

## ORIGINAL RESEARCH PAPER

# Households willingness to pay for improved solid waste management

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**ABSTRACT:** Waste is a by-product of human life. Nowadays, municipal solid waste is being produced in excessive amounts and in this way, both developing and developed countries are facing challenges regarding generation of waste. Economic development, urbanization and improved living standards in cities have contributed to increasing the amount and complexity of solid waste produced. The present study was conducted in the residential area of main Boulevard Gulberg, Lahore to determine the present methods and efficiency of current solid waste management facility and to estimate the willingness of the selected households to pay for the improvement of solid waste management through a questionnaire survey. It was found that current solid waste management system in the area is fair but needs more improvement in terms of improved collection efficiency and rates, recycling bins, and segregation of waste at storage. According to the questionnaire survey, the majority of the respondents despite belonging to middle-class incomes are willing to pay an amount less than USD 4.8 for the improvement of waste management facility in the area. The area lacks a frequent collection of waste containers. Therefore, there is a need for up gradation of storage and collection facilities in terms of increase in collection efficiency and rates, an introduction of the recycling facility and segregation of waste at source. Waste storage and collection sites of the area should be monitored periodically and waste should be disposed of in a scientific manner in sanitary landfills.

**KEYWORDS:** *Analysis of variance (ANOVA); Collection facilities; Communal containers; Developing countries; Waste disposal.*

## INTRODUCTION

Developing and developed countries are facing increasing population growth, industrial development, financial progress and improvements, which are main factors, associated with production of huge amounts of solid waste especially in the fast growing cities and urban dwellings. In these growing cities, inappropriate management of solid waste is damaging human health and triggering ecological, natural & financial harms (Kumar and Nandini, 2013). In this way, local authorities and government bodies are subjected to increasing pressure and are being held responsible for

resolving and finding sustainable solutions for solid waste management. In previous times, the waste did not create any issue to the public as amount of waste produced was within the required limit. However, now a day the situation is totally different because the waste is being produced in excessive amounts all over the world and is causing serious damage to the public as well as to the environment (Yuan and Yabe, 2014). Lack of availability of space for management of huge amounts of solid waste has further enhanced the seriousness of the matter (Afroz and Masud, 2011). Different socio-economic factors including family size, education and income level are associated with the amount and composition of municipal solid waste produced in developing countries (Monavari *et al.*, 2012).

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At present, management practices of waste are fluctuating for residential and industrial manufactures, rural and urban areas, and developing and developed countries. The price of providing appropriate management of solid waste in under developed countries is remarkably high (Hazra et al., 2013). Unplanned and improper waste handling and disposal practices lead to increments in the solid waste management costs. Imperfect method of collection due to which the price of collecting solid waste is very high. In this way, 21% to 81% of the collection rate of solid waste is mostly restricted to high discernibility areas in Nigeria, where people are willing to pay for the better collection of solid waste (Aremu, 2013). It is generally assumed that public is not supposed to be responsible for solid waste management and it is the administrative authorities and local experts that are solely responsible for managing solid waste and disposal with efficacy (Vidanaarachchi et al., 2006; Abdoli et al., 2016). Decision making of residential households in terms of solid waste management and disposal facility is affected by various elements (Noori et al., 2010; Monavari et al., 2011). Waste disposal choice is greatly influenced by type and nature of waste management services. As compared to the usage of communal containers, insufficient provision of waste containers to the public and transportation issues leads to the improper disposal of waste in streets, on roads or in empty plots (Guerrero et al., 2013). In addition to this, there is a lack of proper methods and facilities for dumping of waste in well prepared & engineered landfills due to the inadequate financial support which is another limiting factor in safe disposal of waste (Awunyo Vitor et al., 2013) which is associated with further deterioration of waste management issues at a global scale. Therefore, there is a need for development of applicable and efficient waste management strategies that consider all the aspects and elements of solid waste management and disposal which in turn will help in lessening the global burden of waste related issues. Various types of efficient and safe waste management facilities and services can be provided by both government and private firms (Alavi Moghadam et al., 2009). For best solid waste management practice, it is the duty of both local agencies and the public to contribute towards the public awareness and decision making. Socio-cultural aspects important for devising

