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Perception of people regarding recycling of household waste and willingness to be involved in waste management: a case study of Faisalabad

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Abstract: The objectives of this study were assessment of information level of households regarding waste management, perception regarding recycling benefits, and assessment of willingness of households to participate in waste management. Data were collected through a well-prepared questionnaire from eight areas of Faisalabad. A stratified random sampling technique was used for this purpose. A sample of 240 respondents was selected and 30 respondents from each area. Descriptive statistics were applied to assess information level and perception about recycling benefits. Moreover, they were well aware of its use in recycling. Path analysis was applied to assess the willingness to participate in waste management. Results showed that space and price had a significant and positive impact on waste separation at a 5% significance level. The government needs to make new laws regarding waste management and public participation must be focused during making these laws.

Keywords: waste; recycling; environment; WTP; Faisalabad.

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1 Introduction

Solid waste is a global issue and the management of solid waste is the responsibility of every individual living in this world. In low-income countries, more than 90% of waste is dumped openly (World Bank, 2018). The current population of Pakistan is 200 million with a 1.93% growth rate and makes 2.63% of the world's population. In Pakistan, the solid waste production rate is increasing day by day and its growth rate is 2.4% per year. However, per day waste generation rate ranges from 0.283 kg to 0.612 kg per capita. Waste is not dumped properly and usually is dumped openly in empty lands. Any material discarded from households, manufacturing industry, mining, agriculture termed solid waste. Solid waste can occur in solid, semi-solid, or gaseous forms. Over the previous years, Pakistan has not paid sufficient attention to the environmental problem of waste mismanagement, thus affecting all cities including Faisalabad. (Ashfaq et al., 2019). Most of the recyclable materials are not handled properly and they make their way to dumping areas (EPD Punjab). The increase in waste.

The generation rate in developing countries is due to changes occurred in way of living, eating habits, population increase. (Mosler et al, 2006; Talyan et al., 2008). The solid waste generation rate is continuously increasing affecting the surroundings badly along with the growth in Faisalabad. There is no facility for dumping ground and usually, solid waste is not dumped properly. Most of the waste is thrown on the streets, unused grounds, and water channels. Waste management is worse in adjacent and urban spaces than urban areas in Faisalabad. According to Yasin and Usman (2017) waste carrying capacity in the city is 900 tons but MSW generation is between 1300 to 1600 tons per day. Most of the waste does not make its way to the dumping site and often found on streets and roads and becomes the cause of various health and environmental issues. Faisalabad is currently home to 3.5 million people and is generating almost 1600 tons of municipal solid waste per day. The present waste collection by Faisalabad Waste Management Company is 1,250 tons.

A waste management system is not very advanced and satisfactory in many developing countries including Pakistan. Waste management facilities are serving incites but not in backward areas. Recycling waste materials has some good impacts on the entire environment, but miss management of the waste has more bad impacts than recycling management (Batool et al., 2007). Poor and usual collection and disposal system of solid waste is deteriorating the environment badly in Pakistan (Ali et al., 2014). Openly dumped waste affects health, climate. To run an efficient waste management system is expensive (World Bank, 2018) and the sustainability of any city depends upon the efficiency of waste management (Othman et al., 2013). The recent studies give us information about all the garbage material which is used for recycling purposes. Kitchen waste like food waste material and paper/ cardboard material is available in more quantity for recyclable purposes (Ashfaq et al., 2019).

The global community is focusing on the development of a green economy to grow the economy without neglecting the environment. Solid waste is a threat to the environment but it also provides economic opportunities (Abd' Razack et al., 2016; Sanusi, 2010).

