ASSESSING SOLID WASTE MANAGEMENT PRACTICES AND WILLINGNESS TO PAY FOR IMPROVED SOLID WASTE SERVICES IN KHANOZAI, BALOCHISTAN, PAKISTAN

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Abstract

Background: Solid waste management remains a challenging problem in most developing countries including Pakistan despite consuming a larger portion of municipal budgets. **Objective:** This study aims to assess the solid waste management practices, and households' willingness to pay for improved solid waste management in Khanozai Town, Balochistan. **Methods:** A multistage sampling technique was used to collect the data from 741 households through a universal sampling technique. A purposive sampling method was used to select Khanozai Town. While using a mixed-methods approach, questionnaire and interview were the data collecting tools. Descriptive, inferential statistic (Binary logistic regression), and narrative analysis were used for the analysis of data. **Results:** The results show that waste disposed at specified sites, at irregular sites, burning waste at homes as fuel, direct collection by Municipality, and using animal waste as fuel at homes were the significant solid waste management practices at households' level. Open dumping and landfills were commonly practiced by the municipal committee Khanozai as waste disposal practices. The results of regression analysis showed that age, education level, household ownership status (income), family size, and satisfaction with municipal solid waste management have a positive association with willingness to pay for improved solid waste management in Khanozai. The findings revealed that the majority (62.1%) of the respondents were satisfied with the solid waste management services provided by Municipal Committee Khanozai. Only, 12.9% of the total households were dissatisfied to strongly dissatisfy with the services. In the case of public health importance, 18.6% and 63.8% of the respondents reported it as a top and medium priority problem of the town respectively. The narrative analysis revealed that 70-80% of the municipal fund is spent on solid waste management in Khanozai Town. Approximately, 0.45-kilogram waste is generated per capita per day. The operational capacity in terms of vehicles, human resources, and finances is insufficient and needs improvement. **Conclusion:** It is concluded that despite having insufficient operational capacity, limited human resource and insufficient funds, Municipal Committee Khanozai has been able to provide satisfactory solid waste management services at the household level in Khanozai Town. Keeping in view the willingness of the majority of households, the MC Khanozai is suggested to

collect taxes for improved solid waste management in the town. The sufficiency of funds can enable the municipality to overcome its capacity issues and start door-to-door waste collection services in Khanozai.

Keywords: Solid waste management; waste disposal, residential waste, waste management practices, willingness to pay for improved solid waste management, waste management; Khanozai; Balochistan

1. INTRODUCTION

Solid waste management (SWM) is the process of collecting, storing, treatment, and disposal of solid wastes in such a way that they are harmless to humans, plants, animals, the ecology and the environment generally [1]. It is an important environmental health service and is an integral part of basic urban services. It involves all the activities which tend to minimize health and environmental-related hazards [2]. From the earliest primitive human society, there have been attempts to safely dispose of solid waste. In the early days, disposal did not pose a difficulty as habitations were sparse and the land was plentiful [3]. In recent years, improper solid waste management has arisen as one of the most disastrous issues for the environmental and health sectors across the globe [4]. Moreover, the rate of urbanization, waste composition and its density, rate of precipitation, and most importantly, the efficiency of the concerned departments to manage solid waste are decisive factors for proper solid waste management [5].

The system of solid waste management (SWM) includes waste generation, storage, collection, transportation, and disposal [6]. In the first stage, useless or unwanted items are separated from the useful material, it is called solid waste generation. Further, the waste is stored in trash containers and heaps near the vicinity before it is collected by relevant authorities [7]. Afterward, the collection phase includes the timely collection of waste from identified locations and transportation to the disposal site. In the final stage, the solid waste is disposed of in treatment plants through several techniques. Furthermore, the process of recycling and energy generation are very effective processes in the treatment of solid waste [8]. Finally, the residue is dumped into landfills [9].

