

SOLID WASTE SEPARATION AMONG WOMEN IN DHAKA HOUSEHOLDS: AN EXTENDED TPB PERSPECTIVE

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Abstract: This research focused on determining the factors that influence women's intentions to waste separation in Dhaka. Furthermore, this research might help to attain the 2030 sustainable development goal of a cleaner environment. The theory of planned behaviour was then used as the theoretical framework for this investigation, which includes moral obligation, environmental knowledge, perceived inconvenience, and perceived trust to improve explanatory power. In this quantitative study, purposive sampling and a survey were employed to gather data, resulting in 145 valid responses from women for analysis. The data was then analysed using structural equation modelling, incorporating measurement and structural models. The findings revealed that attitude, subjective norms, moral obligation, environmental knowledge, and perceived trust collectively contributed to intention, explaining 45.2% of the variance. However, perceived behavioural control and perceived inconvenience did not show significant contributions. Fundamentally, this is one of the first studies in Dhaka city to look at the factors that influence women's intentions to segregate their household solid waste, laying the groundwork for future waste management research.

Keywords: Solid household waste, structured equation modelling, theory of planned behaviour, waste separation, women.

Introduction

Solid waste increases as the world's population and living standards improve (Meena *et al.*, 2019). As a result, solid waste management has become one of the world's key developmental issues today. In 2010, homes, commerce, industry, and construction created between 7 and 10 billion tonnes of solid garbage (Wilson & Velis, 2015). However, high-income nations such as West Europe, the United States, Canada, Japan, Australia, and New Zealand generate almost half the total. Importantly, as waste generation expands in other parts of the world, that percentage is anticipated to decline in the coming decades with large increases in Asia and Africa (Wilson & Velis, 2015).

Many cities in industrialised nations have been successful in alleviating this problem to a considerable part by implementing integrated and sustainable garbage management. This

management concept aims to ensure that all trash is treated as a resource material with some recyclable and others suitable for composting, achieved through the sorting and separation of household waste materials into different categories for easier recycling or disposal (Hettiaratchi, 2007; Tang *et al.*, 2023). In addition, waste separation and material recovery for recycling and reuse, part of an Integrated Solid Waste Management (ISWM) system are suggested to save energy, preserve resources, minimise incinerator emissions, and extend landfill lifespans (Seik, 1997). Although most affluent nations such as the United States, Japan, and the United Kingdom have implemented waste management principles into best practices through careful organisation and planning, developing nations frequently face inefficient management systems (Alice *et al.*, 2015).

When it comes to Bangladesh, the situation is similar to that of other Asian nations such as India, Pakistan, and Nepal. Bangladesh's solid waste management is a major problem with a per capita trash output of 0.75 kg per day and a total garbage generation of 21.07 million tonnes per year projected by 2025 (Ashikuzzaman & Howlader, 2019). In Dhaka, the total waste collection is only 37% (Islam, 2016). Notably, if garbage is collected improperly, it will be unlawfully disposed of, posing serious health and environmental concerns to Bangladeshis. However, Bangladesh has previously tried and failed to implement a 3R waste management strategy in Dhaka, which is comparable to that of industrialised countries. Given the city's rapid development and limited trash services, it is critical to enhance source separation and waste management (Rahman *et al.*, 2017). On the other hand, households continue to be viewed as passive receivers of municipal services in many parts of the world, and they are routinely neglected in household decision-making processes (Tadesse, 2009). In addition, the role of women can be a vital factor in household waste management procedures.

Women are the key decision-makers responsible for the family's waste disposal procedure in most homes (Patel *et al.*, 2018). In Bangladesh, women are in charge of home management, including solid waste management (Biswas *et al.*, 2020). Therefore, women's participation in solid waste management is unavoidable, according to societal expectations in Bangladesh. On the other hand, the theory of planned behaviour (TPB) has been employed in several waste separation studies in various nations (Nguyen *et al.*, 2015; Toan, 2021). This theory explains how attitudes, subjective norms, and perceived behavioural control influence the services provided by families for waste separation (Knussen *et al.*, 2004; Ekere *et al.*, 2009; Alhassan *et al.*, 2018; Foon *et al.*, 2020). Besides, moral obligation and environmental knowledge can be potential predictors of the development of attitudes within women. In addition, perceived trust (PT) and perceived inconvenience (PI) are two important variables

from the waste separation perspective that can help to extend the TPB and achieve better explanatory power.

However, no study has yet been conducted to determine the factors influencing women's intentions to separate solid waste in Dhaka, which is our concern. Therefore, comprehensive research is needed to understand better the social and psychological influences on women's intention to separate their waste. Therefore, the objectives of this study are as follows:

- (a) To determine the effect of moral obligation and environmental knowledge on the attitude to separate solid waste in households in Dhaka city.
- (b) To determine the effect of TPB variables (attitude, subjective norm, and perceived behavioural control) on the intention to separate solid waste in households of Dhaka city.
- (c) To determine the effect of perceived trust on the intention to separate solid waste in households of Dhaka city.
- (d) To determine the effect of perceived inconvenience on the intention to separate solid waste in households of Dhaka city.

The remaining sections of this paper are structured in the following way. Section 2 will describe the fundamental information of the TPB along with perceived trust, perceived inconvenience, and their contribution to waste separation. A conceptual model will be proposed in section 3 with the formation of hypotheses. The methodology of this study will be explained in section 4. Section 5 will demonstrate the results achieved from the analysis. A concluding remark can be found in the last section, along with the limitations of this study and some ideas for further studies.

Background of Extended TPB Model

This study was based on Ajzen's TPB, which was developed to increase the predictive ability of the Theory of Reasoned Action (TRA) (Razali

et al., 2020). Because of the deficiencies of TRA noted by Terry *et al.* (1993), Ajzen developed the theory of planned behaviour to broaden the scope of TRA. According to Ajzen (1991), this theory uses three factors to predict an individual's intention to engage in a behaviour at a given time and place: Attitude, subjective norms, and perceived behavioural control (PBC) (Figure 1).

