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## Article

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### **Research Article**

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# Environmental citizenship and solid waste management in Chattogram, Bangladesh

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**Abstract:** Chattogram city is grappling with problems caused by inadequate solid waste management (SWM). Because the successful policy intervention regarding proper SWM depends on the intrinsic motivation of the city dwellers along with government intervention, the objective of this paper was to conduct an attitudinal study of the residents of Chattogram regarding their roles and responsibilities towards the SWM, and thus, the sustainable development of the city. It is a cross-sectional study based on a sample size of 150. Data was collected using a structured, pretested questionnaire. The result showed that the residents were unable to prioritize the city's environmental problem over other problems due to the lack of knowledge and awareness about the environmental problems and its impacts on the Chattogram. However, in respect of SWM in the city, their eagerness for participation is appreciable, even though they are more dependent on government policy initiatives. An attitudinal gap was also observed here among the respondents pertaining to the vacuum of knowledge and awareness. Therefore, strong policy decisions and the awareness campaign can make people aware of their roles and responsibilities for a sustainable city and intrinsically motivate them to participate in SWM.

Keywords: behavior, environmental citizenship; solid waste management; sustainable development; sustainable city.

## **1** Introduction

The individual consumption pattern is increasingly breaking the path of sustainable development both at the global and local level. We know that consumer behavior plays a significant role in determining the environmental wellbeing of the Earth and finally to support life in this. It is also the major propellant of climate change. The management of household and industrial waste is also an inevitable consumption practice since the disposal of waste requires the consumption of Earth's resources such as via landfilling. Solid waste management (SWM) refers to the supervised handling of waste material from the generation at the source through the recovery processes to disposal (UNEP, 2005 as cited in BIGD, 2015). Proper solid waste management is significant in ensuring a healthy, quality, and sustainable environment (Wilson et al., 2006), while mismanagement leads to environmental and health hazards (Akolkar et al., 2008; Zhuang et al., 2008). Therefore, proper solid waste management ensures a healthy environment by encouraging environmentally friendly waste disposal practices (Henry et al., 2006). The achievement of sustainable development goals in a city demands effective and efficient solid waste management which is associated with the attitude and behavioral pattern of the city dwellers.

Chattogram, the second-largest city in Bangladesh, which serves as a port city and thereby a significant contributor to Bangladesh's GDP, is grappling with problems caused by inadequate solid waste management. Trade is considered to be one of the driving factors of a country's economy. Around 80% of Bangladesh's international trade relies on sea trade (Rattri, 2018). Chattogram port manages nearly 90% of all seaborne trade of Bangladesh (Rattri, 2018). The Chattogram

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Export Processing Zone (CEPZ) contributed more than 50% of Bangladesh's tax revenue earnings in 2012 (Muzzini & Aparicio, 2013). Chattogram exports constituted more than 11% of the national GDP in 2011 despite accommodating a population that is 3% of the total population of Bangladesh (Mia et al., 2015).

Chattogram, being a coastal city, is highly vulnerable to the risks from cyclones and other storms. The drainage system of Chattogram is one of the neglected units of city planning and the consequences of this are heightened when uncollected wastes are dumped in open spaces and streets, which clog the drainage system creating serious hazards, environmental degradation, and health risks in the city (Mia et al., 2015; Yasmin & Rahman, 2017). Poor management of Municipal Solid Waste (MSW) and poor drainage systems act concurrently and result in these serious urban, sanitary, and environmental problems. With the amount of MSW having risen due to unchecked population growth and unplanned urbanization, Chattogram is now suffering from waterlogging, environmental pollution, and then reduced public health as a result of the spread of diseases due to improper waste disposal (Chowdhury et al., 2013). Almost one-third (30%) of the daily produced MSW is not collected and is thrown in open places which cause bad stench, breeding of insects like mosquitoes and flies, production of harmful gases, clogging of drains, degradation of soil quality, contamination of water and aesthetic disruption (Chowdhury et al., 2013). Chattogram requires efficient management of solid waste for sustainable development. In Chattogram, sectors like storage and collection, transportation of waste, resource recovery, disposal, and organizational aspect can be improved by identifying the weaknesses and creating an innovative way to tackle them (Hasan & Islam, 2020).

#### 1.1 The current solid waste management scenario in Chattogram

Issues of society, culture, knowledge, politics, technology, and economics are some of the common constraints found in effect solid waste management in developing nations (McAllister, 2015), many of which have been perceived in Chattogram.