1.1 Need of the study

In this complex system, waste management is a cyclic activity and to maintain this system continued efforts of different stakeholders are needed. Developing countries are facing lots of issues including environmental issues. These countries have little history regarding the implementation of waste management public awareness programs formally and informally (Ehrampoush and Moghadam, 2005). The fact is they are not putting in any efforts to educate public regarding the environmental awareness. Government alone cannot manage solid waste. There is a need to promote recycling activities and combine working of recycling and waste management system to manage it efficiently. It is necessary to study such factors which can promote recycling (Suttibak and Nitivattananon, 2008). Public participation is a very important factor to improve the waste management system. Public participation can be increased by providing them knowledge, better waste infrastructure, and by introducing easy separation and recycling methods (Xiao et al., 2017). Knowledge is very helpful to involve households in recycling activities (De Young, 1989). Lack of information is an obstacle in the way of household participation. Education and campaigns regarding recycling are sources of recycling knowledge (Nixon and Saphores, 2009). If people will be aware of recycling activities they will tend to separate waste. If waste separation activities will be promoted they can bring positive change (Banga, 2013). Public participation cannot be increased easily. It needs changes in the behaviours and attitudes of people. Awareness and knowledge cannot help to increase participation alone, people need to understand what problems they can face from this issue and they should consider it their responsibility (Minn et al., 2010). The study aims to analyse the participants' approach toward waste management, their will to contribute, and perceptions regarding the recycling of household waste. To achieve such aims few objectives are accomplished. Participants' information level regarding waste management and perception regarding recycling benefits are assessed. Their willingness to participate in waste management is also assessed.

2 Methodology

Faisalabad is the third-largest city of Pakistan and it is located between 310 N latitude and 730 E longitudes with 1.84 m elevation from sea level. There are six Tehsils (5 rural and1 urban) in Faisalabad district and it has eight subdivisions. Faisalabad district has 16,000 km2 while the Faisalabad city Tehsil covers 1,230 km2. According to the Pakistan bureau of statistics population of the Faisalabad district is 8 million and of the city area is 3 million with 512, with 284 households in a city area. There is only one dumping site in Muhammad Wala near Jaranwala road. The dumping site covers around 75 acres of land (Yasin and Usman, 2017).

2.1 Data collection

Data were collected by taking door-to-door interviews of any household member. A well-prepared questionnaire was used for this study. This questionnaire was finalised in the gaudiness of colleagues and supervisors. Before making it finalised pre-testing were made for the selection of questions and areas. Data were collected from different areas of

Faisalabad such as People's colony2, Liaqat Abad, Gulfishan Colony, Judge Wala, Gobind Pura, Ghulam Muhammad Abad, Batala Colony, and Nisar Colony. Nishat Abad, Gulshan-e- Makkah Colony, and D-type Colony were dropped from data collection due to inconvenience and non-cooperative behaviour of the respondents in the pre-testing. Out of 157 union councils (UCs), 8 union councils were selected randomly. In this case, the study stratified random sampling technique was used because it helps to obtain samples that represent the entire population. This technique was used because this was helpful to draw results of the entire UCs as subgroups. From each union council, only one residential area was selected randomly. Eight areas were selected, further, 30 respondents from each area were selected randomly and a total sample of 240 respondents was used in this study through stratified random sampling. Data were gathered in February and March 2018. Open-ended, close-ended, and the Likert scale questions were asked to the respondents which were made after pre-testing. The questionnaire was generated to assess the respondent's willingness to participate in waste management and to identify the perception about recycling benefits.

2.2 Data analysis and interpretation

Descriptive statistics were applied to analyse respondents' characteristics, level of information about waste management, and their perception of recycling benefits. In the descriptive analysis through SPSS, open-ended questions were used in the numeric form like 1 for yes, 2 for No, and 3 for neutral. Questionnaire data added into MS Excel and imported into SPSS for the final econometric analysis. The structural equation model (SEM) is the combination of factor analysis and path analysis. SEM is a general and cross-sectional modelling technique that is wildly used in the behavioural sciences. SEM is useful to analyse the cross-sectional data and it also helps to measures the strength of regression coefficients. Path analysis, factor analysis, and regression all represent special cases of SEM (Xiao et al., 2017). To analyse the willingness to participate in waste management path analysis were applied. In this model, two types of variables were used as endogenous and endogenous variables. The strength of relationships among variables is measured through path analysis (Xu et al., 2014). It is a form of multiple regression statistical analysis used to evaluate causal models between dependent variables and two or more independent variables. Using this method one can estimate both the magnitude and significance of causal connections between variables. Path analysis assumes that all variables are measured without error. It is used to describe the directed dependence among a set of variables. Relationships between variables determined by some hypothesis, theory, or experience can be tested. It tests linear relationships among variables and all paths are analysed simultaneously. To estimate path coefficients Maximum Likelihood was applied to obtain the path coefficients which are considered as partial regression coefficients (Xiao et al., 2017). Chi-square, CFI, NFI, RMSEA, and SRMR are useful to test the goodness-of-fit of a model (Pugesek and Tomer, 2003; Beaumelle et al., 2016; Xiao et al., 2017). SPSS and Amos were used to analyse the data. SPSS was used to apply descriptive statistics and Amos was used to applying Path analysis to estimate the impacts of factors on willingness to participate in waste management.