solutions for increasing waste related issues include role of public in decision making, spreading apathy towards society and awareness regarding environmental issues (Tadesse et al., 2008). Role of government is considered as a crucial source for the betterment of solid waste and health related issues mostly in the form of implementation of different types of interventions that include decentralization and or privatization of solid waste management and aspects as well as encouragement of both public and private sector for participation in clean-up and disposal of waste campaigns (Rahji Moloruntoba, 2009). In all cases, 'willingness to pay for improved solid waste management' refers to waste management commodity rather than a free social service that utilizes labor, capital and operating and maintenance expenses for efficient and safe waste management and tends to improve satisfaction of the users. Different socio-economic attributes influence the willingness of residential households to pay for solid waste management and disposal (Menikpura et al., 2012). Various studies have been conducted in the recent decades worldwide to determine the willingness of households to pay for efficient and enhanced solid waste management. The findings of these studies conducted in different cities around the world including that in Kempala city of Uganda, Akuapen north district of Ghana (Amfo-Out et al., 2012), municipality in Kuwait (Koushki et al., 2004), Abeokuta city of Nigeria (Achi et al., 2012) as well in Islamabad, capital city of Pakistan (Anjum, 2013) indicated that majority of the surveyed households showed willingness to pay differing rates per month up to USD 1.85 for an improved solid waste management system in their respective areas. These studies have also identified major factors that in turn determine the willing to pay (WTP) for solid waste management and include financial condition, gender, age, levels of satisfaction, level of education, level of environmental as well as time required for reaching public dumpsters. Developing countries including Pakistan lack proper methods and systems for solid waste management and disposal treatments (Hoi-seong and Kwang-Ying, 2007). Lahore, which is the second largest city of Pakistan with total population of approximately 9 million, lacks regular waste treatment and recycling facility due to which 27% of the generated solid waste is recycled by informal sector (Batool and Ch, 2009). Currently,

various private firms are operating in Lahore for decentralized and efficient treatment and disposal of waste. Both government interventions and public and private sector participation will contribute improved solid waste management system in Lahore as well as in other cities of Pakistan (Haydar *et al.*, 2016).

The current study which was conducted in 2016 in Lahore city aimed to determine and quantify the level of awareness and willingness of the residential households in Gulberg area of Lahore to pay for improved solid waste management system as this is the basic need of the area and in order to reduce threats to environment and the residents of the area.

## **MATERIAL AND METHODS**

### *Profile of Study Area and existing solid waste management in the area*

The study to estimate household willingness to pay for improved solid waste management system was conducted in residential areas located near Main Boulevard of Gulberg town of Lahore city which is a heavily populated area. The area of Gulberg is about 3563770 Sq. m. According to Union Council number 97, the total population of Gulberg is 67020. Major areas that comes under Gulberg are Ghalib market, Mini Market, Liberty Market, Ghous-E-Azam Bazar, Hussain Chowk, M.M.Alam Road. Adjacent areas that are located near Gulberg are Firdous market, Faisal town, Garden town, and Model town. Type of families living in the area belong to upper, lower and middle class. Houses are of various sizes in the area. More houses are of 5 marla, 10 marla and 1 kanal. As the area is residential, commercial as well as industrial, huge amount of solid waste is produced in the area on daily basis. Poor handling of a large quantity of waste due to lack of workers and containers contribute to a certain degree of improper solid waste management practice in the area which in turn pose serious threat to the environment and residents. Collection efficiencies and rates recorded in the past few years in different urban areas of Lahore including the selected study area are between 51% to 69% which shows that the management of municipal solid waste in the area needs upgradation. Up to 49% of the waste remains uncollected and ends up polluting the environment (Mahar *et al.*, 2007). The existing solid waste management facility in the area comes under a Turkish company named Al-Bayrak, a local public authority, working under Lahore Waste Management Company

(LWMC) on alternate times for the collection of waste containers in the area of Main Boulevard Gulberg. Al-Bayrak collection vehicles that consist of trucks having compacters on them come at 7am in morning and at 3pm daily in the first shift and in second shift respectively, for collection of waste. Door to door collection of waste by the carts is also available in the area. However, the carts do not show up regularly in the area. The carts throw the collected waste in the large open stationary communal containers which are placed at different places in the area.

The collected waste from communal containers are then transferred to LWMC trucks which take the waste to Lakhodair landfill site where it is segregated, dumped or compacted. Stationary container collection method is adopted for waste collection, in which the containers are emptied on site. Due to the irregularity of the cart collection service, the residents and meat sellers throw their house and animal waste respectively into the main drain of the area that is present near a beverage factory in the area. In the start of the service, the waste management facility (LWMC) used to provide plastic bags for waste storage but after 2 months the provision of this service was finished. There are no individual metal containers outside the streets. However, open communal metal containers are available along the roadside for storage which are often overloaded with waste. In spite of presence of a local public authority for managing municipal solid waste in the area, there is a need for improvement in the management facility in terms of efficient collection frequency, increase in the number of solid waste workers, segregation of waste at storage and introduction of communal recycle bins in different locations within the area.