Chattogram contributes to 15% of the total waste of Bangladesh, the majority of which contains moisture (Chowdhury et al., 2018). As a result, the incineration process is used to eradicate the wastes. At present, the Chattogram City Corporation (CCC) primarily oversees the MSW management in Chattogram, but the CCC is highly dependent on the central government and tax revenues for all of its proceedings. It follows the rules under the City Corporation Ordinance and Pourashava Ordinance 1977 for MSW management. The CCC's conservancy department is in charge of collecting, storing, and disposing of MSW in Chattogram city with 41 wards, but it still relies on other departments under CCC for several tasks pertaining to MSW management, like transportation of the solid wastes to landfill sites. Currently, all wastes in Chattogram are dumped into Ananda Bazar, Kalurghat, and Arefin Nagar open dumping sites (Ashikuzzaman & Howlader, 2020). The amount of waste collected by transportation facilities is lower than what is possible, due to certain infrastructural constraints. 72% of the daily waste collected is disposed of in the only landfill site in Chattogram, which is at Roufabad, Panchlaish (Chowdhury et al., 2013). The landfill site is not maintained at an appropriate scientific or sanitary level, and no environmental impact assessment was conducted. 27.62% of the disposal occurs through open dumping at the Anandobazar area, Halishahar, where the CCC has taken initiatives to develop the waste management facilities (Chowdhury et al., 2013). With no established body to undertake waste recycling in Chattogram, the remaining 0.16% of the waste goes through systematic recovery and recycling, with informal underage waste pickers as the primary collectors (Chowdhury et al., 2013). Financial and infrastructural limitations and the lack of proper planning, data, and leadership are the key reasons for the failures of the current waste management system in Chattogram (Das et al., 2015). While significant structural reforms are required in the CCC conservancy department, citizens also have an important role to play in making waste management successful and sustainable.

The waste generation per capita doubled from 1999 to 2009 as the average standard of living as well as the demand for goods and commodities increased. A recent study on Municipal Solid Waste Management, funded by Bangladesh Municipal Development Fund (BMDF), revealed that waste produced in Chattogram was 0.352kg/cap/day (Hasan & Islam, 2020). If it is considered that the per capita generation of solid waste is 0.352kg to 0.4kg per day, the total solid waste produced in Chattogram is around 913 tons to 1037 tons per day (Hasan & Islam, 2020). This growth of solid waste and inadequate infrastructure of solid waste management leads to many environmental and health problems in the city. In addition, despite the presence of waste collecting containers, people often litter around the bins or in open spaces, drains, and roadsides with an absence of the realization of their responsibilities. To induce changes within

consumer behavior, a certain amount of attitudinal changes should emerge as a result of political, social, cultural, or obligatory pressures.

#### 1.2 Using Environmental Citizenship for solid waste management

The improved environmental quality of the city demands not only government intervention but the intrinsic emotion of the city dwellers. The level of education, personal lifestyle, values, emotion play a significant role in raising the intrinsic emotion of the residents of a city towards environmental up-gradation and sustainable development of the city. Asilsoy and Oktay (2018) suggest that without residents establishing environmentally responsive living as a lifestyle, the outcome of the sustainable urbanism debate would be inadequate or incomplete. Environmental citizenship rose from the discourse surrounding sustainable development, and now, it is increasingly being seen as a method to achieve sustainable development. However, it assumes a primarily conceptual standing in the academic sphere as it carries contested definitions and concepts. Pallett (2017) asserts that the term emphasizes more on the obligations to act environmentally responsibly than the rights it grants, and it spans beyond the geographical definitions of communities. This approach treats environmental citizens as consumers, thereby dismissing the social, emotional, and contextual drivers of certain consumer behaviors, and sees peoples' responsibilities as only being restricted in consumption.

Environmental citizenship is viewed as an effective way of positively altering consumer behavior so that an individual is bound within their respective ecological footprints by a series of rights and responsibilities, carrying the obligations of just at all times (Dobson, 2007). In this respect, although the 'voluntarist' approach is more essential than the 'structuralist' approach. However, an understanding of peoples' attitudes towards their role and responsibilities for maintaining the overall environmental quality of the city and also for a specific environmental policy decision is the first task of a researcher rather than expecting their duties towards maintaining the sustainable development of the city. Taking into consideration and placing more importance on the roles of people in the application of policies improves the chances of success of the interventions (EEA, 2012). This diffusion of power allows for citizens to exercise their participatory and decision making powers in governance, thereby giving rise to 'active participation' (Stoker, 1998). The resulting policies would be more appropriate for the local context and well supported by the public.

As a relatively new idea, attempts have been made to operationalize environmental citizenship mostly at the Global North (EEA, 2012). An example of environmental citizenship is the formulation of the Eco-Town Project initiated in Kita-Kyushu, Japan in the 1960s by the citizens which became a success. The initiative taken by the people in Japan acted as a determining factor for environmental protection and Eco-town activity. Eco-technology has been used to recycle wastes and other daily products. Parnini (2010) explains that familiar projects such as cans, metals, plastics, and papers can also be recycled in Bangladesh, similar to the Kita-Kyushu project. Some products made from recycled materials in Kita-Kyushu such as Biodegradable Plastics, Eco-friendly Plastics, Eco-friendly Steel Products, Eco-cement, Recycling system for Concrete, Recycling Aluminium Cans, can be formed and the techniques can be applied to Bangladeshi industries by using eco-technology if investments are made and proper measures are taken.