Table 1 The Demographic characteristics of the respondents

Characteristics of participants	*Frequency*	*Percentage*
Gender		
• Male	84	35.0
• Female	156	65.0
Marital status		
• Single	97	40.0
• Married	140	58.3
• Widow	2	0.8
• Widower	1	0.4
Education (level)		
• 0–8	5	2.1
• 9–12	79	32.9
• 13–18	151	62.9
• 19–21	5	2.1
Age (years)		
• 10–25	93	38.8
• 26–40	119	49.6
• 41–55	22	9.2
• 56–70	5	2.1
• 71–85	1	0.4

3 Results and discussion

The demographic characteristics of the respondents are shown in Table 1. The result showed more than half of the participants were female. 65% of the respondents were female and 35% were male. Almost 98% of participants were included in the single and married category. 62.9% of respondents had received more than 12 years of education. 49.6% of participants were in the 26 to 40 years age category.

Table 2 revealed that 12.1% of respondents did not know waste management. 25.0% of respondents said they have little knowledge about waste management. 40.4% of respondents said they have moderate knowledge about waste management. 14.2% of respondents said they have higher knowledge about waste management. The remaining 8.3% of respondents said they know about waste management to a great extent. 91.3% of respondents were aware of the recycling term. They were known that what is recycling. Only 8.8% of people did not know about the recycling of products. 91.3% respondents said they know about the reuse of some products. The majority of the respondents, i.e., 53.8% people said they did not ever hear about waste segregation. 46.3% said they have heard about waste segregation. Majority, i.e., 74.2 said they know we can make compost with these items, 25.8% of people said they cannot make compost with organic waste.

Table 2 Knowledge about the waste management

Variables	*Frequency*	*%*
• Not at all	29	12.1
• Little	60	25.0
• Moderate	97	40.4
• High	34	14.2
• To great extent	20	8.3
Total	*240*	*100.0*
Awareness about recycling		
• No	21	8.8
• Yes	219	91.3
Awareness about reuse		
• No	21	8.8
• Yes	219	91.3
Awareness about waste segregation		
• No	129	53.8
• Yes	111	46.3
Awareness about making compost		
• No	62	25.8
• Yes	178	74.2
Total	*240*	*100.0*

3.1 Willingness to participate in waste management

Source separation is the initial stage to begin and apply the 3Rs strategy (Sakai et al., 2008). 26.3% of people said they are not willing to participate in waste management. 27.5% said they can involve a little. 29.6% said they can moderately separate waste. 10.8% and 5.8% said they are willing to participate in waste separation to higher and at great extent respectively.

3.2 Factors affecting respondents' participation

To test the reliability of the scale Cronbach's alpha was used. The value of Cronbach's alpha was 0.822. All the standard deviation (SD) values of variables were between 0.926 and 1,318 which are given below in Table 3. The values of agreement from lowest to highest were environmental laws, care for the environment, price according to waste volume, pressure on landfills, trash bin logos, reward, community rules, knowledge about waste disposal methods, willingness to reuse, space at home, public advertisement, willing to manage, willing to find time, willing to learn, the influence of family, friends, and neighbours willing to compost, willing to use real nappies, and willing to sell to kabariwala. The Chi-square value was significant because the value of probability was 0.000 which was less than 0.05. The Chi-square test is very efficient to check the good fit

