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Factors Affecting Willingness to Pay for Improved Solid Waste Management in Quetta, Pakistan

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ABSTRACT

Background: Solid waste management is continuing to be a great challenge across the globe especially in the developing world, Pakistan not exempted.
Objectives: The aim of this study was to explore the factors affecting willingness to pay for improved solid waste management in Quetta Metropolitan City, Balochistan, Pakistan.
Methodology: For this cross-sectional study, multistage sampling was employed for the selection of the households. The data from collected between November 2022 to December 2022 from 400 respondents through a questionnaire based survey. The data was analyzed through descriptive and inferential statistics.
Results: The findings revealed that 76.5% of the respondents were willing to pay for Improved Solid Waste Management (ISWM) in the study area. The logistic regression analysis on households' willingness to pay for ISWM waste revealed that age, gender, educational attainment, type of family, monthly income, and education on waste disposal were positively associated with on willingness to pay. This research concluded that people with higher incomes are more willing to pay for better waste management. Economic disparities affect community involvement in waste management. Urgent action is needed to address environmental and health problems caused by poor waste disposal in Quetta.
Conclusion: This study has forwarded recommendations that include initiating awareness campaigns, improved sewerage systems, regular waste collection, and government support for a clean city initiative.

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1. INTRODUCTION

The procedure of producing, gathering, shipping, isolating and disposing of solid waste comes under 'Solid Waste Management' Solid waste incorporates every one of those things which are proclaimed undesirable and futile by society (Asim, Ahmad, Salam, et al., 2016). The apparatus converts into the waste only when that is discarded with no expectations of reuse while knowing its intrinsic value (Khattak et al., 2009).This definition has been recognized in the term of practices differ for develop and developing countries because of the effect of several factors such as economy, politics and culture (Miao, 2018).“A material becomes waste when it is discarded without

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expecting to be compensated for its inherent value" (Khattak et al., 2009)

Throughout the world the quantity of the municipal waste is increasing rapidly than the grade of urbanization, in 2012 the cities of world created around per year 1.3 billion tons of solid waste, amounting by a rate of 1.2 kg per day by per person. Due to growth of population and urbanization, municipal management of waste production is anticipated to 2.2 billion tons by 2025 (Akhtar, Ahmad, Qureshi, & Shahraz, 2017; AOIKE, 2019, Shahzada et al, 2024). Presently In sub-Saharan Africa around 62 million tons per year of municipal solid waste production is on average of 0.65kg each person per day (Wilson et al., 2012). All over the world especially in the developing world rising cities and urban areas, the solid waste management is continuing to be a great challenge. Each year about 1.3 billion tons of solid waste of the world urban areas create and this volume can be increased to 2.2 billion tons by 2025. (Afroz et al., 2009).

Annually Pakistan produces 48 million tons of solid waste, overall Pakistan has less infrastructure for solid waste which result in seriously, health and environmental issues for millions of Pakistani people (Mukherji, 2018a). In large Population centers like Karachi, solid waste management, horticulture, and parks are the most pronounced issue. (Asim, Ahmad, & Salam, 2016). This poses serious negative effects on the environment and the health of millions citizen of Karachi living in the city, the government of Pakistan guess 77000 tons of solid waste is produced in the country each day, all these amount is produced in the metropolitan cities, Karachi along general 13000 tons of municipal solid waste each day (Mukherji, 2018a).

Solid waste management in Balochistan, has been one of the challenging in urban services, especially in urban sights, in Balochistan the research studies has reported that, the rate of urbanization and urban sprawl speeded in last years(MALIK et al.) . In Quetta metropolitan area food loss and also food waste has described compact awareness at the household level, inspected by Research study(Rehman et al., 2021).

Municipal solid waste (MSW) could be explained that consist all non-hazardous wastes, and domestic refuse, like institutional and commercial wastes streets sweepings and constructing garbage(Magutu & Onsongo, 2011). The municipal waste includes of waste collected by or in behalf of municipal managements authorities, or directly by the private sector not on behalf of municipalities, such as private non-profit institutions or Business" it is actually generated by household, offices and public institutions(Miao, 2018). Municipal solid wastes are thus seen as basically coming from households and also consists wastes from hotels, offices, shopping complex, schools, shops, institution and also from municipal services like maintenance of recreational area and street cleaning (Magutu & Onsongo, 2011). According to Lijun Zhao (2009) In China, the household generated the 60% MSW on daily basis which mostly consists of paper, organic, plastic, textile metal and others(Miao, 2018).