Very few studies have looked into the prospects of environmental citizenship in developing nations. The knowledge, attitude, and practices regarding environmental citizenship among school-goers were studied in Malaysia and observed a low to moderate level of environmental citizenship (Meerah et al., 2010). The Philippine rural municipality found that despite proper initiatives for waste disposal, the people did not have knowledge about the existing facilities and hence they undertook practices that were not environmentally friendly (Limon et al., 2020). A study examined how issues of environmental citizenship were taken up in the case of an industrial waste facility sting in Taipei, Taiwan, and how local activists recognized themselves as active citizens to fight for justice and sustainability (Fan, 2008). They protested against the establishment of a landfill that would contain industrial waste and ash from incinerators (Fan, 2008). Regardless, studies such as these, which assess people's perceptions of their responsibilities as environmental citizens are very scanty in Southeast Asia, where this study is perhaps the first of its kind in this region. Lorimer (2010) explains that powerful advocates argue that volunteering, like international nature conservation projects, offers active global environmental citizens the opportunity to make a difference, delivering public services through a politically and economically appealing model of social enterprise. The civic republican tradition, which emphasizes deliberation, civic participation, and a commitment to the common good, can be viewed as a stronger and more powerful form of environmental citizenship than its liberal/neoliberal counterpart (Schild, 2016). It is assumed that economic reforms,

technological advancements, or individual lifestyle changes are not sufficient to address environmental issues (Schild, 2016). It is crucial that citizens involve themselves in decision-making alongside the revision of liberal institutions (Schild, 2016). In order to create this driving force among citizens to involve themselves in decision-making processes, the citizens need to be made aware of their rights. There is a knowledge gap present that impedes the citizens' awareness of their rights, thus preventing them from recognizing their rights and taking necessary actions to have their voices heard.

#### 1.3 Objective of the study

Thinking in this way, the primary objective of this paper was to conduct an attitudinal study of the residents of Chattogram regarding their roles and responsibilities towards sustainable development of the city as well as solid waste management (SWM) of the city. Such an attitudinal study is necessary in order to build an effective policy catering to environmental citizenship in Chattogram, Bangladesh.

## 2 Methodology

This survey was designed to discuss the opinion of the city dwellers regarding their environmental rights, roles responsibilities with special reference to solid waste management. So it is a descriptive study based on cross-sectional primary data. The targeted population of this study is the city dwellers of Chattogram.

The metropolis area of Chattogram covers 5,282.92 km2 (2,039.75 sq mi), whereas the urban area covers 2,054.90 km2 (793.40 sq mi), which includes 41 wards. The total population of Chattogram is 24290384 and population density is 19,800/km2 (51,000/sq mi). All economic classes of people with various educational qualifications are staying here. This study wanted to highlight the attitude of the residents of Chattogram regarding their roles and responsibilities towards the SWM. The concept of environmental citizenship is introduced here to achieve the sustainable development goals of the city. The attitude of the citizens regarding the aforementioned issue was essential to understand irrespective of any specific demographic factor such as income, educational qualification, no of family members, gender, etc as household solid waste is related to all households of the city. It was evident from the pilot study that city dwellers' awareness regarding environmental citizenship, that is, their roles and responsibilities for SWM are poor as well as ambiguous. Hence, to achieve the objective of the study, a probability sampling technique of data collection cannot serve the purpose. However, this work is self-financed, so optimum utilization of the time, money, and labor was also necessary to complete the work within the stipulated time frame. Therefore, primary data was collected in this study using the biased sampling technique, that is, the nonprobability sampling technique with a structured questionnaire. The quota sampling technique is used to select the sampling units from different educational backgrounds, occupations from different parts of the city.

A pretested structured questionnaire with close-ended questions was used to collect data from the residents of Chattogram. Questions are formed by using basic scales, and attitudes are measured using the five-point Likert scale. The questionnaire is based on the variables chosen for the study, and cross-questions are also incorporated to know the true attitude of the respondents. A total of more than 200 sampling units was chosen to collect the data, but after data refinement and preparation, it came down to 150. These 150 responses were used for final data analysis and interpretation here.

The relevant variables pertinent to the study were selected from the pilot survey and also drawn from the various empirical works on white pollution in different cities mentioned in the literature. People's perception also plays a crucial role in creating awareness (Troschinetz & Mihelcic, 2009). To understand respondents' awareness, roles, attitude towards their environmental rights, and SWM this study focused on the respondents' perception of environmental citizenship and SWM. In this paper, we have studied the attitude, awareness, and behavior of the city dwellers of Chattogram based on their perception towards environmental rights, sustainable development, and also SWM. For the finalization of demographic variables, this study took support from the literature review by Bharadwaj (2012), Bianco et al. (2008), and Ferdous and Das (2014). Hence, this study collected data on the demographic variables such as age,

educational qualification, income, gender with an expectation that these categorical variables play a significant role in analyzing respondents' perceptions and, in turn, their attitude. The questionnaire is shown in the Annexure.