Globally, several methods are used for the treatment of solid waste depending on the availability of land area and cost of disposal [10]. Incineration is an important method used for disposing of waste. Its combustion process of solid management in presence of Oxygen at a very high temperature reduces the volume to 80-90% of the original. This results in the formation of gas and non-combustible residue [11]. Compaction includes the compaction of large waste material by breaking and grinding. The only purpose is to deduce the volume of solid waste so that can be disposed of easily [10]. Pyrolysis is the combustion of organic solid waste containing a high concentration of carbon in absence of oxygen. This process produces solid char, pyrolysis gas, and synthesis gas where the volume has been reduced significantly [12]. Gasification is the incomplete burning of solid waste in presence of oxygen so that hydrogen-rich fuel gas can be produced [11]. It transforms solid as well as liquid waste material primarily into hydrogen and carbon monoxide-containing gas [13]. Composting is the most technical solid waste process in the regions where the soil needs organic matter for the

enhancement of fertility. In this process, the organic portion of the solid waste is let to be decomposed under specific conditions to get very fertile humus with weight reduced to half of its original [14].

Solid waste management is one of the most ignored sectors in developing countries including Pakistan [15]. The findings of the study, conducted in 2008, in the selected urban areas, show that waste generation ranges from 0.283 to 0.613 kg/capita/day which contains a variety of waste types [5]. A recent study reports that in Pakistan with a total population of 207,684,62, out of which 36.44% live in the urban areas, [16], solid waste generated is 49.6 million tons, weighing 239 kg/person annually, mostly generated in urban areas [17]. Moreover, 60% of solid waste is collected by the relevant authorities on average [15]. While others remain uncollected in vacant spaces, along the streets, roadsides, and most commonly in the drains [5]. The major hurdles in solid waste management in Pakistan include inadequate and untrained manpower, improper management and policy gap, lack of advanced machinery, financial barriers, lack of awareness in public, the shortage of reliable databases, and the applied research on solid waste management that contribute to poor solid waste management practices in Pakistan [18].

In Balochistan, solid waste management has been one of the challenging urban services, particularly in urban areas. Research studies have reported rate of urbanization and urban sprawl has been accelerated in recent years in Balochistan [19], [20]. Research study has explored food loss and food waste in Quetta metropolitan area and have reported little awareness at the household level [21]. The expansion of urban areas, cause a huge burden on local governments and municipalities. Khanozai is an emerging town in Pishin District. Out of the total population of Pishin District, 736,481 as per the 2017 Census, Khanozai town alone comprises of 40,238 [22]. Due to its location on the crossroad of four districts, Khanozai is expected to be the new district, through the bifurcation of Pishin District. To best of the authors' knowledge, no study has been conducted to assess the solid waste management practices in Khanozai town. To fill the gap in the body of knowledge, this study aims to analyze the solid waste management practices and willingness to pay at the household level for Improved Solid Waste Management (ISWM) services by the Municipal Committee Khanozai (MCK) in Khanozai Town, Balochistan, Pakistan.

2. METHODS

2.1 Study design

This research study has used case study design for data collection. Case study design is commonly used in social sciences. It is an empirical inquiry that investigates a phenomenon within its real-life context: in this case solid waste management in Khanozai Town.

2.2 Setting

In Balochistan province, in Karezat District, Khanozai town was purposively selected as study area for this research. Balochistan is the backward province with majority of people living in rural area [23], having weak socio-economic development indicators among all provinces of Pakistan [24], [25]. Khanozai is a town in Tehsil Karezat, Pishin District [26], [27], [28] ,[29]. Pishin District is a medium developed district in Balochistan [30]. The residents of the town belong to sub-cast of Kakar (Panezai) tribe of Pashtun tribe. According to the 2017 census report, the population of Khanozai Municipal Committee is 40,238. This town connects two important districts of the northern Balochistan. In the east, it has boundaries with Killa Saifullah District, in the south with Ziarat District. The planned development of this town will surely have positive impacts of the quality of life of the residents [31]. Khanozai Town was given the status of municipality in 2016. Since then, the Municipal Committee Khanozai (MCK) is providing urban services including municipal solid waste management services to the residents of Khanozai town.

