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Determinants of Willingness to Pay (WTP) for Better Waste Management in Urban Bangladesh

Doctoral (Ph.D.) dissertation

by

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Table of Contents

List of Tables

List of Figures

1.INTRODUCTION AND OBJECTIVES

1.1 Research Background and Significance of the Study

Waste management is a serious concern internationally, influencing population health, the natural environment, and development. There is a need to implement sound waste disposal mechanisms as population ubiquity and town expansion increase. WTP for better waste management services is an essential aspect of determining how much the communities value the services and the additional amount of money they are ready to pay to improve the services (Ahlheim et al., 2013). Worldwide, there are many differences between the practices in waste management and the WTP in this respect. Most developed countries show better waste management structures, including recycling facilities, technologies that convert waste to energy, and legal measures to enforce the practice. WTP for waste management services tends to be higher because of higher income, increased health consciousness, and a sound institutional framework (Zhang et al., 2010). Previous studies have been carried out for WTP in Bangladesh. This situation demonstrates that individuals are willing to pay for improved waste management services, a positive development. It is based on economic factors, perceived benefits, and confidence in the service providers' capability to offer better services.

Furthermore, improving people's understanding of potential gains from effective waste disposal and different publicity measures can also increase WTP among inhabitants (Babel, Rivas, & Ikeda, 2011). On the other hand, most developing nations in the third world have similar obstacles to those observed in Bangladesh, such as poor infrastructure, scarce capital, and low public health literacy. However, there are practical examples of how the implementation of new ideas and the use of communities is effective in the management of waste. For example, Japan and Germany developed a proper way of sorting waste and recycling. Thus, they have successfully minimized the usage of landfills and encouraged environmental conservation (Sakai et al., 1996).

In April 2020, during the pandemic, the effective handling of medical waste decreased significantly to only 7%, a sharp contrast to the regular rate of 14% (Dhaka Tribune, 2021). The increase in medical waste, connected explicitly to COVID-19, highlights the immediate requirement for improved waste management infrastructure and methods to mitigate the elevated public health and environmental hazards caused by the spike in waste resulting from the pandemic. The city of Dhaka generates over 6,500 tons of waste each day. This number is projected to increase to 8,500 tons by 2032, a significant amount. The city has shown that it is improving at collecting waste, averaging 77–80 percent efficiency. While private contractors pick up the bulk of the waste, city governments make sure that the waste is moved from secondary container sites to landfills daily.

WTP for advanced waste management benefits is of pivotal interest in policies. According to Haque et al. (2013), households in Bangladesh are willing to make financial contributions for trash management if those in charge provide them with tangible consequences for their money spent, including better, more frequent garbage collection, safer waste handling, and a cleaner environment. However, WTP depends on household income, environmental concern, and confidence in the local authority's service provision. Hence, it is important to explore why the entire population does not contribute equally to WTP in developing sustainable household waste management solutions for the Bangladeshi environment (Ahmed & Rahman, 2018).

Globally, waste generation is improving due to economic expansion. In 2021, the municipalities made more than two billion tons of waste yearly. One-third of that is still not handled in an ecologically protected way. People worldwide produce about 0.74 kilograms of waste daily, but this can vary widely, from 0.11 to 4.54 kilograms. By 2025, the waste generation of municipalities is predicted to move around 2.20 billion tons owing to increasing population and urbanization (Scarlat *et al.*, 2015;

Akhtar *et al.*, 2017; Indrawan *et al.*, 2018; AOIKE, 2019). While urbanization is a necessary component of social, cultural, and economic growth, the rate at which it occurs is unsustainable. The growing urban population in emerging countries exacerbates the issues confronting urban planners, service providers of governments, non-governmental organizations, and urban dwellers (Damtew and Desta, 2015; Birara and Kassahun, 2018). Urbanization and population increase alone account for the rapidly growing solid waste disposal rate (Rezaei *et al.*, 2010; Anjum, 2013). Urban waste management aims to process, accumulate, and dispose of the inhabitants' waste. Developing nations sometimes leave 30–60% of rubbish uncollected (Monyoncho, 2013).

1.2 Problem Statement and Justification

Waste is often rejected, unused, unwelcome, or excess material from industrial, agricultural, and urban sources.

Table 1: Annual Waste Generation per Capita in Bangladesh

Year	Total urban population	Urban population (% total)	Waste production rate (kg/cap/day)	Total waste production (ton/day)
1991	20872	20	0.49	10227
2001	28808	23	0.50	14404
2004	32765	25	0.50	16383
2011	48059	27	0.51	24360
2012	49821	28	0.51	25270
2013	51624	28	0.51	26247
2014	53456	29	0.51	27212
2015	55305	29	0.51	28209
2016	57168	29	0.51	29203
2017	59047	30	0.51	30218
2018	60944	30	0.51	31238
2019	62866	30	0.51	32279
2020	64815	31	0.51	33335
2025	78440	40	0.60	47064*

Source: author's collection from city corporation offices. *denotes the prospective waste generation. It is calculated based on previous data.

The amount of waste generation, depending on the population in Bangladesh's urban areas for several years, is given in the table. From table 1, within the period of 1991 to 2020, the urban population has risen tremendously in Bangladesh, from 20.87 million in 1991 to 64.82 million in 2020, and the percentage of the total population of urban population has also increased from 20% in 1991 to 31% in 2020. There has been little variation in the waste production rate of 0.49 to 0.51 kg/cap/day during this period, while the total waste production has risen from 10,227 tons/day in 1991 to 33,335 tons/day in 2020. This shows that population has led to an increase in the generation of waste, which has been quantified to be higher than the previous figures. In terms of the projected population by 2025, the urban population is expected to reach 78.44 million, which will be 40% of the total population of 196 million people; waste production rate to increase to 0.60 kg/cap/day; and a resulting overall waste production of 47,064 tons/day (Islam & Hossain, 2020).

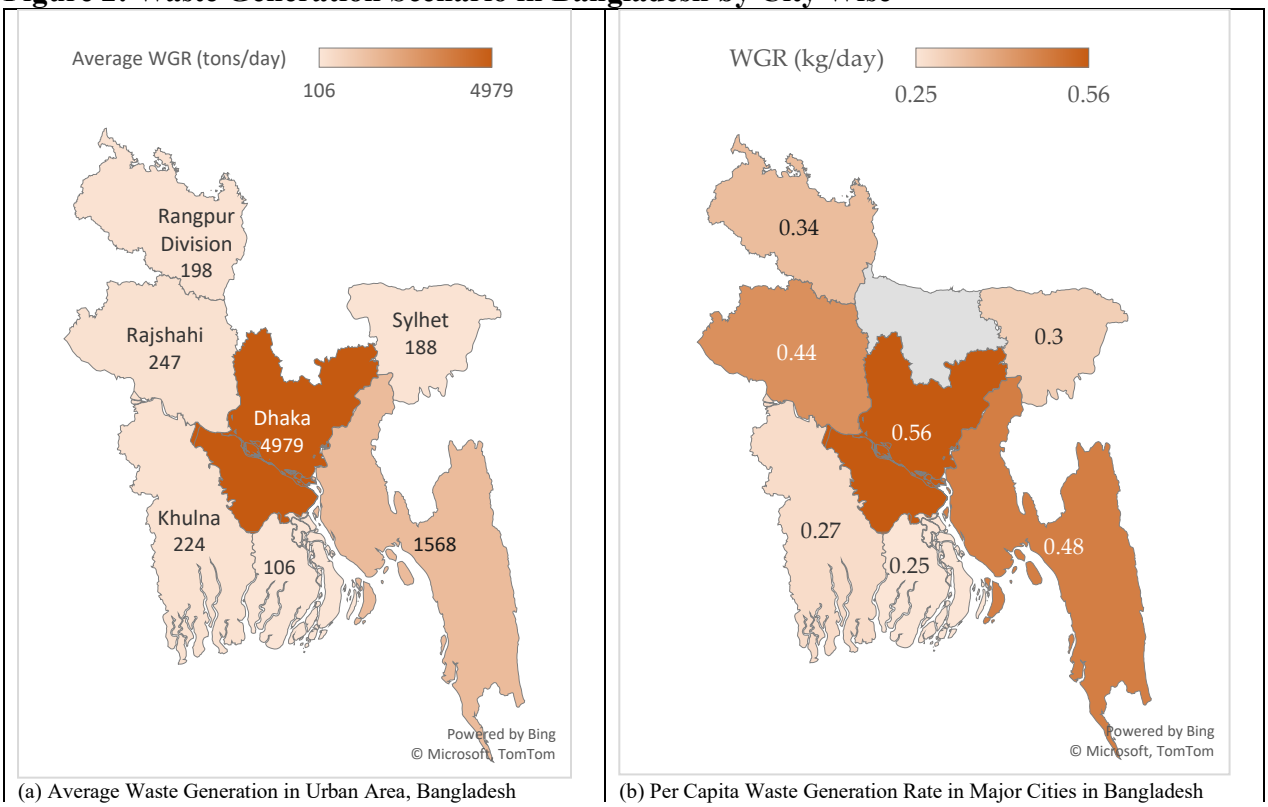
Figure 1: Waste Disposal Area in Bangladesh