## **3 Data Analysis**

This study collected data from the residents of Chattogram city under different demographic scenarios exits in the city. The demographic scenario of the sample is described in the following Table 1.

	Age group	Percentage		Income group	
Age	18-25	32.00	Monthly	Less than Rs.10000	2.00
	26-35	34.67	Income	11000-20000	16.00
	36-45	23.33		21000-40000	31.33
	46-55	8.00		41000-60000	23.33
	56 & above	2.00		61000 - 80000	8.00
	Average age	32		80000 & above	19.33
Educational Qualification	Educational Status	Percentage		Average monthly income	BDT 47167
	Primary level	2.00	Occupation	Occupation type	Percentage
	Below secondary level	4.67		Service	24.67
	Secondary level	9.33		Homemaker	20.00
	Higher secondary level	31.33		Business and Self-employed	40
	Graduate	36.00		Others	3.33
	Postgraduate	16.67			

Table 1: Demographic Scenario.

It is clear from the above table that the respondents are mainly in the age group between 18 to 45. Regarding the educational qualification, respondents are primarily graduates (36%) and completed HSC (31%). 40% of the respondents are self employed and business and the service holders (24%) are the second-highest occupations of the respondent. The average monthly income of the respondents is BDT 47000 per month but 31 % earns within BDT 21000- 40000. Regarding environmental citizenship, it is important to know about the citizens' awareness of their right to a clean environment in the city. This study collected the opinion of the respondents on basic environmental rights such as inhale of clean air, solid waste management, access to good quality food, sound pollution and waterlogging free city, and the right to live in a clean and healthy environment – depicted in Table 2. The respondents are found aware of their environmental rights. More elaborately, we are surprised that along with the right to clean air, the right to solid waste management is also most important for the residents of Chattogram.

Therefore, the scenario of such a strong opinion about their environmental rights raises the need for a discussion of the city dwellers' attitude towards environmental citizenship. For this purpose, data on more than several parameters pertinent to study the attitude towards environmental citizenship were collected. These are stated below in Table 3.

It is evident from the above Table 3 that to understand the attitude for environmental citizenship, a method of data reduction technique is required to group the parameters. To serve this purpose, Exploratory Factor Analysis, a well-known multivariate statistical tool, is applied here. The Exploratory Factor Analysis technique helps to generate a smaller set of new composite variables based on a number of original variables with a minimum loss of information. The Anti-Image Correlation Matrix (Annexure Table 1) is computed to check the adequacy of the data. Here, the partial

Table 2: Importance of Environmental Rights.

	To inhale clean air	Proper SWM	Clean and healthy environment	Access to good quality food	Sound pollution- free environment	City free from waterlogging, and epidemic diseases
Mean, (SD)	4.8, (0.5)	4.7, (0.7)	4.8, (0.5)	4.5, (0.6)	4.4, (0.9)	4.5, (0.8)
Opinion	Most Important	Most Important	Most Important	Important	Important	Important

#### Table 3: Statements Asked To City Dwellers in Chattogram.

Statements	Code
There are more pressing global issues (e.g. Aids epidemic) than environmental issues in my city.	C1
There are more pressing local issues (e.g. unemployment) than environmental issues in my city	C2
Individual actions can make a difference in the sustainable development of the city	С3
Humans are too insignificant to affect the global environmental problem	C4
Our everyday actions affect the environment both locally and globally.	C5
The sustainable development of the city is the responsibility of every one of us & city dweller	C6
To inhale clean air is my Environmental right	C7
Proper solid waste management system is my environmental right	C8
Live in a clean and healthy environment is my environmental right	С9
City free from waterlogging and epidemic diseases spread through water logging is my environmental right	C10
Environmental issues are more important than social issues (e.g. homelessness) in our city	C11

correlations are very low, indicating that the true factor existed in the data. The computed value of the KMO statistic (Annexure Table 3) represents the adequacy of the data set for the use of factor analysis. For extraction of the factors from a set of eleven statements, as mentioned in Table 3, Principal Component Analysis (PCA) was used in this study. The result of the Varimax rotated component matrix for the samples (Annexure Table 5) reveals that three factors are adequate to represent the whole data. The following section in Table 4 represents the interpretation of these factors.

The tools of factor analysis, the rotated component matrix (ref. Annexure Table 3) have incorporated the statements mentioned in Table 4 into three factors:

- 1. Factor 1: Attitude towards Basic Environmental Rights
- 2. Factor 2: Awareness about the importance of environmental issue vis a vis other issues, and
- 3. Factor 3: Individual responsibility as an environmental citizen.

#### Factor 1: Attitude towards Basic Environmental Rights

The variables C7, C8, C8 are having high loading on factor 1. From the perspective of the city dweller of Chattogram, this factor says that to inhale clean air, to live in a clean and healthy environment, and proper solid waste management in the city is their environmental right. These variables represent their attitude as a resident of the city towards the environmental right. It is evident from the last column of Table 4 that the respondents have strongly agreed on each environmental right.