Regarding (McGranahan 1993) waste management in most developing countries, seems to be a serious environmental problem in individual homes and around is (Rahji et al., 2009).The issue of solid waste in the capital of Bangladesh Dhaka is very serious than other cities of developing countries(Afroz et al., 2009).In Nepal the solid waste management is a major problem to the national and provincial government, the total budget that is spent on the municipal waste management is around 10% and about 63.2% waste is collected by municipalities of Nepal (Maskey & Singh, 2017).Rathai (2007) evaluated that, in Mumbai around 6,256 tons of waste is per day produced. In Mumbai Municipal Corporation of Greater Mumbai (MCGM) is liable for the expulsion of Waste Management administrations. (Khattak et al., 2013).

In Nigeria, 21% to 81% of the collection rate of solid waste is mostly prohibited to high discernibility regions where people are willing to pay about the proper collection of solid waste (Akhtar, Ahmad, Qureshi, Shahraz, et al., 2017). According to the survey organized in EsKisehir Metropolitan, municipality overall recognized that the expectations of citizen were less than the municipal services. Satisfaction on waste assortment also impact on the WTP about solid waste management. Household who are more satisfied with collection will pay more than dissatisfied one (Akgul & Sciences, 2012).

2. METHODOLOGY

2.1. Study Design

The case study research design would be used for this ready study. The case study investigates the detailed information, collection of data through social survey,

questionnaire responses and findings of activity within important circumstances (Thomas, 2021).

2.2. Setting

Quetta is largest and most populous city of province Balochistan (Bazai & Panezai, 2020). The city is located at the 30.17° North latitude, and 66.97° East longitude respectively (Khan et al., 2020). In Balochistan province, the population of Quetta city constitutes 2, 037, 637 as per the census of 2017 (Pakistan Bureau of Statistics, 2017). The Quetta city has borders with two neighboring countries such as Iran and Afghanistan. The city is inhabited by the Pashtoon, Baloch, Bravi, Sidhi, Punjabi, Hazara and other minor ethnic groups. Only Quetta city has got the status of Metropolitan Corporation in the province. The management of Solid waste has been one of the challenging issues of the city.

2.3. Conceptual Framework

The aim of the study is to evaluate willingness of households to pay about improved solid waste management (ISWM) services in Quetta city, Balochistan. For this purpose, the respondents will be asked about their willingness to pay about better management of solid waste. They will also be asked about the existing practices for waste management in their areas. The binary logistic regression will be used for exploring the relationship between the independent (IVs) and dependent variable (DV). The dependent variable is willingness to pay and will be measured by yes for willing and no for not willing(Balasubramanian, 2019; Mulat et al., 2019). The independent variables include age, gender, caste, marital status, ethnicity, family type, family size, monthly income, household ownership, satisfactions on current situation, amount willing to pay, environmental awareness (Balasubramanian, 2019; Ndau & Tilley, 2018; Song et al., 2016b; Tassie & Endalew, 2020; Wegedie et al., 2020). The willingness of respondents for improved solid waste management will help urban planning and management authorities, particularly the Metropolitan Corporation Quetta (MCQ) in better solid waste management in Quetta city. Findings of this study will also help assess progress of provincial and districts governments in achieving sustainable development goals, particularly the Goal-11 which is aimed to make the human settlements & cities safe, resilient, sustainable and inclusive across the globe.