Source: photo taken from city corporation report

Figure 1 shows the waste disposal area in landfills in different cities in Bangladesh. Indeed, Figure 2 speaks volumes about the need for fast-track waste management infrastructure, displaying the situation where a lack of proper and organized infrastructure and informal methods prevalently compel one's attention. These badly stacked waste dumps exist all over the urban areas and consist of both household and industrial waste contaminated with plastics, organic matter, and other hazardous waste. This makes the environment depressing and a hub of serious health risks for communities near these facilities and the waste pickers who sort the garbage in improper working conditions (Haque et al., 2013). Furthermore, the decentralised way most recycling and waste processing takes, as portrayed in the picture, creates inefficiencies and health hazards that do not in still confidence in the system and discourage the public from paying accredited formal waste management agencies (Islam & Saha, 2017).

The data presented in Table 2 provides a comprehensive summary of the composition of waste in six major cities in Bangladesh: Dhaka, Rajshahi, Chittagong, Khulna, Barisal, and Sylhet. The composition is partitioned into groups of waste, which include organic waste products, wastepaper, plastics, wood, textiles, dust products, etc. It is therefore important to understand this composition with a view to designing specific waste disposal and optimization of resources in integrated urban systems.

Figure 2: Waste Generation Scenario in Bangladesh by City Wise



(a) Average Waste Generation in Urban Area, Bangladesh

(b) Per Capita Waste Generation Rate in Major Cities in Bangladesh

Source: author's own editing

The primary issue with the waste management system in Bangladesh is its insufficient infrastructure and limited resources, resulting in ineffective waste pickup, incorrect disposal, and negligible recycling. By raising households' WTP for enhanced waste management services, we may effectively address these fundamental issues by securing the required finances and promoting greater public participation. Higher WTP can create the necessary income to invest in modern garbage collection, disposal, and recycling facilities, as well as develop a strong infrastructure to efficiently handle the increasing waste volume (Afroz et al., 2009). By receiving sufficient funds from the waste treatment plant, towns have the opportunity to enhance the quality and dependability of waste management services. This, in turn, results in cleaner streets and a decrease in health hazards related to waste pollution (Afroz et al., 2009). In summarizing the findings, several practical issues arise. First, there is no clear legal obligation regarding who should pay for waste services, and second, implementing an integrated waste management system, including conventional collection and disposal practices, becomes economically unfeasible (Ahmed & Rahman, 2018). Renewable energy resources, particularly biomass, may, on the other hand, play a critical role in electrifying rural, distant, coastal, and isolated places around the United States (Taylan *et al.*, 2018). It has been thousands of years since civilization has relied on a source of energy as biomass. Over the last several decades, Bangladesh has been plagued by a number of issues. These include issues such as overpopulation, scarcity of energy, and global warming, among others. The sustainable production of adequate electricity is a critical problem in light of the fast-expanding population and economic growth.

Table 2:Composition of Waste in Major Cities in Bangladesh

Composition	Dhaka	Chittagong	Khulna	Rajshahi	Barisal	Sylhet	Average
Organic Matters (Vegetables and Food)	68.30	73.60	78.90	71.10	81.10	73.80	74.50
Paper Products and Paper	10.70	9.90	9.50	8.90	7.20	8.40	9.10
Plastics and Polythene	4.30	2.80	3.10	4.00	3.50	3.40	3.50
Woods and textiles	2.20	2.10	1.30	1.90	1.90	2.10	1.90
Leathers and Rubbers	1.40	1.00	0.50	1.10	0.10	0.60	0.80
Metals	2.00	2.20	1.10	1.10	1.20	1.10	1.40
Ceramic and Glass	0.70	1.00	0.50	1.10	0.50	0.70	0.80
Concrete	1.80	1.10	0.10	2.90	0.10	1.80	1.30
Dust Products	6.70	5.10	3.70	6.50	3.10	5.30	5.10
Others	1.90	1.20	1.20	1.30	1.30	2.80	1.60
Total	100	100	100	100	100	100	100

Source: author's collection from city corporation offices, 2023

Renewable energy has the capability to play an essential role in meeting energy demand. Because Bangladesh is an agricultural nation, biomass has the possibility to be one of the country's sources of renewable energy. Biomass energy is mostly derived from wastes of agricultural crops, municipal solid waste, and animal manure in the United States (Sarkar, Ehsan, and Islam, 2003; Kim *et al.*, 2012; Sen and Ganguly, 2017; Uddin *et al.*, 2019).

1.3 Research Questions

The research will concentrate on reasons for WTP, such as income levels, environmental issues, and public awareness. Furthermore, this research attempts to explore the differences in these determinants across different income groups of households using econometric methods. This will help the researchers understand how WTP can be structured and optimized to guide better waste management practices for urban Bangladesh.

Therefore, the main and sub-research questions seek to investigate the factors that might influence the WTP significantly for better waste management in Bangladesh and the mediating link between environmental attitude, climate change perception, and WTP. (1) What are the key determinants that influence Individuals' willingness to pay for better waste management in Urban Bangladesh? (2) How does environmental socialization affect the monetary willingness to pay for the development of better waste management systems in the large cities of Bangladesh? (3) How do the awareness levels regarding climate change affect the readiness of urban residents in Bangladesh to pay for the sustainable management of waste? (4) To what extent do demographic factors (like age, income level, and education) influence the WTP for better waste management practices in Bangladesh? These research questions help identify and explain those factors that influence WTP for environmentally friendly waste management solutions in Bangladesh in response to specific environmental attitudes and climate change perceptions that are in line with the country's urbanization and industrial development. What are the determinants of WTP for better waste management services in Bangladesh?

1.4 Objectives of Study and Hypothesis

Increasing public awareness of global environmental and climate challenges and the need for greenhouse gas (GHG) emission reductions is the driving force behind this research. There are numerous objectives. This research aimed to provide an outline of the biomass energy available in Bangladesh. The primary goals are as follows:

(a) Find out the determinants of WTP for better waste management in Bangladesh.

(b) Identify the relationship between people's environmental attitudes and WTP in the main cities of Bangladesh.

(c) Identify the association between people's climate change attitudes and WTP in the main cities of Bangladesh.

1.5 Hypothesis of Study

Waste management is a critical issue globally, with significant implications for environmental sustainability, public health, and socio-economic development. In Bangladesh, like many other developing nations, challenges in waste management are pronounced, posing threats to both the environment and human well-being.

H1: There is no significant effect of the level of education on WTP for better waste management in the urban area in Bangladesh.