This study is based on both primary and secondary data. Primary data was collected through structured questionnaire forms. The questionnaire forms were distributed among 200 randomly selected households in Main Boulevard, Gulberg Lahore (Fig. 1). The data from the questionnaires was compiled and statistically analyzed using IBM SPSS version 20. Applied statistical tests include Pearson's chi-square, Cramer's V and analysis of variance (ANOVA) one-way test. Secondary data including demographic data and solid waste management facility information of the study area was collected from local union council and internet.



It was observed (Table 2) that majority (87.5 %) of the households had the availability of plastic or metal containers, while 8.5 % of the households did not have plastic or metal container available in the household or nearby. With respect to the availability of waste collection service, 68.5 % of the households availed the waste collection facility provided by local public authority, Al-Bayrak Company. With respect to the frequency of emptying of containers, It was observed that 62.5 % of the respondents agreed that containers were emptied on regular basis, 29 % of the respondents indicated that waste containers were emptied several times each day whereas 4 % of the respondents indicated that containers were emptied once in a week. With respect to the authority currently responsible for waste collection service, 46 % of the respondents indicated local government or local public authority while 44 % of respondents indicated that they didn't know who was currently responsible for waste collection service in the area,. No private company was operating in the area. According to an

inline study done in 2006, despite a significant amount of money spent by municipal authority in developing countries for waste management in residential areas, the management practices were still not efficient (Henry et al., 2006). The existing waste management condition and survey results showed that there is a room for improvement with respect to storage and collection services provided by the local public authority which was availed by the majority of the households in the area.

In addition to the availability of solid waste management facility provided by local government or local public authority in the area it was noted that out of 200 respondents, 61 % of households utilized scrap collection service in order to get rid of scrap waste that mainly consisted of metal, cardboard and plastic waste (Table 3). As far as the best method for waste disposal was concerned, 45 % of the respondents selected landfill, 12.5 % selected burning the waste, 8.5% of respondents selected solid waste treatment plant and 7 % selected waste treatment in waste to

Table 2: Current condition of solid waste management system in Main Boulevard Gulberg area

Variables	Category	Frequency
Availability of plastic or metal containers in households	Yes	175
	No	17
	Don't know	8
Availability of waste collection service	Yes	137
	No	47
	Don't know	16
Frequency of emptying of the container	Several times each day	58
	Daily	125
	Once a week	8
	Less frequently	9
Authority responsible for waste collection service in the area	Local Govt./ Local public authority	92
	Private company	0
	Don t know	88

Table 3: Current condition of solid waste management system in Main Boulevard Gulberg area

Variables	Category	Frequency
Utilization of scrap collection service	Yes	122
	No	78
Best method preferred for solid waste disposal	Recycling	54
	Landfill	90
	Burning	25
	Solid waste treatment plant	17
Concerned for environment-ally safe final disposal of waste?	Waste to energy plant	14
	Yes	123
	No	53
	Don't know	24

energy plant. This was in contrast to an inline study done in swat city of Pakistan where majority of the respondents (95%) selected waste to energy as the best method for waste disposal (Tariq and Rashid, 2014). In Lahore, waste collected from various parts of the city is ultimately dumped in the Lakhodair landfill site where waste undergoes physical treatment which includes dumping or compaction. With respect to concern about safe disposal of waste, the survey showed that 61.5 % of the respondents had concern about safe disposal of waste, 26.5 % had no concern and the remaining 12 % didn't know about it. Although majority of the respondents had environmental concern for waste disposal, there were still a specific number of people who were either not concerned or lacked awareness about the significance of environmentally safe disposal of waste. Various studies have shown that that lack of environmental concern and awareness are the major contributing factors associated with mismanagement of waste (Ejaz and Janjua, 2012, Tariq and Rashid, 2014).