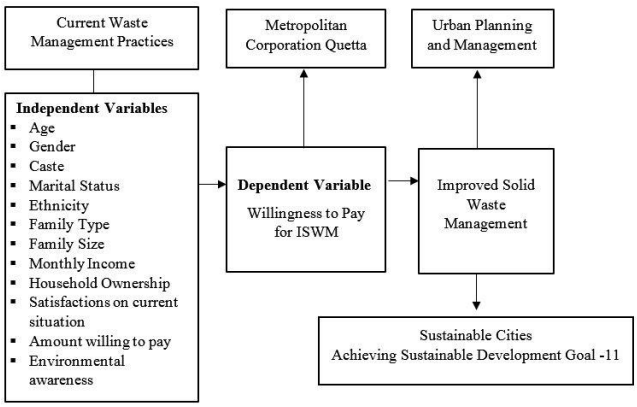

Fig 1. Conceptual Framework

2.4. Study Variables

The variables for this study are related to the solid waste collection at the business sector and household level, variables of socio-demographics of the participants and willingness to pay for the improved solid waste management, dependent and the independent variables.

2.5. Data Sources and Data collection

The primary data, which were collected between November 2022 to December 2022 in Quetta city Balochistan. Tool for the data collection was Questionnaire, on improved solid waste management. A proper survey was managed for 400 questionnaires, in which 210 were collected from three different Universities like, BUITEMS, University of Balochistan and Sardar Bahadur Khan Women University (SBK) and the remaining 190 were collected from the business sectors such as Thoghi Road, Sariab Road, Main AirPort Road, Circular Road, Main Nawan Killi Road, Fatima Jinnah Road and Sabzal Road.

2.6. Unit of Analysis

The households in Quetta city are the units of analysis for this study. The university students will serve as respondents.

2.7. Sample Design

This study employed multistage sampling for the selection of sample and data collection. The purposive and simple random sampling techniques would be used for the current research. The purposive sample, also known as subjective sampling, is type of non-probability sampling in which the sample is selected subjectively keeping in view the requirements of the study. Moreover, simple random sampling was used for selection of the respondents. Details of the sampling stages are given below.

- **Stage 1**

In the first stage, Quetta City is selected purposively as a study area for current research. The reason for selection of Quetta is that it is the provincial capital of Balochistan province. It is the most urbanized city of Balochistan. Due to mass urbanization and poor urban planning, the solid waste management has been a challenging issue for the Metropolitan Corporation Quetta (MCQ).

- **Stage 2**

In the second stage, the students of three public sector universities were chosen to be the respondents of this research purposively. The public sector universities include the University of Balochistan (UoB), Quetta, the Sardar Bahadur Khan (SBK) Women University, Quetta and The Balochistan University of Information Technology, Engineering, and Management Sciences (BUITEMS) located in Quetta city. The students were selected from public sector universities due to the following reasons. Firstly, they represent the general public of Quetta city. Secondly, they represented the all households of low, middle and high come which made the sample more representative.

Table 1. Description of Universities

S/N	Universities	Status
1.	UoB, Quetta	Public
2.	SBK, Quetta	Public
3.	BUITEMS, Quetta	Public

Source: Primary data, 2022

- **Stage 3**

In the stage 3, the simple random sampling was used for selection of the sampled respondents from the Bachelor of Science (BS), the Master of Science (MS), the Master of Philosophy (M.Phil.) and the Doctor of Philosophy (Ph.D.) programs

2.8. Data analysis methods

Descriptive statistics was used for descriptive of the data collected through questionnaire survey from respondents.

2.9. Inferential statistics

2.9.1. Binary Logistic Regression

In this study, we employed a logistic regression model to analyze the willingness to pay for waste disposal among households. The model is expressed as follows:

$$P(\text{Willingness to Pay} = 1) = \frac{1}{1 + e^{\beta 0+\beta 1X1+\beta 2X2+\cdots+\beta nXn}} \ldots\ldots\ldots\ldots (1)$$

P(Willingness to Pay=1) is the probability of households expressing a willingness to pay for waste disposal. X1,X2,…,Xn represent the independent variables associated with the household characteristics and attitudes. β0,β1,…,βn are the estimated coefficients for the respective independent variables. e is the base of the natural logarithm. The logit function, the inverse of the logistic function, transforms the probability into log-odds:

$$\text{logit}(p)=\ln(1/1-pp)=\beta 0+\beta 1X1+\beta 2X2+\ldots+\beta nXn$$

These coefficients (β0,β1,…,βn) were estimated using maximum likelihood estimation, providing insights into the relationship between household characteristics and the probability of expressing a willingness to pay for waste disposal.