#### Factor 2: Awareness About The Importance of Environmental Issue Viv A Vis Other Issues

The variables C1, C2, C4, and C11 are having high loading on factor 2. This factor represents respondents' views regarding environmental issues of the city compared to other social, local, and global problems of the city. The respondents' view about the role of human beings in affecting the global environment is also included in this factor. Later the opinion

 Table 4: Factor Loading (FI) For Environmental Citizenship. (Opinion SA- Strongly Agree).

Factors	Statement	Code	FL	Mean	SD	Opinion
2	There are more pressing global issues (e.g. Aids epidemic) than environmental issues in my city.	C1	0.831	3.49	1.31	neutral
	There are more pressing local issues than environmental issues in my city	C2	0.774	3.70	1.12	agreed
	Humans are too insignificant to affect the global environmental problem	C4	0.753	2.98	1.45	neutral
	Environmental issues are more important than social issues (e.g. homelessness) in our city	C11	0.625	3.60	1.11	agreed
1	To inhale clean air	C7	0.752	4.8	0.5	SA
	Proper solid waste management system	C8	0.767	4.7	0.7	SA
	Live in a clean and healthy environment	С9	0.718	4.8	0.5	SA
3	Our everyday actions affect the environment both locally and globally.	C5	0.796	4.43	.71	SA
	The sustainable development of the city is the responsibility of every city dweller	C6	0.795	4.48	0.71	SA
	Individual actions can make a difference to sustainable development of the city	С3	0.570	4.09	0.84	agreed

analysis of the respondents for the variables included in factor 2 highlights the fact that although they agreed that environmental issues are more important than the social problems of the city but in comparison to environmental issues with the global issues affecting the city, their opinion is neutral. Even in respect of local problems of the cities, they have agreed that those are more pressing problems than the environmental problem of the city. Respondents are found neutral about human influence in environmental degradation. This represents their level of awareness about the human role in environmental degradation. However, to them, the importance of the environmental problem in the city is not much strong compared to other local, social, and global problems of the city. This behavior represents a lack of knowledge and awareness about the environmental problem and its impact on city life. So proper environmental citizenship of the residents of Chattogram demands a need-based awareness program and knowledge expansion programme about the impact of the environmental problem for them.

#### Factor 3: Individual Responsibility As Environmental Citizen

The variables C5, C6, C3 are having high loading on factor 3. This factor signifies the individual responsibility and eagerness of the respondents for the sustainable development of the city. This factor includes their roles and responsibilities to control environmental degradation and, finally, sustainable development. The respondents strongly agreed on the fact that the sustainable development of the city is the responsibility of every city dweller. However, they agreed that although their everyday actions can affect the environment both locally and globally, their individual actions can make a difference in the sustainable development of the city. So these factors significantly highlighted the fact that although people of Chattogram city do not pose importance on the environmental issues over the other social, local and global issues affecting city life, they are aware of their action which is affecting the environment. Moreover, their eagerness is also revealed to change their action for the sustainable development of the city.

After understanding the environmental rights and responsibilities of the respondents, this study wanted to understand the attitude of the respondent towards solid waste management. Regarding their awareness, 81.3% of the respondents seemed aware of the current SWM systems in Chattogram, with televisions identified as the primary source of information followed by social media and newspapers or print media. Online media and magazines also considerably contribute to information dissemination regarding SWM.

Table 5: Waste Disposal Means.

	Take it to the nearby secondary storage receptacle /dustbin	Throw it on an open space or on the street	Throw it into the nearby river or drain	Private collectors collect it
Final Rank	1	2		3

Table 6: Statement Asked To City Dwellers of Chattogram.

Statement for city dwellers about SWM	Code
All city dweller must pay for solid waste segregation	S1
Being a responsible city dweller I am ready to pay Tk.1200/ month	S2
I would segregate garbage more if recycling facilities are taken up by the government/local municipality for cities welfare	<b>S</b> 3
The proper management of solid waste is the responsibility of the city dweller along with the government	S4
Campaigning by the government and private institutions for segregation of solid waste is important for sustainable development of the city	S5
I am interested in segregating waste (plastic and kitchen or degradable wastes) to dispose waste in your house	S6
I am concerned about the solid waste problem of my city	S7
My knowledge about the solid waste management in the city	S8
Pattern of disposal of solid waste every day	S9

Now regarding disposal habits of the solid waste, the private collectors collect the waste in the city. But in this study, the city dwellers have reported that it primarily involved transferring their household wastes to nearby secondary storage as per Table 5. The next most common form of disposal was throwing waste on an open space or street. However, the disposal of waste through the private collectors' collection got the third rank in waste disposal. Such disposal habits are attributed to the fact that the locations of secondary storage receptacles are not properly planned (Chowdhury et al., 2013). Although the least popular, the people of Chattogram are disposing of their household waste in open canals or rivers. Such an attitude of a section of respondents raises questions about their disposal behavior.