2.3 Conceptual framework

The following conceptual framework has been used in the current study. For assessing solid waste management services provided by Municipal Committee Khanozai, the survey was conducted in Khanozai town to identify the solid waste management practices at the household level and services provided by Municipal Committee Khanozai. Furthermore, it aimed to explore the households' willingness to pay for improved solid waste management practices in the town. For this, the regression analysis was employed and the respondents from households were asked whether they are willing to pay for improved solid waste management in the municipality. After assessing the willingness, recommendations were formulated that would help in improving the affairs of solid waste management by Municipal Committee Khanozai.
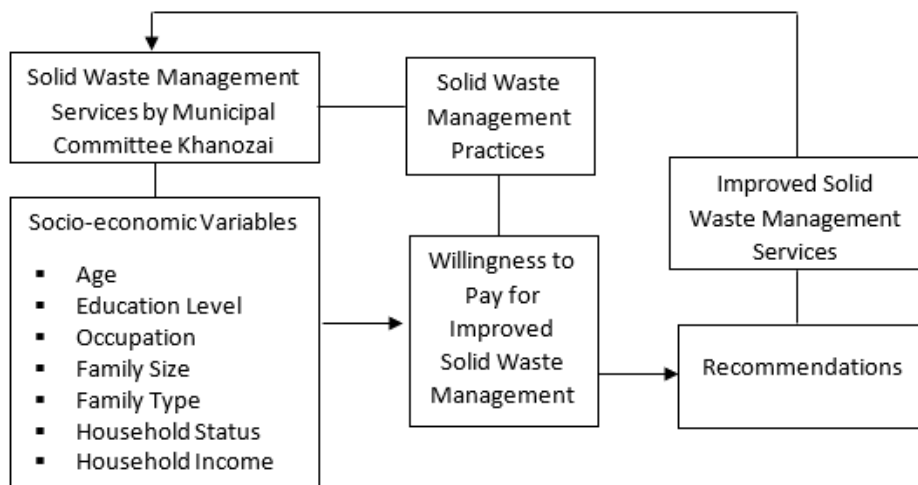

Fig. 1Conceptual Framework

2.4 Study Variables

The study variables for this study are related to the waste management practices at the household level, socio-demographic variables of the participants, willingness to pay for improved solid waste management (dependent variable) and the independent variables.

Table 1 Description of Study Variables

Variables	Measurement Levels	Mean	SD
Waste Management Practices at Household level			
Waste Disposed of at Specified Place	1=Yes; 0= No	-	-
Waste Disposed of at Irregular Places	1=Yes; 0= No	-	-
Waste Burnt at Homes as Fuel	1=Yes; 0= No	-	-
Waste Collected by Municipality from Homes	1=Yes; 0= No	-	-
Animal Waste Used of as Fuel at Homes	1=Yes; 0= No		
Dependent Variable			
Y_1=Willingness to Pay	1=Yes; 0= No	0.83	0.374
Independent Variables			
X_1=Age	In Years	51.04	13.386
X_2=Family Size	Number of persons	11.18	7.200
X_3=Education Level	0=No Education; 1= Primary Education; 2= Secondary Education, 3= Higher Education	3.94	2.093
X_4=Occupation	1=Farmers; 2= Govt. Employees; 3= Business; 4= Unemployed; 5=Wage Labor; 6= Others	4.77	4.356
X_5=Family Type	1= Nuclear; 2= Joint	1.47	0.499
X_6=House Status	1= Own; 2= Rented; 3= Other	0.00	0.000
X_7=Household Income	In Pakistani Rupees		
X_8= Satisfaction with Solid Waste Management Services by MCK	1=Yes; 2= No	2.37	0.899