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 findings in the Table 2 showed the socio-demographic profile of the respondents in Quetta city. Majority of the respondents belong to the age below 45 years old. Out of the total 71.0% were male and 29.0% were female respondents. We regard to education, 6.0% were illiterate, 5.0% were belongs to primary class, middle 10.0%, matric 12.5%, inter 13.0%, bachelor 42.3%, and master 11.3%. The family size of the respondent was, <6 (16.0%), 11-16 (57.8%), between 12-17 (13.0%) and 18+ (13.3%). Family type of the respondent were single 39.8%, and 60.3% were belongs to joint family system. House type of the respondent owned their personal house 75.0% and there remaining 25% were living in rented house. The average monthly income groups of the respondents

were <40000 (12.3%), 40000 – 69999 (28.5%), 70000 – 99999 (36.5%) and 100000+ (22.8%) respectively. Majority (54.8%) of the respondent were found to be aware about solid waste and 45.3% were not aware regarding solid waste. 54.3% of the respondent were having public bins near the house, while 45.8% of the respondent were having no public bins near their houses. 55.3% of the respondent were having no access of door-to-door solid waste collection services, while 44.8% had the access of the door to door solid waste collection services. Of the total, half (50.0%) of the respondent were paying no money for the solid waste collection services and remaining half (50.0%) were paying for the services of solid waste collection. The findings of this study showed that majority of the respondents were found to be considering solid waste collection as very important (37.8%), slightly important (31.0%), extremely important (13.3%), not important at all (10.3%), and moderately important (7.8%) respectively. Majority of the respondent reported the current state of solid waste collection services as poor (48.5%), fair (23.3%), neutral (21.8%), excellent (8%) and good (5%) receptively. Moreover, out of the total, 36.5% of the respondent were satisfied by the MCQ waste management practices, 27.8% were neutral, 19.5%, 13.3% very satisfied dissatisfied and 3.0%. very dissatisfied respectively.

Table 2. Socio-demographic profile of the respondents

Socio-demographic profile	Frequency	Percent
Age of respondents		
< 25	189	47.3
25 - 34	86	21.5
35 - 44	114	28.5
45+	11	2.8
Gender		
Male	284	71.0
Female	116	29.0
Education level		
Illiterate	24	6.0
Primary	20	5.0
Middle	40	10.0
Matric	50	12.5
Inter	52	13.0
Bachelor	169	42.3
Master	45	11.3
Family Size		
< 6	64	16.0
6 - 11	231	57.8
12 - 17	52	13.0
18+	53	13.3
Family type		
Single	159	39.8
Joint	241	60.3
House Type		
Personal	300	75.0
Rented	100	25.0
Average Monthly Income		
< 40000	49	12.3
40000 - 69999	114	28.5
70000 - 99999	146	36.5
100000+	91	22.8
Having awareness proper waste disposal		
No	181	45.3
Yes	219	54.8
Total	400	100.0
Having public bins near your house		
No	183	45.8
Yes	217	54.3
Having access to door to-door waste collection service		
No	221	55.3
Yes	179	44.8

Socio-demographic profile	Frequency	Percent
Currently paying for waste collection services		
No	200	50.0
Yes	200	50.0
Important of solid waste disposal		
Not Important At All	41	10.3
Slightly Important	124	31.0
Moderately Important	31	7.8
Very Important	151	37.8
Extremely Important	53	13.3
Perception of Current State of Solid Waste Collection		
Poor	194	48.5
Fair	93	23.3
Neutral	87	21.8
Good	23	5.8
Excellent	3	.8
Satisfaction with MCQ Waste Management Practices		
Very Dissatisfied	12	3.0
Dissatisfied	53	13.3
Neutral	111	27.8
Satisfied	146	36.5
Very Satisfied	78	19.5
Total	400	100.0

Source: Field Survey, 2022

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

3.2. Disposal of collected waste

The results in Table 3 showed the disposal of collected waste in Quetta City. The highly reported disposal of collected waste was found in general public meeting with 50.3% responses. The second highly reported collected waste was found on an open space with 21.5% attended by respondents. Moreover, in the itinerant waste van (8.5%) by the roads (5.8%) not applicable (4.0%) in a hole (3.0%) others (7.0%) and others.