The individual view that a specific activity makes a good or negative contribution to that person's life is represented by the attitude toward the act or behaviour factor (Razali *et al.*, 2020). According to Ajzen (1991), attitudes are classified into two categories. First, it encompasses the person's sentiments, and second, it includes their awareness of the particular action. On the other hand, the subjective norm element is concerned with everything that surrounds an individual such as social norms, cultural norms, or group beliefs (Fornara *et al.*, 2011). This factor is connected to social pressure, which impacts conduct in situations when people may do such activities with their social peers' approval (Wang *et al.*, 2014; Sicilia *et al.*, 2020). Finally, PBC expresses a person's perception of how easy or difficult it is to exhibit a specific action; it is supposed to reflect prior experience and expected challenges (Ajzen, 1991). Importantly, research by Tonglet (2004) revealed that TPB is a useful theory for studying recycling and waste reduction behaviour (Oztekin *et al.*, 2017).

Many studies rely on TPB theory to prove that psychological factors are the main predictors of waste separation intentions based on their positive intentions (Nguyen *et al.*, 2015a; Tran *et al.*, 2019). Besides, environmental awareness, attitude toward recycling, and societal pressure, according to Ravindra (2019), it have a favourable impact on behavioural intentions to recycle e-waste in Sri Lanka, while the inconvenience and expense of recycling have a negative impact. This is because individuals do not actively engage in trash recycling behaviour despite their knowledge and awareness of the negative effects of incorrect waste management on the environment. Furthermore, according to Zhang *et al.* (2015), environmental awareness and moral obligation have a strong and positive relationship with an individual's attitude. Furthermore, previous empirical research on the impact of subjective standards on individuals' recycling behaviour has had conflicting results. According to Al Mamun *et al.* (2018), the subjective norm impacts household recycling behaviour, while other researchers (Knussen *et al.*, 2004) do not find social influence to be important in explaining recycling behaviour. However, Bortoleto *et al.* (2012) concluded that perceived behavioural control is the main predictor of household waste prevention behaviour. Some recent waste separation-related studies that have used the TPB can be seen in Table 1.

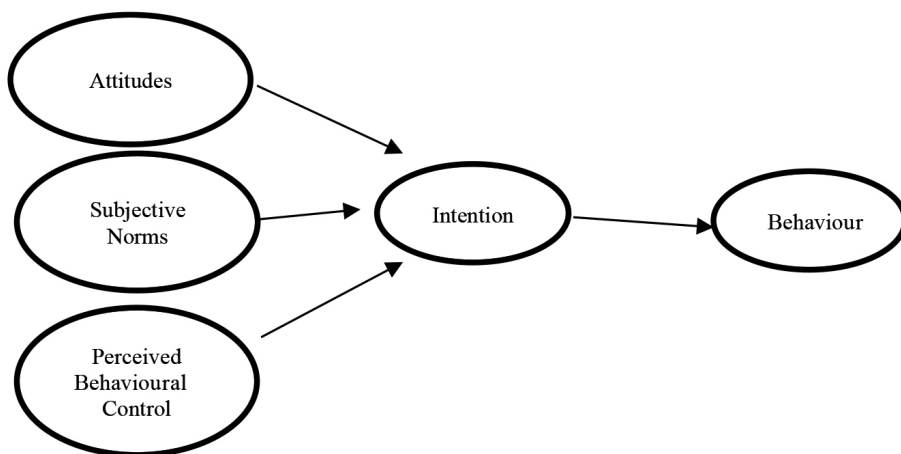


Figure 1: TPB model (Moeini *et al.*, 2017)

Table 1: TPB model in recent waste separation application

No.	References	Authors	Year	Journal/ Conference Name	Country	Sample Type	Sample Size	Number of Citations	Application
1	Vassanadumrongdee & Kittipongvises, 2018	Sujitra Vassanadumrongdee and Suthirat Kittipongvises	2018	Sustainable Environment Research	Thailand	Household leaders	1076	83	Source separation
2	Ayob et al., 2017	Siti Fadzilah Ayob, Low Sheau-Ting, Rohaya Abdul Jailil and Hon- Choong Chin	2017	Facilities	Malaysia	Students from UTM	486	19	Waste separation
3	Zhang et al., 2015	Dongliang Zhang, Guangqing Huang, Xiaoling Yin and Qinghua Gong	2015	International Journal of Environmental Research and Public Health	China	Households' community	208	125	Waste separation
4	Heidari et al., 2018	Ava Heidari, Mahdi Kolahi, Narges Behraves, Mona Ghorbanyon, Fatemeh Ehsanmansh, Nogol Hashemolhosini and Fahimeh Zanganeh	2018	Journal of Material Cycle and Waste Management Volume	Iran	Students	420	32	Waste management
5	Yu et al., 2018	Yu Shuangying, Lu Tiezhan, Qian Xuepeng and Zhou Weisheng	2018	International Review for Spatial Planning and Sustainable Development	China	Citizens	211	9	Waste separation

6	Razali <i>et al.</i> , 2020	Fitriyah Razali, Dzurllkanian Daud, Choong Weng-Wai Wilson, and Ranga Anthony Jiram	2020	Journal of Cleaner Production	Malaysia	High-rise residential	900	7	Waste separation
7	Lou <i>et al.</i> , 2020	Tianyang Lou, Deyong Wang, Huihui Chen, and Dongjie Niu	2020	Sustainability	China	Resident from urban and rural areas	604	3	Waste separation
8	Liao <i>et al.</i> , 2018	Chuanhui Liao, Dingtao Zhao, Shuang Zhang and Lanfang Chen	2018	International Journal of Environmental Research Public Health	China	Residents	538	25	Separation of rural household solid waste
9	Wang <i>et al.</i> , 2021	Keqiang Wang, Jianglin Lu, and Hongmei Liu	2021	Journal of Material Cycles and Waste Management	China	Households	433	0	Waste source separation
10	Toan, 2021	Tran Pham Khanh Toan	2021	Ho Chi Minh City Open University Journal of Science	Vietnam	Residents	487	2	Waste separation
11	Chen & Lee, 2020	Bing Chen and Jiwon Lee	2020	International Trade, Politics and Development	China	Residential communities	371	1	Waste separation
12	Erami <i>et al.</i> , 2015	Soran Erami, Tahereh Pashaei, and Behzad Shahmoradi	2015	Journal of Advance Environmental Health Research	Iran	Home makers	283	2	Source separation