Source: Field Survey, 2021

Note. MCK = Municipal Committee Khanozai; SD=Standard Deviation

2.5 Data Sources and Data collection

The primary data were collected from the 741 households through a household survey in Khanozai town between March 2021 to August 2021. Questionnaire was the tool for data collection on solid waste management at Khanozai town, Balochistan. Moreover,
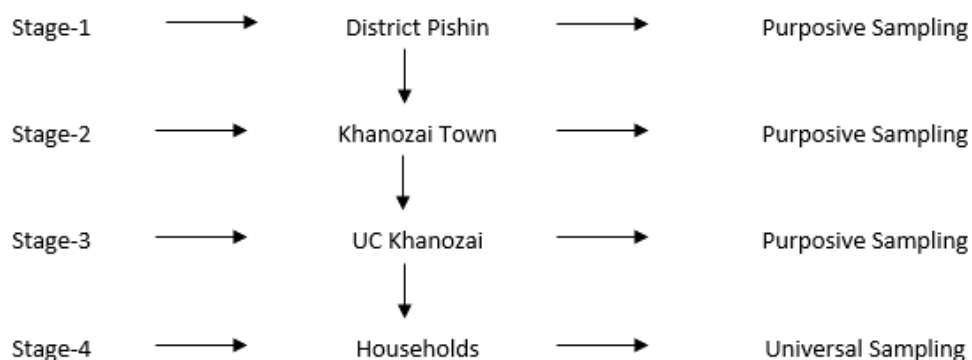
the questionnaires were pre-tested to remove the possible ambiguities and flaws in it. The questionnaire was validated using test-re-test technique while a pilot survey was conducted for 20 questionnaires. Afterwards, the questionnaire was modified and then used for collection of the data.

2.6 Unit of Analysis

The units of analysis for this study include households. Through universal sampling, 741 houses were surveyed purposively in union council (UC) Khanozai. Heads/representatives of the households were the participants of this study.

2.7 Sample Design

Four-stage sampling was used for this research. In District Pishin was selected purposively among 33 districts of Balochistan for current study. For this study, Khanozai town was selected purposively because it is an emerging town, soon to be a headquarter of a new district, it serves as a connection between adjacent four districts. Due to its location on national highway, Khanozai has got identical status. it serves as a charming and cool approach of transportation each to social and industrial sectors [32]. Furthermore, UC Khanozai was also selected through purposive sampling technique among three UCs of Khanozai town, i.e., UC Khanozai, UC Balozai, UC Khushab. Universal sampling technique was then used to select the households within UC Khanozai. It is a type of probability sampling which involves examining the entire population. Khanozai is a Union Council (UC) of Tehsil Karezat, Pishin District.

Stage-1	→	District Pishin	→	Purposive Sampling
Stage-2	→	Khanozai Town	→	Purposive Sampling
Stage-3	→	UC Khanozai	→	Purposive Sampling
Stage-4	→	Households	→	Universal Sampling

Fig.2. Sample Design

2.8 Data analysis methods

This study has used both descriptive and inferential analysis method. The statistical methods used in this research consisted of descriptive statistics of frequency counts, percentage, mean and standard deviation. For descriptive data analysis, mean and standard deviation were calculated. Whereas, for inferential analysis, the binary logistic regression model was used to explore the relationships between willingness to pay for improved solid waste management service and the socio-demographic characteristics.

3. RESULTS

3.1 Descriptive Statistics of Respondents

The descriptive analysis of the data shows that more than fourth-fifth 617 (83.3%) of the respondents were willing to pay for improved solid waste management services. Contrary to this, only 124 (16.7%) were not willing to pay for improved solid waste management. Similarly, the findings also revealed that 379 (51.1%) were willing to pay less than 200 Pakistani Rupees, 224 (30.2%) were willing to pay between 200-399, 115(15%) between 400-599 Rupees. And 23(3.1%) were willing to pay above 800 rupees a month for improved solid waste management practices to the MC Khanozai. Majority of the respondent found to be of age group 25 years old and above. The average household size was 11.18 members. More than four-fifth (81.6%) of the respondents were educated. Around three-fourth 536 (72.3%) of the households had their own whereas 205(27.7%) were living in rented houses. The findings showed that little more than half 392(52.9%) of families were living in nuclear families compared to 349(47.1%) in joint families. With regard to occupation, farmer 45 (6.1%), government employees 193 (26.0%), businessmen 238 (32.1%), unemployed 109(14.7%), wage labor 75(10.1%) and other occupations included 81 (10.9%). In the case of monthly household income, one-fifth 145 (19.6%) of the respondents reported their monthly income as less than 40000 PKR, more than half 390 (52.6%) as 40000-99999 PKR, whereas, 112 (15.1%) reported their household income between 100000-159999 PKR and 94 (12.7%) as 160,000 PKR.