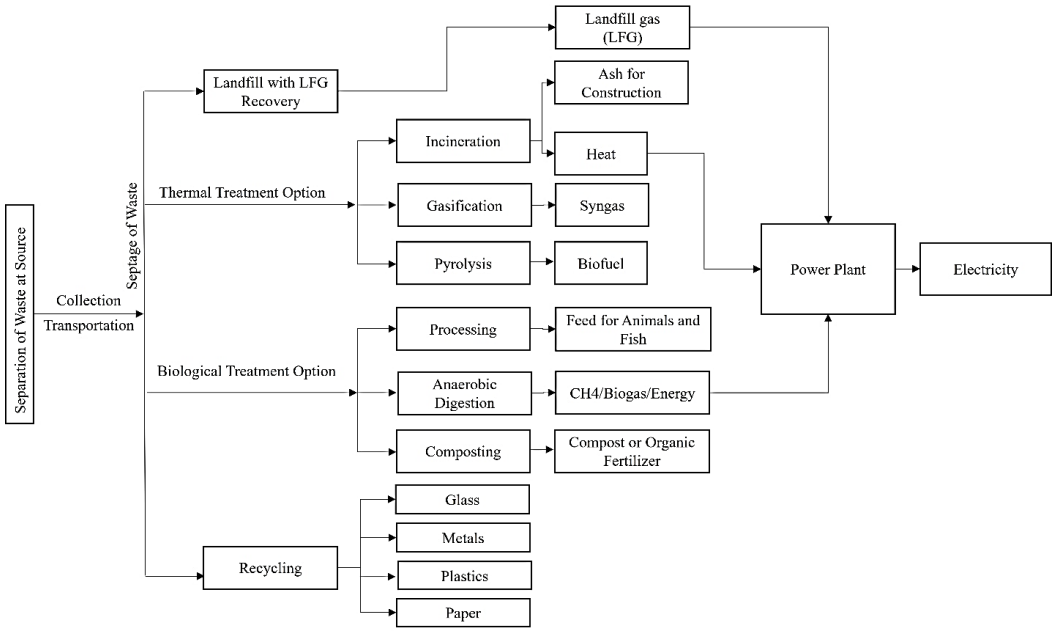
(1) H1: The education level on WTP significantly affects better waste management in urban areas in Bangladesh.
(2) H2: There is a positive relationship between WTP's goal of better waste management and environmental attitudes in urban areas in Bangladesh.
(3) H3: There is a relationship between WTP's goal of better waste management and climate change attitudes in urban areas in Bangladesh.
(4) H4: Income level has a positive influence on WTP among people.
(5) H5: There is a positive impact of gender on WTP in urban areas in Bangladesh.

1.6 Significance of Research

WTP defines an important aspect of individuals and communities that are willing and able to contribute towards the enhancement of SWM services. The WTP of households can enable the government to set the correct charges to encourage residents' use of waste management services and revenue collection to promote adequate funding of the services without overburdening the community. For example, different research conducted with the sample population of Ethiopia, Nepal and Ghana reveals that there always exists positive connection between households' income and WTP for improved waste management, hence it would pay dividends if service providers implemented differential pricing basing on the above factor (Mulat et al., 2019; Awunyo-Vitor et al., 2013). Second, knowing WTP allows us to define the characteristics that affect households' decisions to contribute to enhanced management of wastes. Of the variables of concern, awareness and attitudes towards the conservation of the environment have a considerable effect on WTP, and the studies above conducted in various regions support this (Ray et al., 2023). The chart outlines some of the biological treatments, including anaerobic digestion and composting. Bangladesh produces a high percentage of organic waste, and the largest proportion of waste comes from food and agriculture. Anaerobic digestion can offer sustainability by decomposing organic waste into biogas or energy, and as the flowchart shows, it can be used for power production as recommended by Rahman and Ahmed (2018). Likewise, composting could also assist in the proper handling of organic waste, for it can turn the garbage into

compost or organic fertilizer, which can be greatly needed in agriculture. These methods, however, need infrastructure, proper segregation of waste, and incentives for industries as well as households to embrace the idea (Islam & Hossain, 2017).

Figure 3: Combined Waste Management Plan and Economic Product Generation



Source: author's own editing

The other thermal management techniques that are presented include incineration, gasification, and pyrolysis. Though Bangladesh has inadequate incineration facilities, these methods could be useful in dealing with the increased flow of waste, especially in urban areas such as Dhaka (Rahman & Ahmed, 2016). Technology such as incineration helps minimize waste volume and produce energy in the process due to concerns of air pollution and high operating costs, but it has not been adopted fully (Ahsan et al., 2014). More complicated methods, such as gasification and pyrolysis technologies, can be used to utilize Syngas and biofuels, respectively, to manage non-recyclable waste and energy recovery (Haque et al., 2013). The flowchart also indicates that issues regarding landfill management are crucial, especially with regard to LFG recovery. In Bangladesh, there is considerable and rising adoption of unmanaged landfills that contribute more to greenhouse gas emissions and local pollution (Islam & Saha, 2017). Some examples include the figure that illustrates the ways through which emissions of methane from landfills for energy purposes, which is a concrete renewable source, as pointed out by Ahmed and Rahman (2018). According to the calculations, the prevention of 2 tons of organic waste from being dumped in a landfill resulted in a savings of US$ 23.36. At this time, the cost per ton is USD 11.68 (transportation and land filling cost). It will result in a 25 percent decrease in the utilization of chemical fertilizer. Prices for animal and fish food in the Bangladeshi market are going up. Since feed and other costs were going up, many farmers stopped fish and meat production (Financial Express, no date). Food waste should be used as animal feed as much as possible. Anyone can give food scraps to animals if they do it safely. Businesses and farmers can save money by giving

food waste to fish and animals. Feeding food scraps to animals is often cheaper than sending them to a landfill (Makkar, 2018; Truong *et al.*, 2019).

2. MATERIAL AND METHOD

2.1 Research Design

This mixed-methods study explores WTP variables for managing waste. To understand the research issue, the mixed-methods technique collects and analyzes quantitative and qualitative data. The quantitative component involves structured surveys of urban populations in seven major Bangladeshi cities. The survey will use standardized Likert-scale items and closed-ended questions to assess respondents' demographics, waste management attitudes, views of the current system, and willingness to pay for improved services. Survey data will be utilized for regression analysis to uncover WTP predictors such as demographics, environmental views, and perceived waste management benefits. Segmented semi-structured interviews with survey participants give qualitative data. WTP waste management decision-makers' values, reasons, and methods will be revealed using qualitative interviews. Participants shared trash management opinions, experiences, and anxieties via open-ended questions. Analyzing qualitative data themes and patterns will give rich context for quantitative results. Quantitative and qualitative data identified WTP elements for waste management improvement. Triangulation compares and contrasts data to corroborate key assumptions. Quantitative survey data and qualitative interview findings enhance and support the study findings, revealing WTP behavior factors. The mixed-methods study technique helps us examine waste management and WTP attitudes and practices from quantitative and qualitative perspectives.

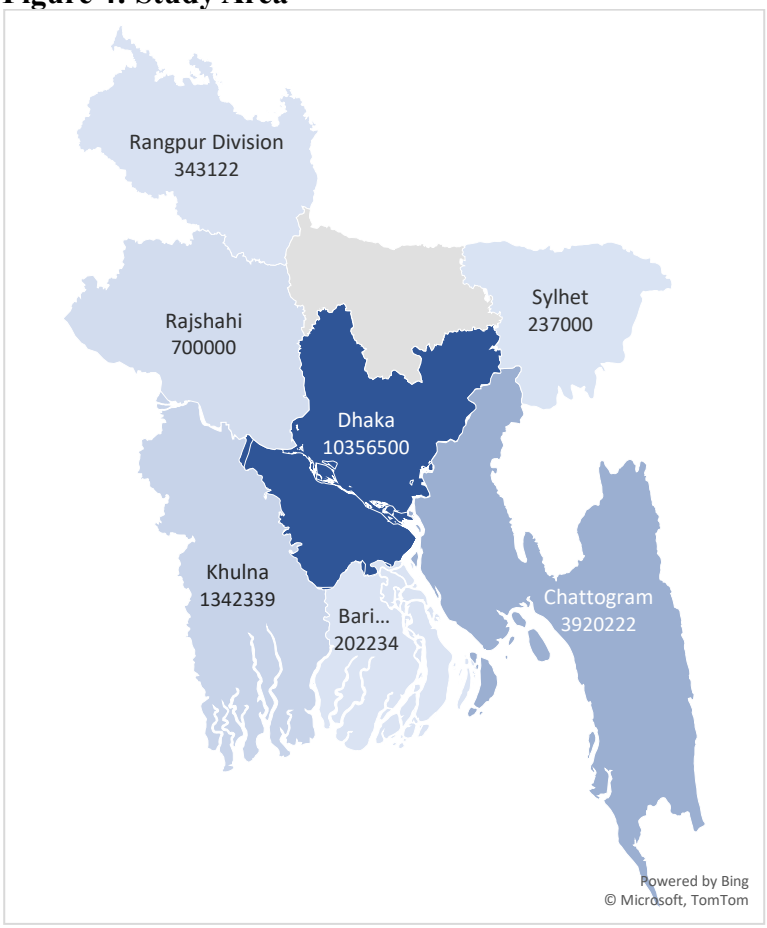
2.2 Sampling Strategy

The sampling strategy involves a systematic approach to confirm the assortment of a representative and diverse sample of participants. Drawing from urban areas within the major cities in Bangladesh, the sampling frame was constructed using available population data, such as census records or municipal listings. Utilizing a stratified sampling method, the population is divided into distinct strata based on key demographic circumstances, including gender, age, education, and income level. Within each stratum, a systematic sampling technique was employed to randomly select participants, ensuring proportional representation across different demographic groups. Efforts were made to achieve a sufficient sample size, calculated based on statistical considerations to ensure the study's power and precision. By implementing this comprehensive sampling strategy, the study aims to capture a varied range of experiences and perspectives related to WTP for advanced services of waste management, facilitating robust and generalizable findings.