13	Khalil <i>et al.</i> , 2017	Muhammad Salisu Khalil, Sabrina Abdullah, Latifah Manaf, Amir Sharaai, and Aliyu Baba Nabegu	2017	Recycling	Nigeria	Households	393	14	Household recycling
14	Okonta & Mohlalifi, 2020	F. N. Okonta and M. Mohlalifi	2020	Waste Management	South Africa	Residents	480	5	Source Recycling
15	Arkorful <i>et al.</i> , 2023	Arkorful, V. E., Shuliang, Z., and Lugu, B. K.	2023	Journal of Environmental Planning and Management	Ghana	Households	707	15	Waste Separation Behaviour

Despite the TPB’s widespread usage in evaluating recycling and waste separation behaviour, numerous studies have suggested that extra factors should be included to increase the TPB’s predictive validity (Tonglet *et al.*, 2004).

Perceived Trust

The degree to which a customer can rely on the system’s advice is defined as trust. Three factors contribute to trust: Ability, integrity, and benevolence. First, the trustor’s confidence that the trustee will satisfy one’s demands is referred to as ability. Then, the confidence in the trustee’s integrity is that one will be honest and follow through on one’s commitments. Finally, the trust that the trustee will look after and act in the best interests of the trustor is known as benevolence (Pal *et al.*, 2019).

Furthermore, researchers have utilised trust as a variable in solid waste segregation in a recent study. Nguyen *et al.* (2015) and Mashal and Shuhaiber (2019) discovered that those with a higher degree of trust are prepared to pay a larger monetary charge, suggesting they are more likely to participate in waste separation. On the other hand, a source separation barrier for recycling linked to recycling infrastructures is distrust caused by non-transparent recycling procedures or recycling routes (Vassanadumrongdee & Kittipongvises, 2018). Trust in waste management programs is a positive driving force behind the behaviour, as seen in this study (Le *et al.*, 2017). As a result, policies and initiatives emphasising trust are critical for boosting residential household participation in waste separation.

Perceived Inconvenience

The amount of time, space, and perceived ease with which a person can manage is convenient (Gadiraju, 2016). It may also apply to an issue that causes a lack of comfort. A simple and convenient recycling facility might attract individuals unconcerned about the environment to recycle. As a result, the recycling rate is quite high (Derksen & Gartrell, 1993). Furthermore, the convenience of recycling has been identified

as a factor affecting recycling behaviour in several studies (Kelly *et al.*, 2006; Wan *et al.*, 2012; Zaikova *et al.*, 2022). Residents' willingness to participate in recycling activities was affected by this perceived inconvenience, as did their desire to segregate garbage (Alhassan *et al.*, 2018). Furthermore, scientists have identified this PI as a situational variable that makes waste separation challenging for families (Loan *et al.*, 2017). In the Netherlands, additional variables such as moral obligation and inconvenience predicted persons' recycling intentions when none of the TPB predictors had any influence (Halder & Singh, 2018). As a result, evaluating the relevance of this element in the context of a developing country would be extremely fascinating.

Conceptual Model and Hypotheses Development

Relationships between Environmental Knowledge and the Attitude

Environmental knowledge and behavioural intention have been linked in several publications. According to previous research, general environmental awareness has a beneficial impact on intentions (Suki, 2013; Goh & Balaji, 2016; Choi & Johnson, 2019; Hamzah & Tanwir, 2021). In addition, Ramayah *et al.* (2012) included environmental knowledge in their model, which indirectly impacts adoption intention. According to Wang *et al.* (2016), people with higher environmental knowledge have more favourable views about the environment and better environmental intents in actuality. As a result, the following hypothesis can be put forth:

H1: Environmental knowledge is positively related to the attitude of households toward solid waste disposal in the Dhaka Metropolitan City.

Relationships between Moral Obligation and the Attitude

The moral obligation to mitigate the effects of global warming and climate change is a

significant factor in determining intentions (Chen, 2016). Resident who feels a strong sense of moral duty can control their thoughts and conduct in life, resulting in a more favourable attitude toward the surroundings. According to theoretical considerations, residents' views in life are frequently influenced by a strong feeling of moral obligation (Zhang *et al.*, 2015). Therefore, the following hypothesis can be suggested:

H2: Moral obligation positively influences attitudes towards household waste separation intention.

Relationships between Attitude and Waste Separation Intention

According to Tonglet *et al.* (2004), attitude is positively associated with intention, which leads to recycling behaviour. According to Alhassan *et al.* (2018), attitudes predicted families' intentions to segregate solidwaste. Another study found that having a positive attitude toward food waste led to greater intentions to minimise waste (Aktas *et al.*, 2018). The theory of planned behaviour claims that attitude does not directly predict behaviour. However, the relationship between attitude and behaviour is mediated by intention (Ajzen, 1991a). As a result, we may construct the following hypothesis:

H3: Attitude has a positive effect on waste separation intention.

Relationships between Subjective Norm and Waste Separation Intention

Social pressure has a substantial influence on consumer intention, according to Wang *et al.* (2016). Furthermore, in the case of segregating food takeaway waste, the aim was somewhat mediated by the subjective norm (Liao *et al.*, 2018). Furthermore, subjective norms were shown to have a strong relationship with inhabitants' propensity to seek effective waste management (Vassanadumrongdee & Kittipongvises, 2018). So, the following research hypothesis can be predicted based on the preceding discussions:

H4: Subjective norms have a positive influence on household waste separation intention.