of the model. The probability value of RMSEA was 0.172 greater than 0.05. The values GFI (0.519) and AGFI (0.395) values were less than 0.9. Path analyses are given below in Figure 2 and observed variables are shown in squares. Residual factors e1 to e18 were not incorporated in the model. Partial coefficients are represented by standardised estimates. The knowledge about disposable methods, willingness to reuse, environmental laws, reward, willingness to buy goods made from recyclable items, willingness to find time, willingness to compost, community rules, price, willingness to sell, the behaviour of family, friends, and neighbours, pressure on landfills all showed a positive influence on willingness to participate. While, willing to use real nappies, care about the environment, willing to learn, trash bin logos and public advertisement showed negative effects. The path analysis showed that in terms of absolute value price has a most strong and positive and significant impact on the willingness to participate followed by space at home which also showed a significant and positive impact on an endogenous variable. The other variables' knowledge about disposal methods, willingness to compost, and waste management laws also showed positive and strong effects on willingness to participate. Trash bin logos showed a strong and negative effect on the dependent variable. The order of the effects of standard path coefficients was price, space, knowledge about waste disposal methods, willingness to compost, environmental laws, trash bin logos, pressure on landfills, the behaviour of family, friends, neighbours, reward, use of durable nappies, willing to sell, willing to find time, public advertisement, community rules, willing to learn, environmental care and willing to reuse. This study showed that enforcement of pay-as-you-throw programs reduced solid waste generation by 20 to 30% in Japan (Sakai et al., 2008). Most people who have separate spaces for discarded items store waste there. Some respondents were not managing waste because the sizes of their houses were small in terms of area. They had no small spaces to store discarded waste in houses. So, separate space at home was found an important variable.

Figure 2 Path analysis (see online version for colours)

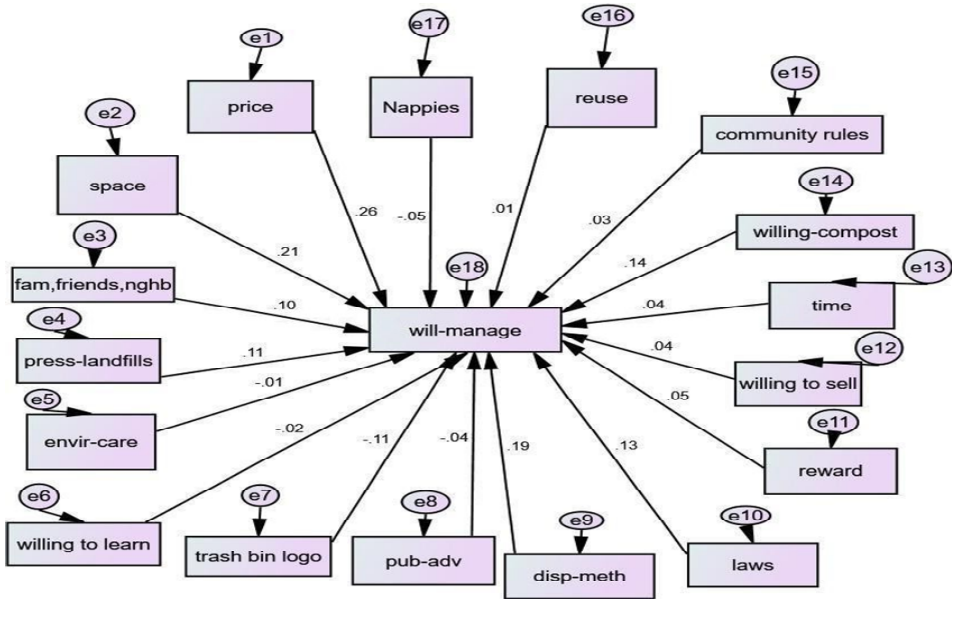

Table 3 Scores of willingness to manage waste and its influencing factors

Variables	*Mean*	*SD*
• Willing to participate in waste management	2.42	1,158
• Price	3.00	1,012
• Space	2.03	1,114
• The behaviour of family, friends, and neighbours	2.83	1,232
• Pressure on landfills	3.00	1,012
• Nappies	2.39	1,308
• Reward	3.58	1,032
• Willing to reuse	3.25	1,111
• Willing to sell	3.22	1,318
• Time	2.71	1,177
• Willing to compost	2.33	1,305
• Community rules	3.98	1,053
• Care for environment	3.57	0.957
• Environmental laws	4.12	0.926
• Knowledge about waste disposal	3.35	1,092
• Willing to learn	3.03	1,213
• Trash bin logos	3.96	1,024
• Public Advertisement	2.92	1,115