2.3 Study Area

Several organizations, including the Bangladesh Bureau of Statistics (BBS), the Rural Development and Co-operatives of Bangladesh, and the Ministry of Local Government, have estimated that Bangladesh has 532 urban centers. There are 11 cities in Bangladesh governed by City Corporations under the local government. We have chosen seven city corporations for our study. Dhaka, Rajshahi, Chittagong, Khulna, Sylhet, Rangpur, and Barisal.

Figure 4: Study Area



Source: BSS census data 2021

2.4 Method of Data Collection

There are several questions regarding the validity and accuracy of the measurements (Carson and Czajkowski, 2014). It is suggested that the survey use the Contingent Valuation Method (CVM). It is a practical method for collecting information on people's preferences regarding the distribution of public goods and services in developing countries (Whittington, 2002). In this study, we will use a dichotomous choice CVM to figure out the WTP of people in major cities in Bangladesh and change the way waste is collected. Numerous studies demonstrate that families are prepared to spend a large sum on effective waste management. It is a widely used approach for valuing natural resources. CVM is one of the strategies for expressing preferences. It is based on the direct opinion of the respondent WTP for changing the quality and quantity or the in the environment ((Kasaye, 2015).

2.5 Questionnaire Formation

Well-structured questionnaires are designed to pick up the most exact data for analysis. The survey was carried out at the end of December 2023, and the questionnaire will be translated into the local language, "Bengali," for better comprehension by both enumerators and respondents. We will carry out a pilot study to circumvent minor problems with the questionnaire before finalization.

2.6 Analytical Method

The enumerator will ask the respondent "yes" or "no" questions about their willingness to pay (WTP) in order to assess their WTP. A particular monetary value was obtained for "yes" responses using the threshold decision-making theory in order to assess their WTP (Hanemann, Loomis, and Kanninen, 1991). Responses from the respondents' WTP figures can be simply a means to obtain a WTP estimate, as seen in the example below.

$$WTP = \frac{\sum Ti}{n} \qquad (1)$$

Where,

Ti = maximum willingness to pay (WTP) by respondent

N = number of respondents.

2.7 Econometric Modelling

Choice models were used to look at the relationship between the chosen socio-economic factors and the household WTP for a better waste management system in Bangladesh. They use a linear probability model to show or estimate the statistical relationships between independent and dependent variables. These models are called binary logit, linear probability, and probit models. There are two types of probability models: probit and logit. The projected possibility of the dependent variable in a model of binary linear probability is outside of the range 0 to 1 when the model is binary linear (Cameron and Trivedi, 2005). The majority of the research on WTP aimed at improving waste management services employed either a probit model or a logistic regression model (Hagos, Mekonnen, and Gebreegziabher, 2012; Seth *et al.*, 2014; Sinha, 2014; Lunojo, 2016) or a logit model (Addai, 2012; Dauda, Yacob, and Radam, 2015; Dhokhikah, Trihadiningrum, and Sunaryo, 2015), in order to figure out what factors influence WTP for a better waste management system (Bhattarai, 2015). Probit and logit models are two different types of models. (Park, 2015; Gujarati, 2021). There is a big difference in how the error term is spread out in each case. Within the framework of the logit model, it is presumed that the error term will maintain continuity with the logistic distribution. The error component is assumed to follow the conventional normal distribution when analyzing data with the probit model. Despite this little distinction, binary logit is superior to binary probit in terms of how straightforward it is to comprehend and apply in mathematical contexts.

There is a point at which a person cannot decide whether or not to pay more money for better waste management. Things that make up this threshold are used to figure out how high this level should be. If you get a lot of stimulation below the threshold, you don't feel anything. At the threshold, though, you do feel something that was caused by the stimulus.

$$Y_i = \beta x_i + \mu_i \qquad (2)$$

The above equation states that when people are willing to pay for better waste management services, Yi = 1, and if they don't, Yi = 0. Equation (2) is a binary choice model in which the probability of WTP for better waste management services 'Y' is estimated as a function of the independent variables' X'. Mathematically, this is shown as

$$P_i(y_i \neq 0 I X_i) = \frac{exp(X_i\beta)}{1 + exp(X_i\beta)} \qquad (3)$$

where,

i =1, 2, 3, ……*n*;

Pi = is the expected likelihood of a given option being made by person *i*.

βi = is an undefined parameter vector, and *X* is a vector of explanatory variables representing the individual's characteristics and choices that are supposed to affect the respective option. Equation (3)

shows the approximate conditional logic models. The binary choice modeling makes it straightforward to look at the results.
Equation (2) shows the logistic regression model.

$$\text{WTP} = \alpha + \beta_1 Gd + \beta_2 Ed + \beta_3 MI + \beta_4 HS + \beta_5 EI + \beta_6 CCI + \beta_7 HA + \mu i \quad (4)$$

where,
WTP (willingness to pay) is the dependent variable.
Gd is Gender
Ed is the level of education.
HS is Household Size
MI Monthly Income
HA Household assets.
EI is awareness of environmental issues.
CCI is an awareness of climate change issues.
μi is the error term.

The theoretical framework has been examined utilizing Stata version 14.

3. RESULTS AND DISCUSSION

3.1 Descriptive Analysis

Table 3 shows the comparative view of several vital socio-economic indicators between the respondents willing to pay for private operators and those reluctant to do so.

Table 3: Descriptive Statistics

		Willing to Pay (WTP)		Unwilling to pay	
Variable		Frequency	Percentage	Frequency	Percentage
Gender	Male	798	74.65	244	73.94
	Female	271	25.35	86	26.06
Age	20-24	54	5.05	68	20.61
	25-29	47	4.40	58	17.58
	30-34	176	16.46	90	27.27
	35-39	493	46.12	89	26.97
	40-More	299	27.97	25	7.58
Monthly Income BDT (USD)	15 K-20 K (120-165)	29	2.71	55	16.67
	21K-25K (121-205)	85	7.95	89	26.97
	26K-30K (206-250)	282	26.38	80	24.24
	31K-35K (210-290)	481	45.00	83	25.15
	36K-More (300 More)	192	17.96	23	6.97
Level of Education	Primary	23	2.15	83	25.15
	Secondary	45	4.21	36	10.91
	Higher Secondary	224	20.95	80	24.24
	Graduate	514	48.05	76	23.03
	Postgraduate	263	24.60	55	16.67
Household Size	2	138	12.91	35	10.61
	3	496	46.40	168	50.91
	4	395	36.95	111	33.64
	5	36	3.37	12	3.64
	6	4	0.37	4	1.21
Value of the Asset BDT (USD)	0-50K (0-400)	0	0	12	3.64
	51K-100K (401-825)	0	0	41	12.42
	101K-150K (826-1240)	2	0.19	86	26.06
	151K-200K (1241-1650)	177	16.56	56	16.97
	201K-250K (1650-2066)	369	34.52	63	19.09
	251K-More (2070 More	521	48.74	72	21.82

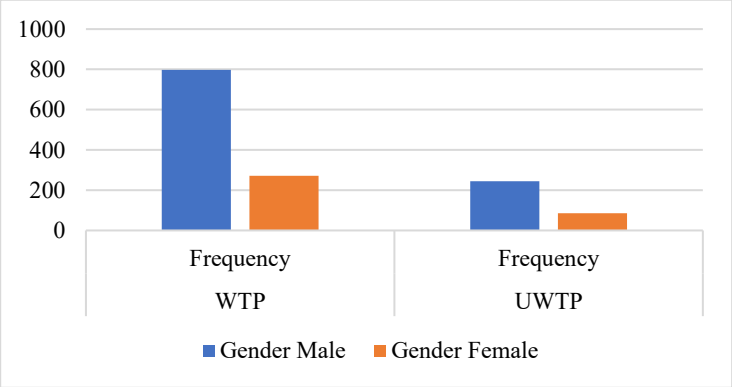
Source: Author(s) own calculation

Values in the brackets of Monthly Income and Asset are equivalent to BDT in USD. BDT/USD = 1/121

The table also provides a precise analysis of demographic and socio-economic determinants affecting the individuals' WTP for an improved waste management system in Bangladesh. The table offers a detailed and multifaceted description of demographic and socio-economic variables that would help differentiate the WTP and UWTP populations for private service delivery. Such research discoveries are relevant in counting the number of contributions, considering the determinants of people's

willingness to fund service delivery. Let's delve into a discussion based on the data presented in the table: As demonstrated by the data, there is also a significant inequality regarding the gender of people willing to pay: the number of males dominates with 74,65% while females comprise 25,35%. On the other hand, regarding the males' unwillingness to pay, the percentage of females is almost equal to that of males.