Table 2 Descriptive Statistics of the Study Variables

Variables	N	Percent
Willingness to Pay		
Yes	617	83.3
No	124	16.7
Amount Willing to Pay (PKR)		
< 200	379	51.1
200 – 399	224	30.2
400 – 599	115	15.5
800+	23	3.1
Age of the Respondents (Years)		
< 25	11	1.5
25 – 49	322	43.5
50+	408	55.1
Family Size		
< 6	98	13.2
6 – 11	398	53.7
12 – 17	127	17.1
18+	118	15.9
Mean Family Size	11.18	
Education Level		
No Education	144	19.4
Primary	66	8.9
Secondary	346	46.6
High	185	24.9
Household Ownership		
Rented	205	27.7
Own House	536	72.3
Family Type		
Nuclear	392	52.9
Joint	349	47.1
Main Occupation		
Farmers	45	6.1
Government Employees	193	26.0
Businessmen	238	32.1
Unemployed	109	14.7
Wage Labor	75	10.1
Others	81	10.9
Monthly Income (PKR)		
< 40000	145	19.6
40000 – 99999	390	52.6
100000 – 159999	112	15.1
160000+	94	12.7
Total	**741**	**100.0**

Source: Field Survey, 2021

Note. PKR= Pakistan Rupee (The national Currency of Pakistan)

3.2 Solid Waste Management Practices at Household Level in Khanozai Town

The results presented in Table 3 shows that out of the total 741 households, 565 (76%) disposed of their solid waste at the specific sites. Only 5(0.6%) of households disposed of the residential wastes at irregular sites. Likewise, 230 (25.4%) of households reported that they burnt waste at homes as fuel. Moreover, 63 (7.0%) of the households reported that waste was directly collected from homes by Municipal

Committee Khanozai (MCK). Lastly, 41 (4.5%) households reported that they use animal waste as fuel at homes.

Table 3 Solid Waste Management Practices at Households Level   (Multiple Responses)

Solid Waste Management Practices	Responses		Percent of Cases
	N	Percent	
Waste Disposed of at Specified Sites	565	62.5	76.8
Waste Disposed of at Irregular Sites	5	0.6	0.7
Waste Burnt at Homes as Fuel	230	25.4	31.3
Waste Collected by Municipality from Homes	63	7.0	8.6
Animal Waste Use of as Fuel at Homes	41	4.5	5.6
Total	**904**	**100.0**	**122.8**

Source: Field Survey, 2021

3.3   Satisfaction with Solid Waste Management Services of the Municipality

The findings in Table 4 show the satisfaction of households with the solid waste management services provided by Municipal Committee Khanozai (MCK). For this purpose, the close-ended question was asked on a five-point Likert scale showing satisfaction levels. The findings revealed that out of total 741 households, almost half 350 (47.2%) households were satisfied with the waste management services, 186 (25%) were neutral, and 109 (14.7%) respondents were strongly satisfied with the solid waste management services provided by the municipality. Only, 12.9% of the total households were dissatisfied to strongly dissatisfied with the services. Moreover, almost one-fifth 138 (18.6%), and almost two-thirds 473 (63.8%) of the respondents considered solid waste management as a top priority problem and medium priority problem in Khanozai town.