We have already discussed their awareness, attitude, and behavior for environmental citizenship. Solid waste management in a city demands both the right and responsibility of the city dweller. Therefore, it is necessary to know the awareness, attitude towards solid waste management of the city dwellers. Thinking in this line, this study was aimed to identify in detail the people's attitude towards solid waste management. Thus, residents' opinions were taken by asking the following statements shown in Table 6.

For extraction of the factors from a set of nine statements, as mentioned in Table 6, Principal Component Analysis (PCA) was used in this study. The result of Anti-image correlation- Solid Waste Management (Annexure Table 2), KMO and Bartlett's Test for Solid Waste Management (Annexure Table 4), and Varimax rotated component matrix for the samples (Annexure Table 6) reveals that three factors are adequate to represent the whole data. The following section in Table 7 represents both factor loading and interpretation of the factors.

They identify that solid waste management is one of the important environmental rights.

The tools of factor analysis, the rotated component matrix (ref. Annexure) have incorporated the statements, mentioned in Table 7, into three factors:

#### 1. Concern and awareness

The variables S6, S7, S8 are having high loading on factor 1. This factor represents the city dwellers' knowledge, concern, and interest in solid waste management. The respondents agreed to take initiative for segregating waste, which is the first step for solid waste management, and displayed interest in segregating waste (plastic and kitchen or degradable wastes) in their houses before disposal. But their concern for SWM is neutral, which is also the same in respect of their knowledge about the importance of SWM in a city. This implies the lack of awareness and concern

Table 7: Factor Loading (Fl) For SWM.

	Factors	Code	FL	Mean	SD	Opinion
Concern and awareness	I am interested in segregating waste (plastic and kitchen or degradable wastes) to dispose waste in my house	S6	0.694	4.03	0.93	Agreed
	I am concerned about the solid waste problem of my city	S7	0.721	3.64	0.63	Neutral
	The solid waste management is necessary for sustainable development of the city	S8	0.699	2.87	1.83	Neutral
Individual action	All city dweller must pay for solid waste segregation	S1	0.924	3.11	1.30	Neutral
	Being a responsible city dweller I am ready to pay Tk.1200/ month.	S2	0.909	2.73	1.39	Neutral
Role: City-dweller and Government	I would segregate garbage more if recycling facilities are taken up by the government/local municipality for cities welfare	\$3	0.497	4.55	0.65	Agree
	The proper management of solid waste is the responsibility of the city dweller along with the government	S4	0.745	4.60	0.61	Strongly agree
	Campaigning by the government and private institutions for segregation of solid waste is important for sustainable development of the city.	S5	0.701	4.53	0.63	Agree

about the SWM among the citizens of Chattogram may be one of the barriers to the adoption and continuation of proper SWM in the city.

#### 2. Role: City-dweller and Government

The variables S3, S4, S5 are having high loading on factor 2. This factor includes the role of the government and city dwellers for solid waste management of the city. They have strongly agreed to the fact that proper management of solid waste is the responsibility of the city dweller along with the government, and such opinion represents their positive attitude towards their collective responsibility. In this respect, they have also agreed on the importance of campaign by the government and private institutions for the segregation of solid waste. However, the city dwellers have confirmed their role again in waste segregation if recycling facilities are taken up by the government/local municipality for city welfare. Therefore, this factor highlighted the fact that the respondents have given utmost importance to the government's roles and responsibilities toward proper SWM and their collective participation depends on the action taken by the government.

#### 3. Individual action

The variables S1, S2, are having high loading on factor 3. This factor highlighted the individual responsibility towards solid waste management especially their eagerness towards monetary contribution for SWM in the city. Here, it is observed that although they have supported government action for SWM in the city along with their collective responsibility, in case of individual action for SWM, their opinion is neutral. They are neutral on the payment for SWM in their own city.

## **4** Recommendations and Conclusion

Hence, it is obvious from the above discussion that the residents of Chattogram are strongly aware of their environmental rights. But they are unable to prioritize the environmental problem of the city over the other problems the city is suffering. The lack of knowledge about the environmental problems of the city and their lack of awareness about its impact are the key factors here. But their eagerness for individual action towards sustainable development is appreciable.

Though their overall awareness is commendable, they do not have a good practice of waste disposal with respect to the SWM, and other studies confirm the lack of adequate infrastructure at the local government level. Despite

acknowledging their rights, people still show reluctance when it comes to taking responsibility individually. So there is a need for awareness generation of this specific problem as they still highlight the government's role for SWM. They are not willing to pay for a better SWM though they recognize that this is one of the important environmental rights. This is because SWM is regarded as a public good, so the negative externality generated through waste generation is not realized. Opportunities need to be created for the citizens so that they can contribute to the cause.