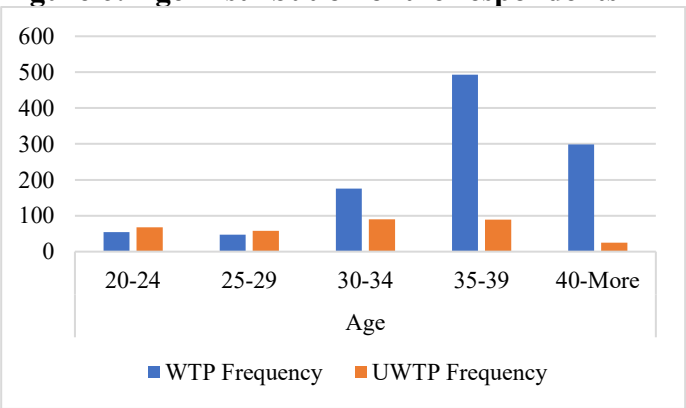
Figure 5: Gender distribution of the respondents



Source: author's own editing

This could be attributed to the socio-cultural factors and economic demographics since males will likely have higher independent purchasing power and decision-making powers regarding service outlay. Another factor that leads to a clear distinction between the two groups is their ages. The willingness to pay target group consists mainly of people in the specified age categories of 35-39 and 40 + years, of which people in the age category of 35-39 represent 46.12% of the respondents, and people in the age category 40 years and above represent 27.97% of the respondents. In contrast, the rest who are unwilling to pay comprise a relatively younger population, with the largest bracket being the 20-29 year olds. These differences could be related to age differences, life events, roles, and available resources, which can explain why some are willing to pay for such services while others are not.

Figure 6: Age Distribution of the respondents

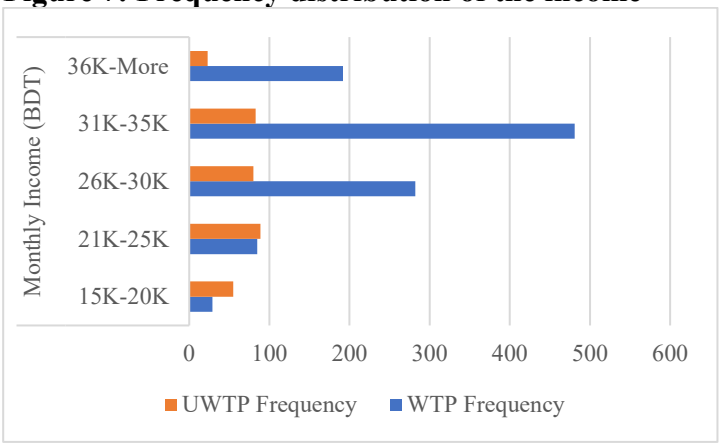


Source: author's own editing

Table 1 presents the actual socio-economic characteristics of the respondents; in the same table, there is an outlook for the respondents. This suggests that consumers' willingness to pay for a product is closely related to their monthly income, effectively defraying the product costs. Looking at the

demographics, we find that the privates with more income willing to use the paid services are more inclined toward those earning between 31 K- 35 K and 36K or more. On the other hand, the results indicate that those individuals with lower income, such as those earning between 15K-20K and 21K-25K, show a higher tendency of financial constraint resistance.

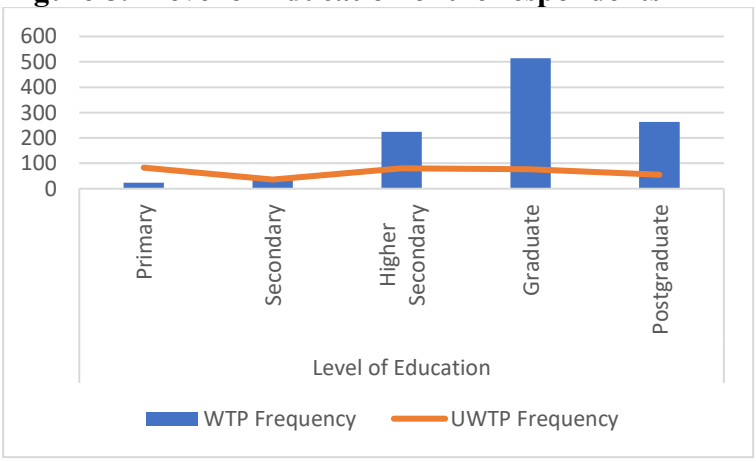
Figure 7: Frequency distribution of the income



Source: author's own editing

Education level also plays a central role in influencing citizens' decisions regarding their willingness to pay. Apart from that, the data also reveal that people with higher levels of education are more willing to pay for the services than people with low levels of education; this increases from the graduate and postgraduate levels to the primary and secondary levels of education.

Figure 8: Level of Education of the respondents

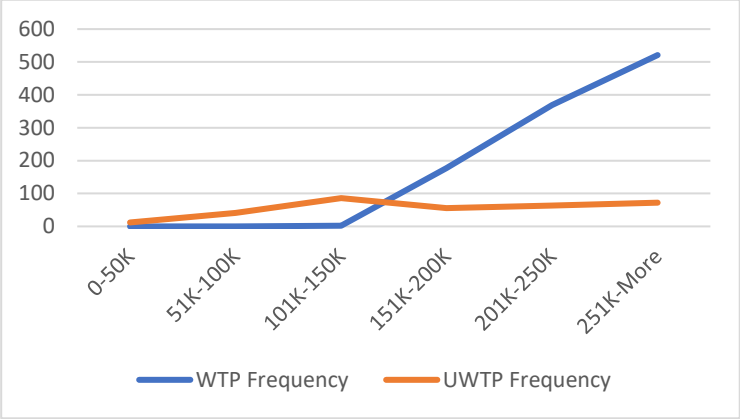


Source: author's own editing

The line chart outlines the relationship between assets and willingness or unwillingness to pay for waste management services. A clear positive relationship exists between how much people are willing to pay and the asset's value. Those with assets above 150,000 BDT show a higher desire to spend more, as shown in recent data. Most WTP respondents reported having more than 250,000 BDT in assets, which reached over 500 people in this category. This relationship is visible: individuals with more assets are more likely to use waste services. The line stays almost constant from 50,000 BDT until it rises above 150,000 BDT. Even though asset value goes up, people's desire to pay rarely drops

greatly, which suggests other aspects like trust and cultural beliefs affect their unwillingness to pay. What is also striking is that the distribution of the size of households also appears to be comparable between the two groups; in fact, the largest segment of both groups turns out to be in houses with 3-4 members.

Figure 9: The relationship between having assets and being willing or unwilling to pay



Source: author's own editing

Thus, while 39 percent of the population is unwilling to pay, there is a somewhat higher percentage of bigger houses in this segment, meaning that house size may be a factor in issues about spending money on services. Moreover, users are those with higher asset values who are willing to pay dominantly, more commonly ranging from 251K to More. On the other hand, users who are not willing to invest can have lower asset values, which means a relationship exists between the ability to earn money and the willingness to pay for technology services.

Table 4: Disposal area in different cities

Disposal Area	Rajshahi	Dhaka	Chattogram	Sylhet	Khulna	Rangpur	Barisal	Total
Municipality/City Corporation Recycle Collector	188	206	117	104	121	93	109	938
Empty Plots	30	66	51	72	37	78	27	361
Highway Side	1	2	0	8	3	3	1	18
Recycle Collector	7	8	0	12	9	3	1	40
Private Farm	6	3	2	7	3	3	0	24
Drainage	4	2	0	6	2	4	0	18
Total	236	287	170	209	175	184	138	1,399

Source: author(s) own calculation

The Municipality/City Corporation Recycle Collector serves as a primary waste collection point in all cities, with high utilization rates: Rajshahi (188 respondents), Dhaka (206 respondents), Chattogram (117 respondents), Sylhet (104 respondents), Khulna (121 respondents), Rangpur (93 respondents), and Barisal (109 respondents). Empty plots are also commonly used for waste disposal, indicating

informal dumping practices: Rajshahi (30 respondents), Dhaka (66 respondents), Chattogram (51 respondents), Sylhet (72 respondents), Khulna (37 respondents), Rangpur (78 respondents), and Barisal (27 respondents). Other disposal areas, such as Recycle Collectors, Highway Sides, and Private Farms, show varying utilization across cities, with smaller numbers reported.
In summary, while formal waste collection services provided by Municipalities and city Corporations are widely utilized, there is also a significant reliance on informal disposal sites such as empty plots across all surveyed cities.