Table 4 Satisfaction with Solid Waste Management Services by Municipal Committee Khanozai

Variables	N	Percent
Satisfaction with Solid Waste Services		
Strongly Satisfied	109	14.7
Satisfied	350	47.2
Neutral	186	25.1
Dissatisfied	92	12.4
Strongly Dissatisfied	4	0.5
Importance of Solid Waste Problem		
Top Priority Problem	138	18.6
Medium Priority Problem	473	63.8
Low Priority Problem	130	17.5
Total	**741**	**100.0**

Source: Field Survey, 2021

3.4   Analysis of Municipal Committee Khanozai

Municipal Committee Khanozai (MCK) was established in 2016 by the then Government of Balochistan for providing urban services to Khanozai Town. The MC Khanozai has 19 wards in its area of services. The MC Khanozai runs its operations through the grant-in-aid and annual budget from Finance Department, Government of Balochistan, Pakistan. However, since 2019, the MC Khanozai is provided budget for running its routine affairs. Its major services include collection and disposal of solid and liquid waste, cleaning of streets, anti-rabies campaigns, street lighting and several other works of urban importance.

The Chief Officer Municipal Committee Khanozai threw light on the major functions and operational capacity of MC Khanozai in the context of solid waste management in the following words;

a.   Service Area of MC Khanozai

"MC Khanozai has as large as 238 square kilometer area for services delivery; however, our operational capacity in terms of vehicles, human resource and finances is insufficient. The MC Khanozai has 23 labours as sweepers and cleaning staff majority on daily basis". **(Chief Officer MC Khanozai)**

b.   Municipal Tax Collection

"We have laws that permits collection of urban taxes from the communities on liquid and solid waste management services. In the last government, we were instructed for doing so. For imposing urban tax, we need the support of community living in residential and doing business in commercial areas of the town. If we succeed in collection of taxes, we can provide door-to-door solid waste collection services to the community through mini vehicles called Ching chi Rikshaw. This tax will enable the MC Khanozai to significantly improve the solid waste management services in Khanozai Town from collection to disposal in the foot hills of southern mountains". **(Chief Officer MC Khanozai)**

c.   Types and Disposal of Residential and Hospital Waste

"We have been transporting solid waste from the residential and commercial entities and dispose it of in the open dumping sites in the south of Khanozai Town. The residential waste incudes plastics, bottles, pampers and food. We, also collect hospital waste and dump in separately away from the residential waste because of its hazardous nature". **(Chief Officer MC Khanozai)**

d.   Waste Collection Sites and Dustbins

"MC Khanozai has installed 50+ movable dustbins in Khanozai Bazar in front of all important markets, shopping centers and hospitals. On daily basis, our team collects the entire commercial waste and dispose it off. The collected solid waste is mixed in type. In each ward of the municipality, we have fixed sites for collection of solid wastes and the MCK supervisors have established a close coordination with

the notables of the wards. Once these sites are filled with solid waste, our vehicle go to sites and dispose of the wastes". **(Chief Officer MC Khanozai)**

e. **Vehicles and Human Resource for Waste Disposal**

"Compare to our service area, we have limited vehicle for waste disposal. In MC Khanozai, we have four (04) tractors and two (02) Ching Chi Rikshaws and three (03) mini tippers and two (02) loaders for solid waste disposal and in addition we have a fire brigade for firefighting. In total, we have forty-eight (48) staff. Of which 45 are daily wages staff and only three (03) are permanent staff. The MC Khanozai is planning for hiring of 25-30 permanent staff for its operations in the near future". **(Chief Officer MC Khanozai)**

f. **Means of Communication for Waste Lifting and Disposal**

"MC Khanozai provides 24/7 waste disposal services to the community. The mobile numbers of our two supervisors are disseminated through social media. They could be contacted for any urban services because the local people of the town know them very well". **(Chief Officer MC Khanozai)**

g. **Finances and Estimates of Daily Waste Generation in Khanozai Town**

"Solid waste management is one of the highly important services. Out of the total funds received by municipal committee, 70-80% is spent on solid waste management of the Khanozai Town. Approximately, 0.45 kilogram per capita per day waste is generated in Khanozai Town. Similarly, around nineteen (19) ton of solid waste is generated per day in MC Khanozai. However, around 12-14 ton of waste is lifted and disposed of through dumping each day by the MC staff". **(Chief Officer MC Khanozai)**