Therefore, it is obvious from the above discussion that regarding the solid waste management of the Chattogram city, the city dwellers emphasized more on government action. Although they have shown interest in waste segregation both at a collective and individual level but their knowledge about the importance of SWM in a city and, as a result, the concern for SWM in their city is lacking. That is the reason for the existence of the attitudinal gap between their interest for participation in SWM and individual action in SWM. On the other hand, they are interested in waste segregation. Therefore, this gap does not represent their reluctance towards individual action in SWM. It highlights the fact that lack of proper knowledge and awareness about the importance of solid waste management are the main hindrances behind it.

This can be done so by encouraging prosocial behavior such as through participatory community processes, and through the advocacy of the concepts of environmental citizenship by the government through the integration of the citizenship curriculum in high schools to advance environmental citizenship, with a focus on rights, justice, and sustainable development. The attainment of the status of an environmental citizen necessitates being a responsible consumer, which is majorly a practice of reducing, reusing, and recycling of goods. Environmental citizenship can thus promote responsible consumption patterns among citizens, thereby reducing strain on the already overstressed and vulnerable SWM infrastructures in the Chattogram city.

Historically, SWM is managed by the City Corporation and individual responsibility was not a part of our practice both at the local and national levels. Hence, the participation of the city dwellers in this area demands strong policy decisions and action from the local government. These communities should also have the right to take part in these governmental processes. Allowing the relevant stakeholders to take part in the decision-making processes gives them a feeling of belonging in that area and also a chance to take accountability for their actions along with the government. The awareness campaign on the importance of solid waste management and action-based programmes by the government can motivate and ensure the city dwellers' participation in the SWM programme in Chattogram city. Not only the government but also the private institutions, NGOs have the space to work here.

Considering the positivity among the city dwellers in the participation of waste segregation, both at an individual and collective level, the local government, private institutions, and NGOs should channelize this interest for the city's welfare.

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## Annexure

Table 1: Anti-Image Correlation- Environmental Citizenship.

	C1	C2	С3	C4	C5	C6	C7	C8	С9	C10	C11
C1	0.655	-0.560	0.158	-0.249	-0.079	0.033	-0.129	-0.147	0.008	-0.079	-0.218
C2	-0.560	0.646	-0.015	-0.142	0.113	-0.202	0.112	-0.074	0.000	0.098	0.056
С3	0.158	-0.015	0.700	0.026	-0.216	-0.124	-0.160	0.035	-0.045	-0.034	-0.031
C4	-0.249	-0.142	0.026	0.724	-0.146	0.215	-0.003	0.103	0.121	0.205	-0.250
C5	-0.079	0.113	-0.216	-0.146	0.523	-0.400	0.077	-0.124	-0.115	-0.122	0.029
C6	0.033	-0.202	-0.124	0.215	-0.400	0.503	0.000	0.069	0.012	0.054	-0.025
C7	-0.129	0.112	-0.160	-0.003	0.077	0.000	0.602	-0.268	-0.212	0.054	0.069
C8	-0.147	-0.074	0.035	0.103	-0.124	0.069	-0.268	0.647	-0.256	0.021	0.029
C9	0.008	0.000	-0.045	0.121	-0.115	0.012	-0.212	-0.256	0.689	0.036	-0.021
C10	-0.079	0.098	-0.034	0.205	-0.122	0.054	0.054	0.021	0.036	0.694	0.120
C11	-0.218	0.056	-0.031	-0.250	0.029	-0.025	0.069	0.029	-0.021	0.120	0.766

 Table 2: Anti-Image Correlation- Solid Waste Management.

	<b>S</b> 1	S2	<b>S</b> 3	<b>S</b> 4	<b>S</b> 5	S5	<b>S</b> 7	S8	<b>S</b> 9
<b>S</b> 1	0.489	-0.735	0.144	0.064	-0.042	0.142	-0.076	0.152	0.060
<b>S</b> 2	-0.735	0.492	-0.106	-0.115	-0.062	-0.132	0.104	-0.126	-0.108
<b>S</b> 3	0.144	-0.106	0.490	-0.049	-0.076	-0.083	-0.012	0.048	0.016
<b>S</b> 4	0.064	-0.115	-0.049	0.585	-0.293	-0.111	-0.080	-0.035	-0.111
<b>S</b> 5	-0.042	-0.062	-0.076	-0.293	0.636	-0.029	0.024	0.062	-0.029
S6	0.142	-0.132	-0.083	-0.111	-0.029	0.648	-0.250	-0.162	0.171
<b>S</b> 7	-0.076	0.104	-0.012	-0.080	0.024	-0.250	0.656	-0.246	0.112
<b>S</b> 8	0.152	-0.126	0.048	-0.035	0.062	-0.162	-0.246	0.648	0.117
<b>S</b> 9	0.060	-0.108	0.016	-0.111	-0.029	0.171	0.112	0.117	0.677

Table 3: KMO and Bartlett's Test (Environmental Citizenship).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.636	
Bartlett's Test of Sphericity	Approx. Chi-Square	344.475
	df	66
	Sig.	2.65E-39

Table 4: KMO and Bartlett's Test (Solid Waste Management).