Table 5: Comparative Analysis of the Willingness to Pay (WTP)

	Willing to Pay (WTP)		Unwilling to pay	
Price/Month BDT (USD)	Yes	Percentage	No	Percentage
100 (0.80)	2	0.19	13	3.94
150 (1.25)	6	0.56	58	17.58
200 1.65)	141	13.19	146	44.34
250 (2.06)	296	27.69	73	22.12
300 (2.47)	187	17.49	29	8.79
350 (2.89)	223	20.86	7	2.12
400 (3.30)	43	4.02	2	0.61
450 (3.71)	108	10.10	2	0.61
500 (4.13)	63	5.89	0	0

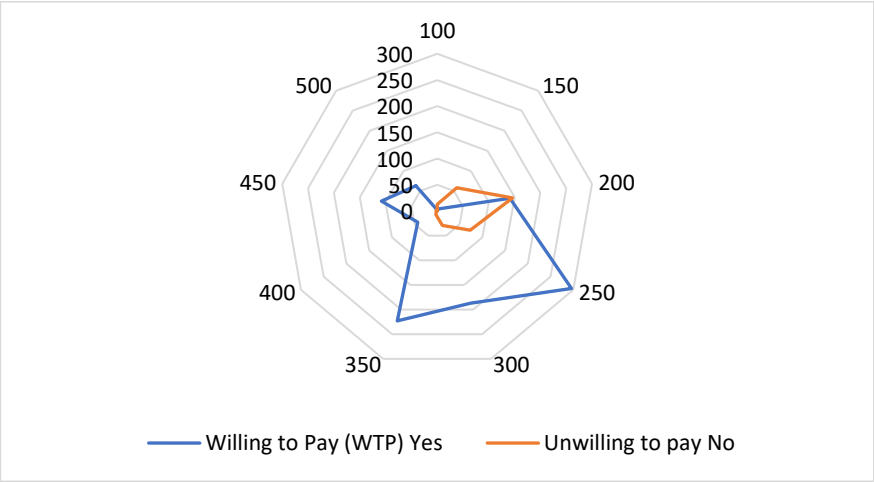
Source: author(s) own calculation

* Values in the brackets are equivalent to BDT in USD. BDT/USD = 1/121

Table 4 provides a comparative analysis of the willingness to pay (WTP) for better waste management in Bangladesh, delineating the monthly payment amounts in Bangladeshi Taka (BDT) for two groups: those willing to pay for the content and the individuals who have no intention of paying for the content. The first column also considers individuals' willingness to pay the amount in BDT, which is depicted below for each month and is analyzed for a better waste management service. On the other hand, the second bar shows a lack of constructive indication of willingness to pay, as portrayed by the low means with no amounts stated under the monthly payment. Indeed, out of all the respondents willing to pay, there is quite an evident split towards how much people would be willing to pay monthly, which is between BDT 100 and BDT 500. Specifically, BDT 250 attracts the highest percentage of respondents, as 296 (27.69%) are willing to pay by providing their figured responses. Respondents belonging to the BDT 200 and BDT 300 categories constitute other large proportions, comprising 13.19% and 17.49% respectively, with 141 and 187 participants. As for the results of the product's popularity with the monthly payment amount, the data totals 60%, reflecting a gradual decrease in the number of respondents falling within the range of BDT 250 to BDT 500. The radar diagram compares Willing to Pay (WTP) and the willingness to pay group. The blue line (Yes) shows a strong peak at BDT 250 and BDT 350, indicating these are the most commonly preferred contribution levels among willing respondents. Values drop significantly below BDT 150, suggesting that very low payment offers are not perceived as credible or sufficient to support meaningful service. The line extends up to BDT 500, with a small representation, showing some high-income respondents' support for premium-level services. The blue line indicates that those unwilling to pay tend to justify their position by citing affordability or dissatisfaction with low-value services. The line remains close to the center beyond

BDT 250, implying little to no interest in higher payment tiers among this group.Similarly, rare was the revelation of a willingness to contribute financially for enhanced waste management services among those unwilling to pay; all the monthly payment amount categories will offer an amount for enhanced waste management services. It has eight members, which is still over the willing to pay group, with the majority stating that they are not willing to pay.

Figure 10: Comparative Analysis of the Willingness to Pay (WTP) of the respondents



Source: author's own editing

Table No. 8 indicates the classifications of the households as per their WTP at different tariff/price structures. Thus, even when asked at what price a monthly subscription of BDT100 is viable for them, all the households responded positively, being 100%. About 74 percent of the households said they would pay BDT150 monthly to watch programs on the Digital System. From the value of BDT 50 each month, the percentage dropped to 63% for each of them. About 48% of the participants provided feedback stating their readiness to spend at least BDT200 per month. Therefore, from the results of the present study, there was a decrease in the extent to which the study participants reciprocated the increase in the price of the service above. Similarly, the results of this study show that the level of demand is proportional to the cost of the service, and the discovered increase in the price after having a considerable number of participants conditionally suggests a reduction in the number of clients. The logit model was chosen to identify the factors that affect willingness to pay for the service. To control the explained variability, the Pearson chi-squared ($\chi 2$) statistic was used to examine the model's goodness of fit. Based on the likelihood ratio test, the value is calculated to be 226.3052, higher than the critical values at the 5% and 1% significance levels of 124.3420 and 135.8070, respectively. When taking this test, we can see that the vector of coefficients of the elements in the model greatly differs from zero at 5% and 1% levels of significance, respectively. As another measure of fit, default coefficients of estimation P are calculated with the help of the following formula. A chi-square test can also be used in regression analysis, where the value of $P < 0.15$ indicates a lack of fit. The value of p, according to this ratio, should be greater than or equal to 0.15. According to the model, these models present a satisfactory fit. By examining the regression output, it is seen that the value of P is greater than 0.05 and equals 0.6315, which means that the model fits well. Therefore, in the study, the difference between the number of individual factors perceived by the two groups was determined using the t-test, as Table 4 shows. The results of this study, based on the logit model, confirm that the

age of the respondents, the average amount of money they were ready to spend, and the collector's brand significantly and negatively influenced their willingness to pay. T-ratios of the variables indicated that age had a p-value equal to 0.10, thus indicating that this variable was significant at a 10 percent level. In contrast, the average quantity and kind of collector had p-values of 0.01, implying that these variables were significant at a 1 percent level.

3.2 Model Evaluation

The logistic regression analysis aimed to examine the predictors influencing the likelihood of individuals supporting a better waste management system in Bangladesh. The intercept term (-9.19) indicates the log odds of the outcome when all predictor variables are zero. The odds ratio of 0.00 implies a very low likelihood of supporting better waste management when other predictors are absent. The coefficient of gender (-0.03) suggests a negligible effect of gender on the odds of supporting better waste management in Bangladesh. The odds ratio of 0.97 indicates that being male slightly decreases the odds of supporting better waste management. This ratio is not significant ($p = 0.879$) at the 5% level of significance. The coefficient of household size (0.10) indicates that larger household sizes are correlated with a slight increase in the odds of supporting better waste management (odds ratio = 1.10), although this effect is not statistically significant ($p = 0.361$). The coefficient of monthly income (0.30) implies that higher monthly incomes are positively related to supporting better waste management (odds ratio = 1.35). This effect is statistically significant ($p = 0.000$), indicating that individuals with higher incomes are more likely to support enhanced waste management. The value of the Asset's coefficient (0.19) indicates a significant positive relationship between asset value and support for better waste management (odds ratio = 3.31). Individuals with higher asset values are more likely to support improved waste management ($p = 0.000$). A coefficient of 0.37 for level of education suggests that higher levels of education are positively associated with supporting better waste management (odds ratio = 1.45). This effect is statistically significant ($p = 0.000$), indicating that individuals with higher education levels are more likely to support improved waste management.