Relationships between Perceived Behavioural Control and Waste Separation Intention

Perceived behavioural control was an important predictor of intention in several situations (McMillan & Conner, 2003; Hansen *et al.*, 2018). In the case of waste separation, PBC increases the capacity to anticipate or explain intention (Armitage *et al.*, 2002; Nguyen *et al.*, 2015). Besides, residents' intentions are influenced by their ignorance about the result of the garbage they segregate. As a result, perceived behavioural control was found to impact household waste separation (Erin, 2001). Therefore, we suggest the following hypothesis:

H5: Perceived behavioural control has a positive influence on waste separation intention.

Relationships between Perceived Inconvenience and Waste Separation Intention

In general, inconvenience is linked with a lack of storage space, high time demands, or perceived hazards involved with recycling. Besides, it involves moving recyclables to a drop-off location (Ekere *et al.*, 2009; Saphores *et al.*, 2012). Furthermore, people's willingness to segregate garbage is influenced by their perceived inconvenience (Vassanadumrongdee & Kittipongvises, 2018). Several studies have revealed that people are less likely to recycle because they consider it inconvenient (Boldero, 1995; Domina & Koch, 2002; Do Valle *et al.*, 2005). Furthermore, this inconvenience would be a barrier to waste separation counterproductive to the goal (Latif *et al.*, 2012; Liao *et al.*, 2018). As a result, the following hypothesis can be proposed:

H6: Perceived inconvenience has a negative impact on waste separation intention.

Relationships between Perceived Trust and Waste Separation Intention

Trust has been found to be detrimental to the desire to distinguish wastages (Vassanadumrongdee &

Kittipongvises, 2018). Furthermore, the amount of money a household was willing to pay as a fine was considerably and positively connected to their trustworthiness. It indicates that those with a higher degree of trust are prepared to pay a higher monetary fine, suggesting they are more eager to engage in trash separation (Nguyen *et al.*, 2015). On the other side, according to Knickmeyer (2020), collaboration levels in a waste separation program grew when trust among individuals grew. As a result of the above debate, the following hypothesis may be formulated:

H7: Perceived trust has a positive impact on waste separation intention.

The extended TPB model is presented to fulfil the study goals (Figure 2). The proposed model uses regular TPB variables such as attitude, subjective norm, PBC, perceived trust, and perceived inconvenience to predict separation intention. In addition, two other constructs, moral obligation and environmental knowledge, impact attitude. The conceptual framework illustrates how attitudes, subjective norms, and perceived behavioural control impact women's intentions to segregate solid waste. In addition to the overarching model's demographic components, the framework stresses the direct and indirect impacts of moral obligation, environmental knowledge, perceived trust, and perceived inconvenience on intention.

Methodology

Women in Dhaka city make up the population of this research. The data were collected from women in Dhaka using the purposive sampling approach. For our target participants to reply, we established the following criteria:

- (a) Are you a woman?
- (b) Do you live in Dhaka city?
- (c) Are you responsible for household waste separation?
- (d) Do you know about solid waste separation?
- (e) Are you above 15 years of age?

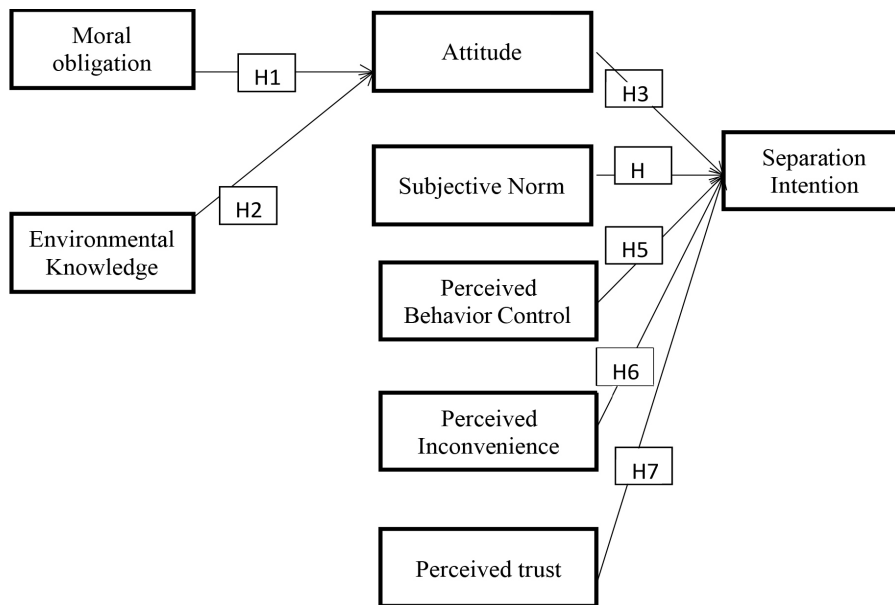


Figure 2: Proposed extended TPB model

Table 2 contains all of the 34 elements that were modified from prior literature for illustration (Zhang *et al.*, 2015) and were followed to adapt the items for environmental knowledge (5 items), moral obligation (3 items), and attitude (4 items). In addition, the instruments for subjective norm (5 items), PBC (5 items), PI (4 items), PT (4 items), and separation intention (4 items) were adapted from Mahmud & Osman (2010), Gadiraju (2016), Ayob *et al.* (2017), Vassanadumrongdee & Kittipongvises (2018), and Toan (2021), respectively. In addition, the 7-point Likert scale was used in our quantitative, self-administered cross-sectional survey. Besides, minor changes were made to the components to ensure they fit the model's framework.