Kaiser-Meyer-Olkin Measure of Sampling Adequacy       0.562					
Bartlett's Test of Sphericity	Approx. Chi-Square	214.670			
	df	36			
	Sig.	2.69495E-27			

	1	2	3
C1	0.831	0.172	0.014
C2	0.774	0.067	0.096
С3	-0.246	0.132	0.570
C4	0.753	-0.129	-0.107
C5	0.044	0.101	0.796
C6	0.021	-0.041	0.795
C7	-0.024	0.752	-0.016
C8	0.150	0.767	0.052
С9	-0.093	0.718	0.141
C10	-0.413	-0.040	0.174
C11	0.625	-0.098	-0.016

Table 5: Rotated Component Matrix (Environmental Citizenship).

Table 6: Rotated Component Matrix (Solid Waste Management).

	1	2	3
<b>S1</b>	-0.099	0.924	-0.046
<b>S2</b>	-0.008	0.909	0.136
<b>S</b> 3	0.050	-0.174	0.497
<b>S4</b>	0.101	0.115	0.745
<b>S</b> 5	-0.104	0.190	0.701
<b>S6</b>	0.694	-0.022	0.261
<b>S7</b>	0.721	-0.025	0.071
<b>S8</b>	0.699	-0.022	0.007
<b>S9</b>	-0.567	0.075	0.241

## **Questionnaire for Respondents**

Code:

e: Name of the Surveyor:

Date & area:

#### QUESTIONNAIRE

(This is a self-administered questionnaire designed purely for academic purpose. I hereby declare that none of the information that you extend in this questionnaire will be disclosed to any other party) 1. Do you know about solid waste management in the city.

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Yes/ no

If Yes, how do you know (multiple options can be ticked)

- o From Radio
- From TV
- From newspaper or print media
- From social media sites
- From online media/magazines
- From other source (please mention).....

2. How concerned you are about this SOLID WASTE PROBLEM OF **YOUR CITY**.

Yes, very much concerned	Somewhat concerned	Slightly concerned	not at all concerned
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3. How do you usually dispose off your solid waste? (rank the categories from following- 1 is most used and 4 is least used)

Factor	Take it to the nearby secondary storage receptacle /dustbin	Throw it on an open space or on the street	Throw it in to the nearby river or drain	Private collectors collects it	Any other (specify)
Rank					

4. Are you interested in segregating waste (plastic and kitchen or degradable wastes) to dispose waste in your house: please tick one of the following

Yes, very much interested	Yes, interested	Neutral, if it is implemented I will participated	No, not interested	No, not at all. I don't have that much time to segregate

5. If yes, why you are interested explain: \_\_\_\_\_

6. In your opinion, do you consider the following as your **environmental rights** as you live in the city? Tick the point 1 to 5 to the following rights according to your choice (1 is least and 5 is most important)

Rights	1	2	3	4	5
To inhale clean air					
Proper solid waste management system					
Live in a clean and healthy environment					
Access to good quality food and controlled use of chemicals					
Sound pollution free environment					
City free from water logging and epidemic diseases spread through water					
logging					

7. To what extent do you agree or disagree with the following statements for **sustainable development** of the city? (SA = strongly agree; A = agree, N = neither agree nor disagree, D = disagree; SD = strongly disagree)

		SA	A	N	D	SD
a	Awareness of environmental issues and encouraging others to behave in an environmentally responsible way (e.g. through education) is important for development of the city					
b	Recycling of waste is worthwhile					
с	I I would segregate garbage more if recycling facilities are taken up by the Govt / local municipality for city's welfare					
d	The proper management of solid waste is the responsibility of the city dweller along with the government					
e	Campaigning by the governments and private institutions for segregation of solid waste is important for sustainable development of the city					
f	Individual actions can make a difference to sustainable development of the city					
g	Humans are too insignificant to affect the global environmental problem					
h	li Our everyday action affect environment both locally and globally.					
i	The sustainable development of the city is the responsibility of every one of us, the city dwellers					
j	Environmental issues are more important than social issues (e.g. homelessness) in our city					
k	There are more pressing global issues (e.g. Aids epidemic) than environmental issues in my city.					
l	There are more pressing local issues (e.g. unemployment) than environmental issues in my city					
m	All city dwellers must pay for solid waste segregation					
n	Being a responsible city dweller, I am ready to pay Tk.1200/ month for solid waste management					

Age Gender		Educational Qualification		Occupation		
a.	18-25	Male	a.	Primary level	a.	Homemaker
b.	26-35	Female	b.	below secondary level	b.	Self-employed
с.	36-45		с.	Secondary level	с.	Service
d.	46-55		d.	Higher secondary level	d.	Others(please mention):
e.	56 & above		e.	Graduate		
			f.	Post Graduate		

8. Personal Details ----tick (v) the correct one

9. Monthly family Income (in taka): a) below 10,000 b) 10,000-20,000 c)20,001-40,000 d) 40,001-60,000 e) 60,001 – 80,000 f) 80,000 and above