3.3 People's perception regarding recycling benefits

People were asked are you familiar with recycling benefits of solid waste, 17.5% of respondents responded that they are not familiar with recycling benefits, 20.4% respondents said they know little about recycling benefits, 40.8% respondents had moderate knowledge, and the remaining 11.7% and 9.6% respondents had higher and more than higher familiarity with recycling benefits respectively. 31.3%, 29.2%, and 21.7% think it helps at moderate, higher, and at a great extent to preserve natural resources respectively. 2.9% of people do not think recycling can generate jobs. 19.2% of people think recycling can generate employment to little extents. 34.2%, 27.9% and 15.8% people think that recycling has the potential at moderate, higher, and to the great extent to generate employments opportunities. Table 4 showed that 2.9% of people responded that recycling does not help to clean surroundings and pollution reduction. 11.7% said that recycling has minor impacts. 33.8% and 36.3% people said recycling helps at moderate and at a higher level in this regard. 15.4% of people said recycling helps to great extents. 6.3% of respondents said we cannot earn money with the help of recycling. 32.5% and 21.3% of people admitted that recycling can help at moderate and at a higher level to gain some money. Majority of the respondent's 31.7% and 23.3 people responded it helps to reduce the need at moderate and at higher level respectively. Table 4 also explored that 37.5%, 21.3%, and 15.8% said recycling saves energy to some

extent, to a medium extent, at a higher level, and great extent respectively. 15.4% of people said it reduces GHG emissions to great extents.

Table 4 Information level of households regarding waste management

Variables	*Frequency*	*%*
Familiarity with recycling benefits		
• Not at all	42	17.5
• A little	49	20.4
• Moderate	98	40.8
• Higher	28	11.7
• To a great extent	23	9.6
Preserves natural resources		
• Not at all	9	3.8
• Little	34	14.2
• Moderate	75	31.3
• Higher	70	29.2
• To a great extent	52	21.7
Employment generation		
• Not at all	7	2.9
• A little	46	19.2
• Moderate	82	34.2
• Higher	67	27.9
• To great extent	38	15.8
Reduces pollution		
• Not at all	7	2.9
• A little	28	11.7
• Moderate	81	33.8
• Higher	87	36.3
• To great extent	37	15.4
Economic incentive		
• Not at all	15	6.3
• A little	69	28.8
• Moderate	78	32.5
• Higher	51	21.3
• To great extent	27	11.3
Reduces need to burn waste		
• Not at all	15	6.3
• A little	67	27.9
• Moderate	76	31.7
• Higher	56	23.3
• To great extent	26	10.8

Table 4 Information level of households regarding waste management (continued)

Variables	*Frequency*	*%*
Saves energy		
• Not at all	20	8.3
• A little	41	17.1
• Moderate	90	37.5
• Higher	51	21.3
• To a great extent	38	15.8
GHG emissions		
• Not at all	33	13.8
• A little	43	17.9
• Moderate	78	32.5
• Higher	49	20.4
• To a great extent	37	15.4
• Total	240	100.0

4 Conclusions and policy implications

Waste management is an activity that requires the contribution of every stakeholder. It continues from the source to the final disposal. Waste should be managed properly at every level to achieve better results. The solid waste generation rate is continuously increasing affecting the surroundings badly along with the growth in Faisalabad (Ashfaq et al., 2019). There is no facility for dumping ground and usually, solid waste is not dumped properly. Most of the waste is thrown on the streets, unused grounds, water channels. Waste management is worse in adjacent and urban spaces than urban areas in Faisalabad. Path analysis is used to identify the factors which can help to increase contribution in waste management in communities. The path analysis showed that in terms of absolute value price has a most strong and positive and significant impact on the willingness to manage followed by space at home which also showed a significant and positive impact on the dependent variable (Xu et al., 2016). The other variables knowledge about disposal methods, environmental laws, willing to compost also showed positive and strong effects on willingness to manage. Trash bin logos showed a strong and negative effect on the dependent variable. If waste management corporations charge households according to waste volume people would tend to reduce waste. People responded they cannot keep waste separately due to a lack of space at home. People who like gardening can make compost at home which can help to reduce waste. Laws regarding waste management can also help to improve waste management (Ashfaq et al., 2019). The findings of the study indicated few measures which can be taken to improve public participation in waste management. By giving information about waste disposal methods and composting methods and 3Rs strategy through televisions, radio shows, print media, and social media. Teacher training is important to teach and encourage children at school. Government should introduce new rules regarding waste

management. Households should be bound to separate waste into different plastic bags before handover to waste collectors.

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