Results

SPSS v26 was used to evaluate the demographic questionnaire and preliminary data screening. Furthermore, Harman's single factor was utilised to calculate the independent sample t-test, which yielded a result of about 26.9%. Smart PLS v3.3.3 was also used to investigate the conceptual model and hypotheses. There

were two phases in this evaluation technique: A measurement model assessment to guarantee reliability and validity and a structural model to evaluate the hypotheses.

Data was taken between the second and fourth weeks of June 2021. Because of the epidemic, data was exclusively gathered online using a Google Form. 246 respondents received questionnaires through email, Messenger, and WhatsApp. Following that, 145 valid replies were chosen for analysis, yielding a response rate of 58.9%. Researchers discovered that the minimal sample size is 138 using the G* power test. Table 3 shows the demographic characteristics of the sample, revealing that the majority of participants (41.4%) are in the youth group, followed by 25 to 30 years old (18.6%). Furthermore, 50 and 38 of them are graduate and postgraduate students. Moreover, most women are married (49%) or single (43.4%). Most notably, the majority of women claimed to have a moderate to good understanding of waste separation and management.

Factor loading also known as standardised regression coefficients or outer loading, is a metric for the strength of the link between each

Table 2: Questionnaire development

Variables	Statement	Source
Environmental Knowledge	EK1 Waste separation is a primary way to protect the environment	(Zhang et al., 2015)
	EK2 If wastage problem continues on their present course, we will soon experience a major ecological catastrophe	
	EK3 Household waste separation can reduce environmental pollution	
	EK4 Climate change or global warming is a very serious problem, and wastage's effect is happening	
	EK5 Household waste separation can reduce global warming	
Moral Obligation	MO1 I separate waste out of my sense of responsibility to protect the environment	(Zhang et al., 2015)
	MO2 Waste separation behaviour is a virtue	
	MO3 I would feel guilty if I did not separate waste properly	
Attitude	ATT1 Waste separation is beneficial	(Zhang et al., 2015)
	ATT2 I feel angry if other people throw out waste incorrectly	
	ATT3 Waste separation can create a better community environment	
	ATT4 We have a responsibility to reduce the amount of waste generate	
Subjective Norm	SN1 Most people who are important to me support waste separation	(Toan, 2021)
	SN2 My neighbors expect me to separate waste	
	SN3 The community expects me to separate waste	
	SN4 My families expect me to separate waste	
	SN5 The people who are doing waste separation that I know always say good things about this regulation	

Perceived Behavioural Control	PBC1	I separate waste regardless of whether there are community incentives	(Mahmud & Osman, 2010)
	PBC2	Waste separation is a very easy thing for me	
	PBC3	Whether I separate waste is dependent on me	
	PBC4	Waste separation is costly for equipment	
	PBC5	I receive information on source separation from the media (TV/radio/ newspaper)	
Perceived Inconvenience	PI1	I am busy with my household works, there is not enough time for waste management	(Tonglet <i>et al.</i> , 2004; Kelly <i>et al.</i> , 2006)
	PI2	Source separation is too complicated	
	PI3	Waste separation takes up too much storage space making it difficult to perform	
	PI4	Difficulties in waste separation facilities will influence my intention	
Perceived Trust	PT1	Solving wastage problem is the duty of the government and municipalities, not me	(Vassanadumrongde & Kitipongvises, 2018)
	PT2	If policies are strong to separate waste, then it would be trustworthy	
	PT3	Even I do source separation, garbage collectors would mix sorted waste with other waste	
	PT4	Even the environmental quality is getting worse, I still think that the economic problem outweighs environmental problem	
Separation Intention	INT1	I am glad to engage in the government waste separation plan	(Ayob <i>et al.</i> , 2017)
	INT2	I am willing to participate in household waste separation	
	INT3	I am glad to follow the waste separation guidance of the community	
	INT4	I am glad to continue to engage in a waste separation	

Table 3: Demographic characteristics

Variables	Category	Frequency	Percentage
Age	16-24 years	60	41.4
	25-30 years	27	18.6
	31-35 years	12	8.3
	36-40 years	8	5.5
	41-45 years	11	7.6
	46-50 years	6	4.1
	51-55 years	7	4.8
	56-60 years	9	6.2
	61-65 years	4	2.8
	Above 65 year	1	0.7
Academic qualification	Diploma or equivalent	5	3.4
	Homemaker	1	0.7
	Honours or equivalent	50	34.5
	HSC or equivalent	27	18.6
	Masters or equivalent	38	26.2
	No recognised academic degree	12	8.3
	Post Doctorate or equivalent	1	0.7
	SSC or equivalent	11	7.6
Marital status	Divorced	2	1.4
	Married	71	49.0
	Separated	5	3.4
	Single	63	43.4
	Widow	4	2.8
Occupation	Business	2	1.4
	Do not work	44	30.3
	Freelancing	1	0.7
	Homemaker	3	2.1
	Housemaid	1	0.7
	Housewife	1	0.7
	House worker	1	0.7
	Housemaid	2	1.4
	Housewife	2	1.4
	ING	1	0.7
	Journalist	1	0.7
	Maid	1	0.7
	Private sector	28	19.3
	Public sector	6	4.1
Student	51	35.2	
Waste management knowledge	Very poor	9	6.2
	Poor	16	11.0
	Moderate	51	35.2
	Good	60	41.4
	Very good	9	6.2
Waste separation knowledge	Very poor	9	6.2
	Poor	19	13.1
	Moderate	58	40.0
	Good	52	35.9
	Very good	7	4.8

item (Yong & Pearce, 2013). To guarantee convergent validity, items with factor loadings of 0.5 or less should be removed (Maskey *et al.*, 2018). Due to a low factor loading of less than (0.5), four items were deleted: SN1, SN2, PT1, and PBC4. Therefore, the rest of the factor

loading values are adequate in Table 4. On the other hand, Average variance extracted (AVE) and composite reliability (CR) were evaluated to assess the internal consistency and convergent validity. To be approved, all components must have a CR value larger than 0.7 and an AVE