Table 6: The result of logistic regression for a better waste management system in Bangladesh

Variables	Coefficients	Odd Ratio	t-statistics	p-value
Constant	-9.19	0.00	-12.25	0.000
Gender	-0.03	0.97	-0.15	0.879
Household Size	0.10	1.10	0.91	0.361
Monthly Income	0.30	1.35	3.41	0.000
Value of the Asset	1.19	3.31	13.72	0.000
Level of Education	0.37	1.45	4.45	0.000
Awareness about Environmental Issues	1.27	3.56	4.39	0.000
Awareness about Climate Change issues	1.33	3.79	7.16	0.000
LR Chi2	595.35			
Pro>chi2	0.000			
Pseudo R2	0.3895			
Log Likelihood	-466.58			

Source: author(s) own calculation

The coefficient of 1.27 for Awareness about Environmental Issue states that awareness about environmental issues positively influences support for better waste management (odds ratio = 3.56). This effect is statistically significant ($p = 0.000$). Similarly, awareness about climate change issues

positively influences support for better waste management, with a coefficient of 1.33 and an odds ratio of 3.79 ($p = 0.000$). The overall model fit was measured by the likelihood ratio chi-square test (LR Chi2 = 595.35), which was statistically significant ($p < 0.001$). The pseudo-R-squared value of 0.3895 suggests that the model accounts for approximately 38.95% of the variance in the likelihood of supporting better waste management.

3.3 Discussion

The table highlights clear socio-economic disparities between individuals willing and unwilling to pay for advanced waste management services. Those willing to pay tend to be male, older, with higher incomes, educational attainment, and asset values. In contrast, those unwilling to pay are more likely to be female with lower incomes, education levels, and asset values. These findings emphasize the value of considering demographic and socio-economic factors in aiming for inclusive and effective service delivery strategies. These findings have significant implications for service providers and policymakers. Understanding the demographic and socio-economic factors affecting individuals' WTP can inform targeted marketing strategies, pricing models, and policy interventions to promote inclusive and equitable access to essential services. Moreover, addressing underlying disparities in income, education, and asset ownership can enhance socio-economic empowerment and foster a more equitable distribution of service benefits across diverse population segments.

The distribution of WTP amounts reflects varying levels of commitment among respondents. While a small percentage is willing to pay lower amounts (e.g., 0.19% for 100 BDT per month), a larger proportion demonstrates a readiness to contribute higher sums, particularly in the 200 BDT to 350 BDT range, which collectively accounts for over 60% of the respondents' WTP. The distribution shows that individuals are willing to pay higher amounts for improved waste management services, indicating an identification of the significance of effective waste management and environmental sustainability. This willingness to contribute financially underscores the potential for implementing improved waste management initiatives with public support. The data also highlights disparities in WTP amounts among different income groups. People with higher disposable incomes may be more liable to pay larger amounts for enhanced waste management services, while those with lower incomes may face challenges in meeting higher payment thresholds. Addressing these economic disparities is crucial for ensuring equitable access to improved waste management solutions.

The results of the logistic regression analysis provide valuable insights into the factors influencing support for a better waste management system in Bangladesh. Waste management challenges in the context of Bangladesh hold significant implications. The positive associations between monthly income, asset value, and level of education with support for better waste management, underscore the role of socio-economic status in shaping attitudes toward environmental issues. Policymakers should focus on initiatives aimed at enhancing economic opportunities and education levels to foster greater support for improved waste management practices. The significant positive effects of awareness about environmental and climate change issues on support for better waste management highlight the importance of environmental education and outreach programs. Efforts to raise awareness about the health and environment of inadequate waste management practices can mobilize public support for policy interventions and behavioral changes. To address Bangladesh's waste management challenges effectively, policymakers should prioritize strategies that target socio-economic disparities, promote environmental education, and foster awareness about climate change. Sustainable waste management techniques and environmental conservation initiatives in Bangladesh can be supported by investments in recycling facilities, trash management infrastructure, and public awareness campaigns. To summarize, the findings shed light on the multifaceted nature of the challenges that are associated with waste management in Bangladesh. Furthermore, they highlight the necessity of adopting holistic

approaches that incorporate socio-economic development, environmental education, and policy interventions to encourage environmentally responsible waste management practices and improve environmental quality.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

This study's hypotheses seek to investigate the determinants of individuals' WTP on socio-economic factors for enhanced trash management in urban settings, with a special emphasis on Bangladesh. These hypotheses are essential for comprehending the determinants affecting public perceptions and actions regarding waste management programs, which subsequently guide policies and intervention measures designed to promote sustainable practices. The first hypothesis claims that education level has no significant influence on WTP for improved waste management in urban Bangladesh. This hypothesis is based on the premise that education may not inherently correspond with environmental awareness or concern for waste management in a less developed nation such as Bangladesh. The data indicate a substantial positive correlation between elevated educational attainment and WTP for enhanced waste management. This research shows that those with higher education levels are more inclined to endorse activities designed to improve waste management practices, perhaps owing to increased awareness, knowledge, and comprehension of the environmental consequences of inadequate waste management.

Similarly, the second and third hypotheses propose that there is no relation between environmental attitudes and climate change attitudes, respectively, and WTP for better waste management in urban Bangladesh. These hypotheses question the influence of environmental consciousness and concern for climate change on individuals' willingness to invest in waste management improvements. However, the analysis yields compelling evidence to the contrary, indicating that both environmental awareness and concern for climate change positively influence WTP for better waste management. This finding underscores the value of environmental consciousness after climate change awareness in shaping public attitudes towards waste management practices, even in a less developed country context.

Furthermore, the fourth hypothesis suggests that income level does not influence WTP among the people in urban Bangladesh. This hypothesis is predicated on the notion that socio-economic status may not significantly impact individuals' willingness to invest in waste management improvements, particularly in a country where income disparities are prevalent. However, the results reveal a significant positive association between higher asset values (a proxy for income level) and WTP for improved waste management. This recommends that persons with higher socio-economic status are more inclined to support initiatives aimed at addressing waste management challenges, potentially due to their greater capacity to bear the financial costs associated with such initiatives.

Lastly, the fifth hypothesis proposes that gender does not impact WTP in urban areas in Bangladesh. This hypothesis questions whether gender differences play a role in affecting individuals' attitudes to waste management and their willingness to invest in its improvement. However, the analysis does not find a significant association between gender and WTP, suggesting that gender may not be a significant determinant of WTP for waste management improvements in urban Bangladesh.

In summary, the findings of this study highlight the complex interplay between socio-demographic factors and individuals' WTP for developed waste management in urban Bangladesh. By comparing these findings to the contexts of developed countries and other less developed countries, valuable insights are gained into the contextual factors that shape public attitudes towards waste management and the potential implications for policymaking and intervention strategies. These insights can inform the development of targeted obstacles aimed at promoting sustainable waste management systems as well as advancing environmental sustainability goals both locally and globally.

In conclusion, addressing Bangladesh's waste management challenges requires coordinated efforts from policymakers, service providers, and communities. Investments in formal waste management infrastructure, public awareness movements, and targeted policy interventions are necessary for promoting sustainable waste management practices and enhancing the quality of the environment. By prioritizing equitable access to waste management services, addressing informal disposal practices, and raising public awareness, Bangladesh can pave the way towards a cleaner, healthier, and sustainable future.

4.2 Recommendations and Implications

Service providers and policymakers should tailor marketing strategies and pricing models based on demographics in addition to socio-economic factors influencing individuals' WTP. By implementing these policy implications, Bangladesh can address its waste management challenges effectively while promoting sustainable development and environmental conservation efforts. The study suggests the following policies:

(1) Public Awareness Campaigns: One way to boost willingness to pay (WTP) for improved waste management is to conduct broad public awareness campaigns. These efforts emphasize the importance of appropriate waste management for sustainability, public health, and economic expansion. To guarantee more reach and impact, government agencies can lead these initiatives in conjunction with environmental non-governmental organizations.