Table 3. Disposal of collected waste (Multiple Responses)

Disposal of collected waste	Frequency	Percent
Not Applicable	16	4.0
In The Public Bin	201	50.3
In the Itinerant Waste Van	34	8.5
By The Road or Street Side	23	5.8
On an Open Space	86	21.5
In a Hole/In Own Compound	12	3.0
Others	28	7.0
Total	400	100.0

Source: Field Survey, 2022

3.3 Willingness to pay for improved solid waste management

The findings in the Table 4 reveals the willingness to pay for improved solid waste management in Quetta city. A little more than three-fourth (76.5%) of the respondents were willingness to pay whereas, 23.5% were not willing to pay.

Table 4. Willingness to pay to ISWM

Willingness to pay to ISWM	Frequency	Percent
No	94	23.5
Yes	306	76.5

Source: Field Survey, 2022

4. DISCUSSION

This study has assessed the households' willingness to pay for improved solid waste management in Quetta Balochistan. The swift rise in the amount of solid waste is becoming a significant environmental issue in the developing countries (Khattak et al., 2009). destroying human health and stimulating ecological, financial and natural harms due to poor management of solid waste in developing cities(Akhtar, Ahmad, Qureshi, & Shahraz, 2017) Therefore, there is a pressing need for improved solid waste management, because of its major environmental and public health intimation.

Our findings showed the socio demographic profile of the respondent in Quetta city, where majority of the

respondent were youth and quite mature and most of them were male, and somehow females too, as the data has been collected from universities and business sector. Similar findings are reported by (Akhtar, Ahmad, Qureshi, & Shahraz, 2017).

Majority of the respondent of this study were students of different universities in Quetta city, where mostly belonging to bachelor and master degree, and most of them were part of large family as the people of Quetta city mostly live in join family system. The study of Macau university showed the interviewee was 38.96 years old, and just 33.33% of the respondent were male, beside this the average number of household member was 3.70, and the education status was high school (Song et al., 2016a).

The findings of this study revealed that majority of the respondents are part of joint family systems, as mostly of the population of Quetta city live in joint family system as per their tradition and a small number of this interview has single family system. As Quetta city where this study has been done is developing city, where majority of the population belongs to middle class and somehow upper class and majority of this respondent, who took part in this data belongs to middle class. Our study is quite similar with(Akhtar, Ahmad, Qureshi, & Shahraz, 2017)

The findings of this study showed that, majority of the respondent were aware about solid waste management and its importance, and some number expressed their views, that they are unaware about it, and majority of the them in this study found that, they are thinking about this major issue regards solid waste collection, which is very important, as it cause many problems, same study showed that, majority of the respondent would concern for the environmental problems in Macau and most of the answers (80.8%) almost spent work on it(Song et al., 2016a).

Majority of the respondents of this current study found that, they are already paying money for the solid waste services, and expressed their concern about its environmental problems and wished to overcome it, and also wanted to play their role along the local government, whereas some respondents answered that, they are not concern about it, as this number of respondents showed that, the current state of solid waste in this area is very poor and need to be boost up, but those who were paying money showed, its good even some showed its excellent, similar study revealed the findings, where the respondent were not happy as the waste management workforce is too small to active municipalities to attain their goals(Limon et al., 2020).

Beside all these large number of the respondent of this study were pleased by the MCQ waste management practices, and some of them were neutral, average respondent very satisfied, and a small number of the respondents were dissatisfied 13.3% and very few were dissatisfied respectively with solid waste management services, which need to be improved as soon as possible.