Pic. 1

Pic. 2

Pic. 3

Pic. 4

Pic. 9

Pic. 8

Pic. 7

Pic. 10

Pic. 11

Pic. 12

Pic. 13

3.5 Willingness to Pay for Improved Solid Waste Management in Khanozai Town

An improved solid waste management in an important urban service provided by the local governments. It has been challenging for municipal governments because of several factors, particularly the unavailability of sufficient financial resources. Thus, local governments need sufficient funds for the improved solid waste management. For assessing willingness to pay by the households for improved solid waste management in Khanozai Town, the regression analysis was performed. The results of regression model are summarized in Table 5. From the variables mentioned above, due to high multicollinearity (VIF>10), they are dropped from the model. Only six variables are included in the final model that show a good model fit shown by *Hosmer and Lemeshow Test value* Chi-square= 10.5, p-value=0.231. Results for the age show a positive relationship with willingness to pay for solid waste management. Its odds ratio is 1.071 with significant level <0.01. Likewise, education is positively influencing the willingness to pay for solid waste management. It implies if the person is literate, he/she is 2.95 times more likely to pay for solid waste management and the results are significant at p-value<0.01. Household status, a proxy for economic status of the respondents, showed that if the people own house, the likelihood of willingness to pay for solid waste management increases by 5.45 times. Unlike to the previous results, family size has negative relationship with willingness to pay for solid waste management, shown by its odds ratio<1, and the association is significant at p<0.01. The satisfaction level of the people on Waste Management Service of MC Khanozai show a positive relationship with willingness to pay for solid waste management. It implies that those people who are satisfied more from waste management service of MC Khanozai, they are more likely to pay for solid waste management.

Table 5 Results of Regression Model

Variables	Odd Ratio	P-Value	95% Confidence Level	
			Upper	Lower
Age	1.071	0.000***	1.049	1.094
Education Level	2.955	0.000***	1.683	5.188
Marital Status	0.374	0.197	0.084	1.668
Household Ownership Status	5.453	0.000***	3.137	9.478
Family Size	0.905	0.000***	0.870	0.941
Satisfaction with MSWM	1.273	0.068*	0.982	1.651

Note: *= significant at 10%, **= significant at 5%, and ****=Significant at 1%.

Abbreviations. MSWM= Municipal Solid Waste Management

4. DISCUSSION

This study has assessed the solid waste management practices at the household level, and households' willingness to pay to Municipal Committee Khanozai for improved solid waste management in Khanozai Town, Balochistan. The proper solid waste management has been ignored by the government in developing countries which has become an environmental threat to the population [33]. Research has reported the ineffective household solid waste management has severe negative effects on public health of the population [34]. Thus, improved solid waste management has important public health and environmental implications. Due to lack of finances and weak operational capacity, the municipal governments, particularly in Pakistan, remain unbale to establish an improve solid waste management system.

Our findings showed that majority of the households disposed of their solid waste at the specific sites and few disposed of the residential wastes at irregular sites. A considerable portion of the households burnt waste at homes as fuel for cooking meals and source of energy. Some of the solid waste was directly collected from homes by Municipal Committee (MC) Khanozai and few households used animal waste as fuel at homes. This shows that majority of the people used to dispose of the waste at regular sites. On the one hand, disposing waste at regular sites makes easy job for the MC Khanozai for safe and easy collection. Whereas, on the other hand, this shows high level of awareness, civic sense and trust of the community on the waste management services of the municipality. Similar findings are reported by [33] which show that level of awareness have positive association with proper solid waste management.