Table 4: Factor loadings, CR, and AVE

Variables	Abbreviation	Indicators	Factor Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)
Attitude	ATT	ATT1	0.911	0.913	0.725
		ATT2	0.746		
		ATT3	0.894		
		ATT4	0.845		
Environmental knowledge	EK	EK1	0.756	0.884	0.603
		EK2	0.782		
		EK3	0.809		
		EK4	0.766		
		EK5	0.770		
Separation intention	INT	INT1	0.919	0.96	0.861
		INT2	0.938		
		INT3	0.913		
		INT4	0.941		
Moral obligation	MO	MO1	0.848	0.881	0.712
		MO2	0.816		
		MO3	0.867		
Perceived behavioural control	PBC	PBC1	0.837	0.825	0.545
		PBC2	0.800		
		PBC3	0.645		
		PBC5	0.649		
Perceived inconvenience	PI	PI1	0.919	0.919	0.743
		PI2	0.931		
		PI3	0.889		
		PI4	0.684		
Perceived trust	PT	PT2	0.889	0.828	0.623
		PT3	0.864		
		PT4	0.577		
		PT2	0.889		
Subjective norm	SN	SN3	0.797	0.889	0.728
		SN4	0.855		
		SN5	0.905		
		SN3	0.797		

value better than 0.5 (Hair et al., 2014). Both criteria were satisfied for the variables in this research.

The Fornell-Larker criteria were used to assess discriminant validity in this study. According to this criterion, the diagonal values must be bigger than the corresponding row and column values. The measures were adequate and passed the discriminant validity test, as shown in Table 5.

The explanatory power of a structural model may be determined using the coefficient of determination (R^2) (Chin, 2010). In this investigation, the R^2 values for ATT and INT to

separate household solid waste were 0.651 and 0.452, respectively (Table 6).

According to our findings, five of the seven hypotheses are significant (Table 7). EK and MO, as expected, have a substantial influence on attitude. PBC and PI, on the other hand, obtained P-values of 0.201 and 0.244, respectively, which are much lower than the predicted level, given that P-values must be less than or equal to 0.05. Regardless, the remainder of the factors ATT, PT, and SN were shown to be significant predictors of separation intention. As such, H1, H2, H3, H4, and H7 are all supported, except for H5 and H6 (Figure 3).

Table 5: Discriminant validity

	ATT	EK	INT	MO	PBC	PI	PT	SN
ATT	0.852							
EK	0.668	0.777						
INT	0.526	0.423	0.928					
MO	0.746	0.552	0.460	0.844				
PBC	0.610	0.528	0.511	0.696	0.738			
PI	-0.388	-0.236	-0.212	-0.436	-0.292	0.862		
PT	0.041	0.035	0.281	-0.061	0.011	0.271	0.790	
SN	0.647	0.532	0.567	0.624	0.728	-0.314	-0.002	0.853

Table 6: Coefficient of determination

	R-square	R-square Adjusted
ATT	0.651	0.646
INT	0.452	0.432

Table 7: Results of hypotheses

No.	Relationship	β -values	T-values	P-values	Decision
H1	MO → ATT	0.543	6.075	0.000	Supported
H2	EK → ATT	0.369	4.061	0.000	Supported
H3	ATT → INT	0.197	1.988	0.047	Supported
H4	SN → INT	0.321	3.422	0.001	Supported
H5	PBC → INT	0.132	1.279	0.201	Not supported
H6	PI → INT	-0.076	1.165	0.244	Not supported
H7	PT → INT	0.293	3.163	0.002	Supported

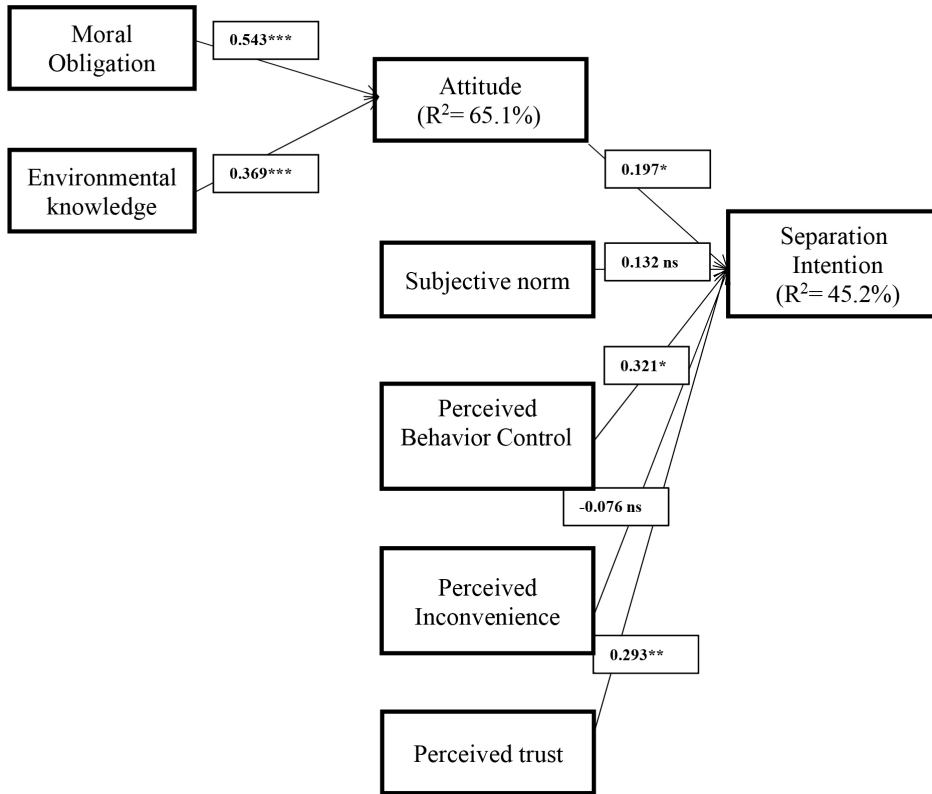


Figure 3: Structural model results

The amount of an effect is determined by the R² value and is divided into three categories: Small, medium, and substantial with values more than or equal to 0.02, 0.15, and 0.35, respectively (Hair *et al.*, 2014). Table 8 shows

that we have discovered all four types of effects. It should be noted that any number less than 0.02 has no impact. As a result, PBC and PI do not affect separation intention.