Our findings showed that, highly reported disposal of collected waste was founded in general public bins and small amount of collected waste was found in open spaces such as roads, grounds, streets and even in drains, about which everyone knows its negative effects and environmental disasters. Similar studies are reported, Everybody knows the negative effect of unlawful waste dumping throw into disaster, the effect of burning waste, put aside organic-inorganic waste, or permit it to pile up in the public places(Brotosusilo et al., 2022).Moreover, 8.5% in the itinerant waste van, 5.8% found on roads, 4.0% not even applicable, 3.0% found in a hole and others 7.0%. For waste disposal, 45% of respondents chose landfill, 12.5% chose burning,(Akhtar, Ahmad, Qureshi, & Shahraz, 2017) .To establish an effective solid waste management system, it is crucial to immediately stop the practices of open dispose of and open burning(Mukherji, 2018b).

Our findings revealed the willingness to pay for improved solid waste management in Quetta city, where majority of our respondent were found willing to pay for solid waste services, while just a small number of respondents were not pleased to pay for the improved solid waste services. Some studies also reported, that 63% of interviewer were willing to pay less than USD 48 for neighborhood cleaning, 18.5% denied to pay anything, 16% were willing to pay USD 4.8-9.7, and 2.5% were willing to pay over USD 9.54(Akhtar, Ahmad, Qureshi, & Shahraz, 2017). The study found that, majority of the interviewer expressed positive views on Solid waste management, from the point they have agreed with all the beliefs specify in the researcher-designed surveyt, resulting in an average rating of 1.08(Limon et al., 2020).

5. CONCLUSION

This research study on the willingness to pay for improved solid waste management services in Quetta, Balochistan, Pakistan, has produced important findings that has explored the current status of waste management and disposal services in the Quetta metropolitan city of Balochistan, and also investigate household's willingness to pay for improved solid waste collection and associated factors in Quetta Metropolitan city.

The major findings of this study showed that, the overall state of solid waste collection services in Quetta city is quite poor, this is due to lake of awareness about solid waste, no proper education about solid waste collections, due to insufficient availability of dustbin at home, and due to poor management and strategy by MCQ, as there is no such public bins near houses, in case if there are public bins, then that is quite in

distance, and these container are not getting empty properly by MCQ, and there is no sufficient public bins in metropolitan area to dispose solid waste safely, thus to sort out this major problems, MCQ should prioritize solid waste disposal, and adopt advanced waste collection services, MCQ has to initiate proper campaign about solid waste disposal and should take well strategy about solid waste management, Government should take part to provide financial and technical resources to MCQ, and should provide sufficient and technical human resource to MCQ, above all these MCQ should follow waste reducing strategy.

The major findings of this study showed that, the problems that is caused by solid waste is air pollution, water pollution, smell and many health related problems and diseases, beside these problems, it also affect the environment, and there is a pronounced hazard on the street, just because of the presence of solid waste, and it caused harmful gases, because of rotting of solid waste, and these all happening, because there is no proper disposal strategy, no collection services of solid waste on daily basis, no sufficient public bins for safely disposal, no social and public awareness campaign to educate people about the importance of solid waste collection, now to overcome these major problems, MCQ should start campaign to educate people through social media, through posters, through commercial adds, and making social platforms to aware people about solid waste collection, and MCQ should make strategy to reduce solid waste by implementing recycling mechanism, so that gain economic importance, because after recycling solid waste, new product could be produce to utilize for solid waste collection, MCQ should enhance solid waste collection services. Establishment of Waste Segregation Mechanism at Source, therefore sort out these said problems.

The findings of this study showed that, majority of the population of the Quetta city has dustbins at home, most of these dustbin made of plastic material, but they are not having such mechanism to segregate these collected waste, nor placed such spare dustbin for separated solid waste by MCQ, along this there are even no sufficient public bins near the house for properly disposal the collected solid waste from household, in case if there are public bins, then that is either insufficient or quite in distance from a household, therefor people throw solid waste in open spaces, on street or roads which cause blockade of sewerage system and lines, beside this throw in grounds, in big Nala or even burn it, which spoil the environment by emission such harmful gases and also air pollution and it can cause disasters hazards. To sort out these problems, there should be expansion of Installing Solid Waste Bins across the Metropolitan area, there should be a separating mechanism for solid waste as it boosts income potential, and there should be a proper campaign to aware people that segregate the solid waste before disposal, which could also reduce the solid waste problems.

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