As far as the location of emptying of container was concerned (Table 4), it was noticed that 34 % of the respondents indicated that their household waste was emptied in containers located beside roadside which was then collected by the collection vehicles while, 19 % of the respondents indicated that waste container was emptied in a larger container that was located in same building, 10.5 % of the respondents

said that household waste container was emptied in a communal container placed in the neighborhood, 2 % of respondents indicated their household waste container was taken to be emptied onto an open pile, 4.5 % of the respondents indicated that their container was taken to be emptied at a final disposal site and rest 29.5 % of respondents didn't know about the location of emptying of their respective household containers. With respect to satisfaction with current waste collection service it was noticed that 65.5 % of the respondents were reasonably satisfied, 21.5 % of the respondents were satisfied with the service, while 13 % were not satisfied and the rest of 29.5 % of respondents didn't know about the service. This showed that majority of people were satisfied with the collection service and the overall waste collection and management service in the area is fair. The respondents who were not satisfied with the service had some reasons. 45.5 % respondents not satisfied believed that the service was unreliable, 19 % indicated that the collection frequency is low, 12 % indicated lack of cleanliness, 11 % of respondents indicated that the location of communal bins is unsatisfactory and the remaining 9 % said improper disposal of waste is the reason behind the dissatisfaction. This indicated several flaws of the current service provided by the local public authority which majorly included unreliability of the service followed by inefficient collection frequency, improper location and hygiene

Table 4: Current condition of solid waste management system in Main Boulevard Gulberg area

Variables	Category	Frequency
Location of emptying of container	Beside road side for collection by vehicle	68
	Larger container in same building	38
	Communal container in neighborhood	21
	Open pile	4
	Final disposal site	9
	Don't know	59
Level of satisfaction with current service	very satisfied	43
	Reasonably satisfied	14
	Not satisfied	26
Reason for not being satisfied with the service	Unreliable service	91
	Unsatisfactory Collection frequency	38
	Unsatisfactory location of communal bin	22
	Lack of clean appearance	24
	Expensiveness	7
	Improper disposal	18
Current amount being paid for cleaning the neighborhood	None	61
	Less than US\$ 4.8	105
	US\$ 4.8-9.5	27
	More than US\$ 9.5	7



of waste storage containers. It was also noticed that with respect to the current amount paid for cleaning of the neighborhood, the survey showed that 52.5 % of the respondents were paying less than USD 4.8, 30.5 % of respondents were not currently paying any amount, 13.5 % were paying in the range of USD 4.8-9.7, 3.5 % of respondents were currently paying more than USD 9.54. This indicated that majority of the households were currently paying less than USD 4.8 for cleaning of the neighborhood.

With respect to the amount of willingness to pay for cleaning of neighborhood (Table 5), it was observed that 63% of respondents said they were willing to pay less than USD 48 for the cleaning of neighborhood, 18.5 % respondents not willing to pay any amount for cleaning of the neighborhood, 16 % said they were willing to pay from USD 4.8-9.7, 2.5 % said they were willing to pay more than USD 9.54. Similarly with respect to provision of improved disposal services in the area it was noticed that 66.5 % of respondents were willing to pay but less than USD 4.8, while 16.5 % said they were willing to pay from USD 4.8-9.54, 14.5 % respondents were not willing to pay for better disposal service while, 2.5 % said they were willing to pay more than USD 9.7. Different inline studies conducted in the developing countries including Nigeria (Ezebilo et al., 2013) India (S. Mahima et al.,

2013) and Malaysia (Muhammed et al., 2014) showed that majority of the households were willing to pay for improvement of solid waste management facilities in their respective areas. The respondents whom did not show willingness to pay for both cleaning activities and up-gradation of solid waste management services had specific reasons (Table 6).42.5 % of respondents not willing to pay any amount for improvement of solid waste management facility didn't believe that the improvement in the service would happen, 26.5 % of respondents believed that general taxes should cover the cost while rest of 10 % said they don't consider the service is important. The respondents were also asked for preferred authority for improved solid waste facility. The results showed that 71 % of the respondents said local government, 16.5 % said private company, 7.5 % said there is no difference between local government and private company but one has to pay for the service, while rest of 5 % said they didn't know about it and had no concern about it. The result of the willingness to pay showed that majority of the people were willing to pay for the service but in less amounts, mostly below USD 4.8 mainly due to due to financial and socio-economic state and indicated that they were already paying extra tax for bills and that general tax should cover the cost of the collection service. Most of the people

Table 5: Willingness to pay for improved solid waste management facility in the area

Variable	Category	Frequency
How much amount will you be willing to pay for cleaning of the neighborhood	None	37
	Less than US\$ 4.8	126
	US\$ 4.8-9.5	32
	More than US\$ 9.5	5
How much will you be willing to pay for improved collection and disposal service?	None	29
	less than US\$ 4.8	133
	US\$ 4.8-9.5	33
	more than US\$ 9.5	5

Table 6: Willingness to pay for improved solid waste management facility in the area

Variables	Category	Frequency
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 that service will be important enough to pay	85
	Believe that general taxes should cover the cost of service	20
	Other	53
		14
Preferred authority for improved solid waste management facility (improved collection and disposal) in the area	Local Govt.	142
	Private company	33
	There is no difference	15
	Don't know	10

believed that it is the responsibility of the government to pay for better collection service in order to keep our environment clean and it is the birth right of the people to have clean environment according to the law.