Table 8: Effect size

Relationship	Effect size (f ²)	Decision
MO → ATT	0.587	Substantial effect
EK → ATT	0.271	Moderate effect
ATT → INT	0.035	Weak effect
SN → INT	0.076	Weak effect
PBC → INT	0.014	No effect
PI → INT	0.008	No effect
PT → INT	0.146	Moderate effect

Discussions

To minimise future harm to individuals and the environment, it is critical to reduce pollution at the home level by sorting solid waste (Misra & Pandey, 2005; Pujara *et al.*, 2019). This study developed a comprehensive model of household solid waste separation intention, which included both traditional cognitive factors (ATT, SN, and PBC) and other waste-related factors such as environmental knowledge, moral obligation, perceived trust, and perceived inconvenience. When coupled with SEM, the expanded TPB is an acceptable model for evaluating waste separation intention, revealing the quantitative connections between observable and latent variables.

Relationship between Moral Obligation and Attitude

Zhang *et al.* (2015) found that moral obligation positively impacts attitude that influences intention to separate waste. Tran *et al.* (2019) also found that internal norm or moral obligation has a significant impact on intention ($\beta = 0.333$, $p < 0.01$). This research revealed that moral obligation ($\beta = 0.543$, $p < 0.000$) positively correlates with attitude. So, the ethical obligations of individuals are important in encouraging household waste separation intention.

Relationship between Environmental Knowledge and Attitude

The findings show that ATT depends highly on a person's environmental knowledge to determine the consequences of poor waste management. Zhang *et al.* (2015) and Xu *et al.* (2017) found that environmental knowledge positively impacts attitudes influencing the intention to separate waste. In this research, H1 has a significant relationship with attitude, which is dependent on environmental knowledge ($\beta = 0.369$, $p < 0.000$). To look at it another way, women with a good understanding of waste separation and management were likelier to have a positive attitude towards behavioural intention. In this study, environmental knowledge was found to

be positively related to women's behavioural intentions. This observation revealed that most women had good knowledge (41.5%) of waste management and moderate knowledge (40.1%) of waste separation, indicating that they were aware of how to reduce, reuse, and recycle waste. Environmental knowledge is also influenced by education, age, occupation, and media (Aminrad *et al.*, 2013; Laor *et al.*, 2018).

Relationship between Attitude and Intention

A study on university students by Ayob *et al.* (2017) discovered that attitude has a large effect size ($f^2 = 0.474$) and a significant path coefficient ($\beta = 0.563$, $t = 12.586$, $p < 0.001$) with intention. As a result, their study findings confirm that waste separation attitudes positively impact waste separation intention. In this study, researchers also found that the intention has a statistically significant positive correlation with attitude ($\beta = 0.196$, $p < 0.005$), and the effect size is weak ($f^2 = 0.035$). This research is supported by the theory of planned behaviour (Ajzen, 1991), which states that an individual's attitude determines whether or not they will engage in a particular behaviour. The attitude was linked to the intention (Laner, 2018; Ikhwan *et al.*, 2018). The women who have a positive attitude towards waste separation when it comes to acting (Ayob & Sheau-Ting, 2016).

Relationship between Subjective Norm and Intention

H4, subjective norms have an influence on source separation intention in this study, which is consistent with previous research in Bangkok, Iran, and China, respectively (Pakpour *et al.*, 2014; Vassanadumrongdee & Kittipongvises, 2018; Z. Wang *et al.*, 2018). It also demonstrates that Dhaka residents care about other people's behaviours, implying that raising residents' awareness of waste problems and providing an easy recycling environment in the society and workplace can significantly enhance residential source separation practice in Dhaka. Data shows that social norm ($\beta = 0.321$, $p < 0.001$)

positively impacts intention, indicating that H4 is strongly supported. These findings align with the previous findings of Zhang *et al.* (2015) and Vassanadumrongdee & Kittipongvises (2018). In contrast, some research in different contexts has shown that SN is the poorest predictor of waste-related behaviour in the TPB (Foon *et al.*, 2020). To determine the strength of the effect, f^2 values were calculated and it was discovered that SN ($f^2 = 0.076$) affected INT. Separation intention was significantly influenced by subjective norms. This indicates that residents' social relationships are likely to encourage waste separation and that families and communities have a greater influence on subjective norms. The factor loadings were 0.797, 0.855, and 0.905, respectively, indicating that positive publicity and guidance from the studied families and community will most likely improve residents' subjective norms.

Relationship between Perceived Behavioural Control and Intention

PBC exerts a much stronger impact on the intention to separate waste ($\beta = 0.83$, $p < 0.001$). PBC was found to have a significant positive effect on intention by Zhang *et al.* (2015) and Foon *et al.* (2020). Zhang *et al.* (2015) also mentioned separation behaviour intention, implying that residents' behavioural intentions were largely dependent on their self-control abilities. When there is supervision and motivation in a community, self-control will improve. However, the study findings were insignificant when measuring H5. However, the researcher discovered that ($\beta = 0.132$, $p < 0.201$) PBC have no direct effect on waste separation intention in this study. Similarly, Toan (2021) found that PBC has a negative significance with intention. This does not comply with other relevant studies that claimed that PBC could predict intentions significantly. Residents believe that waste separation is a difficult task, but in this study, the majority of participants responded that waste separation is a simple task. The factor loading for these hypotheses was 0.800, 0.837, 0.645, and 0.649, respectively. PBC has an insignificant relation

in the structural model and it is not surprising that in connection with the waste separation, the opportunity and ability of an individual do not necessarily convert itself into the motivational influence of behavioural control (Boldero, 1995). Thus, communities must improve their guidance to facilitate waste separation, which will in turn improve the intentions of women residents to separate waste.

