduate	12
Occupation	Employed	288
	Unemployed	112
Income	Below Rs 20,000	40
	Rs 20,000 to Rs 50,000	160
	Rs 50,000 to Rs 1 lac	140
	Above Rs 1 lac	60
Household Type	Flat	32
	Portion	92
	House	276
Household Area	3 Marla	8
	5 Marla	12
	10 Marla	160
	1 Kanal or more	220
		Total: 400

Source: Respondents response

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Table 2: Current condition of Solid Waste Management in Shadman and Shahjamal

Variables	Category	Frequency
Availability of Plastic and metal containers in households	Yes No Don't Know	213 136 51
Availability of waste collection service	Several times each day Daily Once a week Less Frequently	32 272 80 16
Authority responsible for waste collection service in the area	Local/Government Public Authority Private Company Don't Know	160 120 82 38
Utilization of scrap collection service	Yes No	239 161
Level of satisfaction with current service	Very satisfied Reasonable satisfied No satisfied	84 176 140
Reason for not being satisfied with the servicer not being satisfied with the service	Unreliable service Unsatisfactory collection frequency Unsatisfactory location of communal bin Lack of clean appearance Expensiveness Improper Disposal	48 196 64 40 25 27
Current amount being paid for cleaning the neighborhood	None Less than 100 PKR 100-500 PKR More than 500 PKR	12 24 328 36 Total: 400

Source: Respondents response

Table 3: Willingness to pay for improved Solid Waste Management in Shadman and Shahjamal

Variables	Category	Frequency
Willingness to pay for cleaning of neighbourhood	None Less than 100 PKR 100-500 PKR More than 500 PKR	12 24 328 36
Willingness to pay for improved collection and disposal	None Less than 100 PKR 100-500 PKR More than 500 PKR	16 60 260 64
Reason for not willing to pay a fee to cover the full cost of a waste collection service from the government or a private company	Don't believe in the service Don't consider the service important enough to pay Believe that general taxes should cover the cost of service Other	48 32 82 272 48 Total: 400

Source: Respondents Response

Table 4: Pearson's CHI Square & Cramer's V test

Pearson's Chi Square				
Study Area	Pearson's chi	Value	df	Asymp. Sig (2-sided)
Lahore	square	593.219a	9	.000
Cramer's V test results				
Study Area	Cramer's V test	Value	Approx. Sig	
Lahore		.703	.000	

Source: Statistical Analysis through IBM SPSS

Table 5: PEARSONS CORRELATION

Pearson's correlation		Income	How much will you be willing to pay for improved collection and disposal service
Income	Pearson Correlation	1	.780**
	Sig. (2-tailed)		.000
	N	400	400
How much will you be willing to pay for improved collection and disposal service	Pearson Correlation	.780**	1
	Sig. (2-tailed)	.000	
	N	400	400

Source: Statistical Analysis through IBM SPSS

Table 6 shows analysis of variance

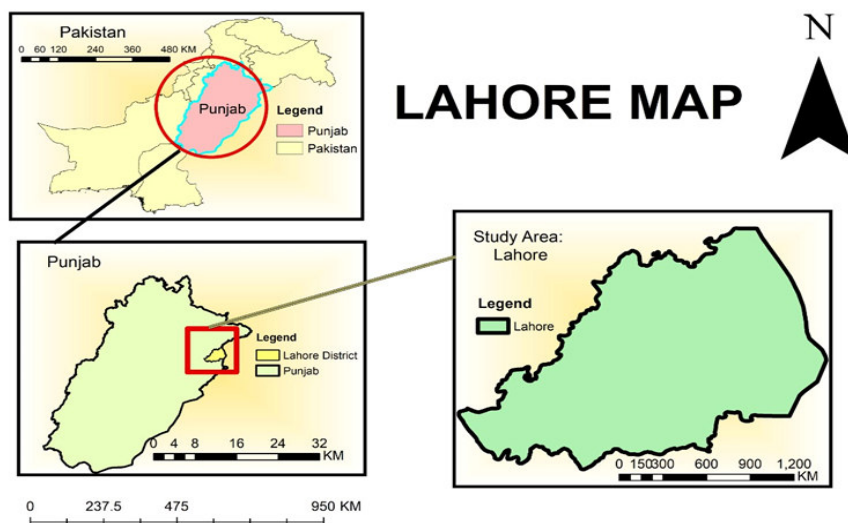| ANOVA TEST		Sum of Squares	df	Mean square	f	Sig.
Education	Between the groups	57.819	4	14.455	90.713	.012
	Within the groups	62.941	395	.159		
	total	120.760	399			
Occupation	Between the groups	292.932	26.331	1	26.331	110.982
	Within the groups	78.133	94.429	398	.237	
	total	371,065	120.760	399		
Income	Between the groups	90.189	3	30.063	389.412	.000
	Within the groups	30.571	396	.077		
	total	120.760	399			
Householdtype	Between the groups	1.456	2	.728	2.422	.090
	Within the groups	119.304	397	.301		
	total	120.760	399			

Source: Statistical Analysis through IBM SPSS

Figure 1. The Map of Study Area