#### Statistical tests

Pearson's Chi-Square test was performed instead of regression analysis to conduct bivariate analysis was between two nominal variables i.e. income level amount for willingness to pay for improved solid waste management. According to the chi-square test (Table 7), there is evidence of strong or significant relationship between household income levels and amount of willingness to pay for improves solid waste management facility in the study area. ( $X^2= 39.793$ ,  $df=9$ ,  $p < 0.01$ ). The Cramer's V indicate the effect of the size which is 0.258 which shows strong correlation between income level and amount for willingness to pay for improved solid waste management services.

The Pearson correlation coefficient is a degree of the strength of a direct relationship between two variables and is represented by  $r$ . Pearson' correlation (Table 8) indicated significant positive correlation between income levels and amount of the willingness to be paid for improved SWM facility in the study area ( $p < 0.01$ ) which means higher the income level, higher the amount will be paid for improvement of SWM facility in the area. Table 9 indicated significant relationship between amount for willingness to pay for improved SWM facility in the area and status of employment ( $p > 0.05$ ), education level ( $p > 0.05$ ) and income level ( $p > 0.01$ ). The results of the study are in line with the study conducted in Swat, Pakistan (Tariq and Rashid, 2014) and in India (Ashish and Uttam, 2013) that showed that income level, education level are associated with the amount of willingness to pay for improved services of solid waste management facility in the study area.

Table 7: Pearson's Chi-square and Cramer's V tests

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.925 <sup>a</sup>	9	.000
Cramer's V			
	Value	Approx. Sig. (2-sided)	
Cramer's V	0.258	.000	

Table 8: Pearson's Correlation

Correlations			
		Income (monthly)	How much will you be willing to pay for improved SWM facility?
Income (monthly)	Pearson correlation	1	.335**
	Sig. (2-tailed)		.000
	N	200	200

Table 9: Analysis of variance

ANOVA						
		Sum of squares	df	Mean square	F	Sig.
Status of employment	Between groups	65.351	3	21.784	3.804	0.011
	Within Groups	1122.469	196	5.727		
	Total	1187.820	199			
Education level	Between groups	16.110	3	5.370	3.656	0.013
	Within groups	287.890	196	1.469		
	Total	304.000	199			
House type	Between groups	.148	3	0.049	0.223	0.881
	Within groups	43.447	196	0.222		
	Total	43.595	199			
Income (monthly)	Between groups	18.188	3	6.063	9.163	0.000
	Within groups	129.687	196	0.662		
	Total	147.875	199			



## CONCLUSION

Solid waste management is necessary for urban environment due to production of huge amounts of waste on daily basis in urban areas. While keeping in mind the development of sustainable economic growth, designing of urban infrastructure is important for ensuring healthy & safe environment for humans. Current results show that present municipal solid waste management system in the area is fair. However, based on the survey of existing solid waste management facility, the area lacks adequate supply of waste collection bins and vehicles for transportation of waste. Waste is not segregated at source. The area lacks frequent collection of waste containers. Therefore, there is a need for up-gradation of storage and collection facilities in terms increase in collection efficiency and rates, introduction of recycling facility and segregation of waste at source. According to the survey, majority of the respondents despite belonging to middle class incomes are willing to pay an amount less than USD 4.8 for the improvement of waste management facility in the area. Waste storage and collection sites of the area should be monitored periodically and waste should be disposed of in a scientific manner in sanitary landfills.

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## CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

## ABBREVIATIONS

<i>ANOVA</i>	Analysis of variance
<i>df</i>	Degree of freedom
<i>Govt</i>	Government
<i>IBM</i>	International business machines
<i>LWMC</i>	Lahore waste management company
<i>SPSS</i>	Statistical package for social scientists
<i>Sq. m</i>	Square meters
<i>SWM</i>	Solid waste management
<i>USD</i>	United states dollar

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