Relationship between Perceived Inconvenience and Intention

The perception of a lack of time, space, and formal separation scheme reduces the likelihood of the intention to separate the household source (Alhassan *et al.*, 2018). Based on Alhassan *et al.* (2018), H6 separation behaviour was predicted by perceived inconvenience ($\beta = 0.076$, $p = 0.244$). People are less likely to participate in waste separation if they perceive it to be more inconvenient such as the cost of waste separation or a lack of time. This is supported by Ajzen's research and several other recent behavioural modelling studies (Ajzen, 2012; Nguyen *et al.*, 2015; Loan *et al.*, 2017). Even though this study perceived that inconvenience negatively impacts waste separation intention among Dhaka women in Dhaka.

Relationship between Perceived Trust and Intention

People in Bangkok and other Thai cities are discouraged from doing source separation because they believe their efforts are in vain when municipal garbage collectors mix their sorted recyclable waste with non-recyclable waste (Vassanadumrongdee & Kittipongvises, 2018). As for hypothesis H6, data shows that perceived trust has a positive impact on intention ($\beta = 0.293$, $p < 0.02$) and has a moderate effect on intention ($f^2 = 0.141$). The results of the empirical testing of these newly developed relationships revealed significant relationships among them. DMC needs to invest in separate collections to change people's perceptions; however, that requires a large investment and it will not work if most people still do not sort

their waste. PLS-SEM is an appropriate method for testing a multivariate, multi-path mode for measuring the relationship between variables that influence household waste separation intention among women in Dhaka city, and the thesis is based on a very well-conducted and well-reported quantitative analysis of a proposed model of extended TPB.

Based on our findings, it can be claimed that waste separation intention depends on attitude, subjective norm, and perceived trust, where both moral obligation and environmental knowledge can lead to developing attitudes. However, PBC and perceived inconvenience have no role in waste separation among women in Dhaka. The results can be interpreted in the following way. Both moral obligation and environmental knowledge have been proven to be key predictors of waste separation attitudes with a greater value of moral obligation leading to a higher value of attitude. On the other hand, women who had a strong comprehension of environmental information were more likely to have a favourable attitude toward waste separation. Furthermore, education, age, employment, and media impact this knowledge (Aminrad *et al.*, 2013; Laor *et al.*, 2018).

Furthermore, enhancing people's understanding of waste separation may impact their attitudes. People would acquire positive sentiments about the intention if information about the benefits of waste separation were widely distributed. Furthermore, the subjective norm that builds social bonds is likely to support waste separation, and families and communities with a stronger effect on waste separation intention are likelier to do so. However, women in Dhaka city do not feel that the current waste management system is simple, flexible, or appropriate.

As a result, PBC had little influence over them regarding waste separation. A similar finding has been seen regarding PI, where women do not believe the current waste management system is inconvenient. This inconvenience is caused by various collecting and transportation techniques used in different areas, which is

insignificant in our instance. Finally, people's willingness to separate their waste is influenced by their level of trust. As a result, strategies and efforts that focus on developing trust are critical to increasing residential families' engagement in waste separation.

Theoretical and Practical Implication

This study adds to the body of knowledge about women's views on solid waste separation and the implications of several factors that influence their separation intentions. This is one of the first studies to look at the elements that impact women's willingness to separate their household solid waste in Dhaka. Besides, it gives a helpful insight into which issues should be prioritised when seeking to improve waste management within the target population. Aside from that, the TPB included two additional variables: Perceived inconvenience and perceived trust. However, in the case of women of Dhaka, perceived inconvenience has no significant link with intention, but perceived trust has shown to have a substantial relationship with intention. These findings imply that eliminating possible impediments and guaranteeing women's trust in the separation of their daily waste should be prioritised. Overall, the TPB, the study's conceptual model is suitable for examining women's intent to segregate their trash. In addition, it helps to understand the major and minor elements that impact women's decision-making.

These findings will point researchers and practitioners in new areas, allowing them to take into account past knowledge of the elements before enacting any policy or taking additional action. Academics and practitioners must assess the purpose before measuring any action because understanding one's behavioural activities is impossible without knowing one's goal. Furthermore, the researchers anticipate that the data will give empirical support for this expanded model and equip policymakers and top management with the factors they need to consider to minimise environmental degradation and ensure successful policy implementation.

The outcomes of the study may also be utilised to recommend ways to boost the target group's waste separation intentions. According to the findings of this study, it is critical to include students from schools, colleges, and universities to impact their families' subjective norms. Schools may also begin a range of environmental initiatives in the community through their students, which can raise people's knowledge of trash separation and their motivation to act. Furthermore, public media and communication efforts should be well-designed to attract more individuals and increase their desire to engage. Effective planning for waste separation policy execution, residence waste separation practice, and public awareness, on the other hand, are required for the system to work. The findings of this study might be used to enhance waste separation intentions to reduce the negative impacts of rising solid waste, especially in developing nations.

Limitations and Future Research

Only women from Dhaka are included in the study. The contribution of males, on the other hand, has been overlooked and the results cannot be generalised. As a result, it would be fascinating to evaluate gender as a moderator, comparing men's and women's intentions in the same circumstance. Furthermore, a comparison of waste management practices in urban and rural areas might lead to new study directions. In addition, the obtained variance is 45.2%, which is not satisfactory. As an external variable, we added perceived trust and perceived inconvenience. However, incorporating TPB with other models like TAM, UTAUT, PMT, etc., will add more information to the current body of knowledge. Finally, geographical distinctions such as established and emerging economies with cultural variations, remain unknown, necessitating further investigation.

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Conflict of Interest Statement

The authors declare that they have no conflict of interest.

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