The findings of the current study revealed that more than 60% of the households were satisfied to strongly satisfied with the solid waste services provided by Municipal Committee Khanozai. Contrary to this, only 12.9% of the households report their dissatisfaction. This clearly indicates that fact that Municipal Committee Khanozai has been providing satisfactory waste management services in the town. Moreover, majority (82.5%) of the respondents considered solid waste management as top to medium priority problem of Khanozai town. This shows that for the residents of the town,

managing soldi waste is highly important. Because, its improper management can cause severe health and environmental problems for the community. Our findings are contrast with those of [1] who reported that majority with more than half (55.8%) of the respondents expressed dissatisfaction with solid waste management in Nigeria.

The findings of the regression analysis revealed that age, educational level, household ownership and satisfaction level of the respondents with the solid waste services was positively associated with their willingness to pay for improved solid waste management by the Municipal Committee Khanozai. It implies that those people who are aged, educated and permanent residents of the town and satisfied more from waste management service of MC Khanozai, are more likely to pay for solid waste management. It further indicates the trust of residents of the town on the management of Municipal Committee Khanozai. Our findings are consistent with those of [35] who reported that level of education has positive association with willingness to pay for improved solid waste management services in Tonga, in Iran [36], and in Pakistan [33]. Out findings showed that majority (83.3%) of the town's households showed willingness to pay for improved solid waste services. In Pakistan several studies have reported people's willingness to pay for improved solid waste management. For instance in Islamabad [4], Abbottabad [33]. Little more than half (51.1%) of the households' respondents in the town reported that they can pay less than 200 PKR. a month to the Municipal Committee Khanozai for further improving their solid waste management services. Furthermore, the remaining 48.9% reported that they can pay more than 200 PKR for improved waste management services. Similar findings are reported from Our findings showed that economic status and willingness to pay for improved solid waste management had positive association. It implies that people with more income were more willingness to pay for municipality services. Similarly, people having permanent residency of the town had also positive association with willingness to pay for improved solid waste management. Our finding are similar with those of [36], [37], [38],[33], and [39] who showed a positive correlation between income and willingness to pay.

The results indicated that In Khanozai Town, solid waste was disposed of through open dumping in and land fill in the southern mountainous side of the town. The findings also showed that the collected solid waste is mixed in type and residents do not segregate it. Our findings are similar with those of [38] that 96% of municipal solid waste was collected mixed and only 4% was separately collected. Further, 68% of the solid waste was disposed of in landfill.

5. CONCLUSION

Improved solid waste management has been an issue of great concern for both the municipal governments and the communities because of significant health and environmental impacts. It has been challenging for municipal governments due to lack of operational capacity, limited human resource and more importantly the inadequate financial resources. Thus, municipal governments need sufficient funds for the improved solid waste management. The findings of the current study showed that majority of

people are satisfied with the solid waste services provided by the Municipal Committee Khanozai. Although, the Khanozai municipality has done good job in the safe disposal of solid waste; however, it still faces shortage for financial, technical and human resources for its smooth operations. Basically, the Municipal Committees under the Balochistan Local Government Act 2012 receive funding from the Government of Balochistan. The same Act under Part 3, Taxes of urban Council also permits the Municipal Committees to impose taxes on the urban services provided by the Municipal Committees. The findings of current study revealed that majority of the households showed willingness to pay for improved solod waste management in Khanozai Town. It is suggested that for increasing revenue of the Municipal Committee Khanozai and sustainable solid waste services, on pilot basis, the solid waste management tax should be imposed in Khanozai Town after awareness campaigns and consultations with the community. The Municipal Committee Khanozai is suggested to prepare proper waste management plan from collection to disposal of solid waste. Once, the community's trust is built then this tax can be scaled up. Furthermore, door-to-door collection of solid waste can be made successful through increase in urban revenues and enhancing operational capacity. Once the revenue flow is established then capacity of human resources and as well as vehicles can be upgraded which can help in establishing a sustainable and improved solid waste management system in Khanozai.

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