(2) Education and Training Programs: Funding for educational and training initiatives that target professionals, and the public alike can improve knowledge and aptitude for environmentally friendly waste management techniques. It is recommended that policymakers set aside funds for the creation of thorough training programs and workshops that cater to a range of stakeholders, including waste collectors, local government representatives, and community leaders. (3) Incentive Mechanisms: Providing tax breaks or other financial aid to individuals or companies that implement eco-friendly waste management techniques can encourage behavior modification and boost WTP. It is imperative for policymakers to devise incentives that are both financially viable and enduring, while also guaranteeing fair allocation among diverse socio-economic groups. (4) Infrastructure Development: Improving waste management systems requires spending money on infrastructure for waste collection, segregation, recycling, and disposal. Policy makers should prioritize infrastructure development projects, assigning appropriate finances and resources for the building and upkeep of waste treatment facilities, landfill sites, and recycling centers. Implementing these projects can be made easier by working together with foreign donors, private sector organizations, and government authorities. (5) Infrastructure Development: Improving waste management systems requires spending money on infrastructure for waste collection, segregation, recycling, and disposal. Policy makers should prioritize infrastructure development projects, assigning appropriate finances and resources for the building and upkeep of waste treatment facilities, landfill sites, and recycling centers. Implementing these projects can be made easier by working together with foreign donors, private sector organizations, and government authorities. (6) Community Engagement and Participation: Encouraging locals to get involved in waste management projects can help them develop a sense of accountability and ownership. It is recommended that policymakers assist in the formation of neighborhood committees or community-based groups devoted to waste management and supply them with the tools and resources they need to carry out locally focused solutions. In addition, the development of partnerships among communities, local government agencies, and other relevant stakeholders has the potential to improve cooperation and group efforts related to balanced waste management.

In terms of responsibility, the implementation of these policy implications would involve various stakeholders. National and local government organizations are principally in charge of developing and carrying out waste management policies. To handle waste management concerns, they are essential in establishing legal frameworks, allocating resources, and determining priorities. This category comprises public and private organizations that handle the collection, transportation, processing, and disposal of garbage. It is the duty of service providers to provide communities with effective and efficient waste management services while upholding legal requirements and quality standards. Community Organizations: By actively advocating for the needs of their communities, spreading awareness, and gathering resources for sustainable solutions, local community organizations, non-governmental organizations, and civil society groups can actively participate in waste management projects.

The form that these actions should take will depend on Bangladesh's needs and the circumstances. Legislative changes, technological and infrastructure investments, capacity building, public-private partnerships, and community-based strategies customized to the socio-economic and environmental circumstances of the area could all be part of it.

4.3 Limitations and Future Research Directions

The study focuses solely on urban areas, potentially overlooking the perspectives of rural populations regarding waste management. Finally, while the logistic regression model identifies significant predictors of willingness to pay, it may not capture all relevant factors, such as cultural or psychological influences, that could affect individuals' decisions. Further research is warranted to delve deeper into the factors driving waste disposal practices and their environmental and social impacts. Longitudinal studies tracking changes in waste management infrastructure and behaviors over time can provide valuable insights into the effectiveness of interventions. Additionally, comparative analyses between cities can identify the best practices and lessons learned that can be applied elsewhere. It may also investigate the fundamental elements affecting individuals' willingness to pay for waste management services. Elements including knowledge, awareness, perceived advantages, and confidence in service providers may affect willingness to pay decisions and require further examination.

5. New Scientific Results

The present investigation of the WTP for enhanced waste management services in Bangladesh reveals several original scientific insights and observations that enrich our understanding of the key socio-economic and demographic factors that determine people's attitude towards the environment and their preferences regarding related services. The following are the primary findings and their results:

1. This study offers the first broad, data-driven evaluation of how much people are willing to pay for solid waste management across multiple cities in Bangladesh. Surveying 1,069 households in seven different urban areas delivers strong and widely applicable insights, overcoming the limitations of earlier research focusing on single locations.

2. A stand-out feature of the study is the inclusion of climate change awareness as a new and powerful factor in predicting WTP. The data shows that individuals concerned about climate change are nearly four times more likely to be willing to pay (odds ratio of 3.79, $p < 0.01$). This underscores the value of incorporating environmental messaging into local government strategies for service delivery.

3. One of the key findings is that people's environmental attitudes significantly influence their WTP. Those with a stronger environmental mindset were more likely to contribute financially, regardless of their income or education level. This supports the idea in behavioral economics that personal values and civic duty play a crucial role in funding public services.

4. The research develops and tests a comprehensive behavioral model that blends economic (income, education) and non-economic (environmental attitude, climate awareness, trust in institutions) factors. This integrated approach challenges the traditional income-only models by showing that attitudes and trust also matter.

5. Findings also support the practicality of a tiered pricing model for waste management services. Most participants who expressed willingness to pay favored a monthly contribution between BDT 250 and 350, offering clear guidance for setting service fees.

6. Trust in institutions emerged as a key condition for WTP. People were more willing to pay if they believed the service providers were transparent and accountable. This finding highlights the importance of involving citizens and maintaining open communication in managing public funds.

7. The study translates its findings into actionable insights for municipal budget planning. Estimating potential revenue from households willing to pay (e.g., 60% at 250 BDT/month) supports the design of realistic subsidy plans and co-financing models.

8. Finally, the study introduces a new tool for urban policy: behavioral segmentation. By blending data on demographics, attitudes, and economic status, policymakers can design targeted strategies that improve service delivery and promote fairness.

9. These findings add valuable perspective to the global conversation on waste management by placing urban behavior in South Asia within a broader international context. The study's approach—

combining contingent valuation with behavioral insights—is particularly useful for other developing cities facing similar urban waste challenges.

10. The research outlines actionable policy strategies to enhance urban waste services. Key recommendations include promoting environmental education, implementing reforms to build public trust, and introducing adaptable pricing models. These suggestions are backed by strong statistical evidence of how households behave.

Table 7: The validation of each hypothesis tested

Hypothesis	Validation (Statistical & Literature)	Validation (Survey Findings)
H1: Education level affects WTP	✓ Fully verified	✓ Confirmed
H2: Environmental attitude affects WTP	✓ Fully verified	✓ Confirmed
H3: Climate change awareness affects WTP	✓ Fully verified	✓ Confirmed
H4: Income level affects WTP	✓ Fully verified	✓ Confirmed
H5: Gender has an effect on WTP	✓ Not verified	✓ Confirmed

Source: author's own estimation from the result

6. Novelty of Research

This study introduces several fresh contributions to the fields of environmental economics, public finance, and sustainable urban governance, especially relevant to the context of developing nations:

1. First Nationwide WTP Assessment in Bangladesh

This is the first study to assess Willingness to Pay (WTP) for enhanced waste management services across seven key urban centers in Bangladesh. Earlier research focused mainly on Dhaka, but this broader geographic coverage ensures that the results are more representative and applicable nationally.

2. Climate Change Awareness as a Behavioral Driver

The study breaks new ground in South Asia by empirically linking climate change awareness to WTP. Including these variable bridges a critical gap by showing how environmental awareness can influence financial decisions in urban service delivery.

3. Integrated Behavioral-Economic Model

The research builds a comprehensive model that combines economic indicators (like income and assets), behavioral attitudes (such as environmental concern and climate change awareness), and trust in institutions. This approach moves beyond traditional income-based models and offers a more rounded framework for policymaking in low- and middle-income settings.

4. Tiered Pricing as a Policy Innovation

The study recommends a tiered pricing approach for municipal waste services using data on preferred WTP levels. This context-sensitive strategy balances revenue generation with fairness, making it both sustainable and equitable.

5. Institutional Trust as a Conditional Factor

The findings show that public trust in service institutions significantly affects WTP, but only under perceived transparency and accountability conditions. This insight deepens our understanding of behavioral drivers and suggests targeted reforms for building public confidence.

6. Turning WTP into a Planning Tool

Finally, the study takes WTP beyond theory, demonstrating how it can be used for practical budgeting. City governments can develop more accurate financial plans, cost-recovery strategies, and subsidy models by estimating potential revenue from household contributions.

6. LIST OF PUBLICATIONS

1. **Ali, S.,** Ghosh, B.C., Osmani, A.G., Hossain, E. and Fogarassy, C., 2021. Farmers' climate change adaptation strategies for reducing the risk of rice production: evidence from Rajshahi district in Bangladesh. *Agronomy*, *11*(3), p.600.
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3. **Ali, S.,** Akter, S. and Fogarassy, C., 2021. Analysis of circular thinking in consumer purchase intention to buy sustainable waste-to-value (WTV) foods. *Sustainability*, *13*(10), p.5390.
4. **Ali, S.,** Akter, S., Ymeri, P. and Fogarassy, C., 2022. How the use of biomass for green energy and waste incineration practice will affect GDP growth in the less developed countries of the EU (A case study with Visegrad and Balkan countries). *Energies*, *15*(7), p.2308.
5. Akter, S., **Ali, S**., Fekete-Farkas, M., Fogarassy, C. and Lakner, Z., 2023. Why Organic Food? Factors influence the organic food purchase intension in an emerging country (study from northern part of Bangladesh). *Resources*, *12*(1), p.5.

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