



Understanding residents' behaviour intention of recycling plastic waste in a densely populated megacity of emerging economy

Qian Jia^{a,b}, Md Sahidul Islam^e, Md Shahadat Hossain^f, Fengting Li^{a,d,**},
Ying Wang^{a,c,*}

^a College of Environmental Science and Engineering, Tongji University, Shanghai, 200092, China

^b UNEP-Tongji Institute of Environment for Sustainable Development (IESD), Shanghai, 200092, China

^c Shanghai Institute of Pollution Control and Ecological Security, Shanghai, 200092, China

^d Key Laboratory of Cities' Mitigation and Adaptation to Climate Change in Shanghai, Tongji University, Shanghai, 200092, China

^e State Key Joint Laboratory of Environment Simulation and Pollution Control, School of Environment, Tsinghua University, Beijing, 100084, China

^f Department of Environmental Science and Management, Independent University of Bangladesh, Dhaka, Bangladesh

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ABSTRACT

Plastic waste is choking our planet, but the recycling rate is still universally low. Understanding factors affecting recycling behaviours can help address this pressing issue. Taking Dhaka as an example, this study explores the determinants of the intentions to recycle plastic waste. We employed the Theory of Planned Behaviour (TPB) and extended it with two additional variables: Moral Norms, and Perceived sufficiency of knowledge and policy support. Survey data of 577 were collected and analysed using PLS-SEM. The findings suggest attitude, perceived behavioural control, moral norms and subjective norms significantly impact recycling intention, among which moral norms ($\beta = 0.148$, $p < 0.05$) acts even more strongly than subjective norms ($\beta = 0.12$, $p < 0.05$). Moreover, low level perception of knowledge and policy support makes people perceive less control over recycling behaviour ($\beta = 0.188$, $p < 0.05$), but actually reinforce their recycling intention ($\beta = -0.091$, $p < 0.1$). This study enriches the theoretical discussion of TPB, and contributes to the efforts of encouraging plastic recycling in populated megacity of emerging economy.

1. Introduction

Plastic waste is choking our planet earth to its tipping point [1,2]. Study reveals that predicted plastic waste growth will exceed the counter efforts by 2030 globally [3], when the amount of plastic in the oceans and other water bodies is likely to double [4]. To control plastic pollution, mitigation efforts on land-based source and removal from the water body are addressed by many researchers [3–6]. It has been demonstrated that the plastic pollution is closely linked with population density [7] and growing consumption from economic growth [8]. Noticeably, populous developing countries are having challenges over mismanaged plastic waste, due to high population density in urban area and unbalanced waste management infrastructure [5,9]. Despite mitigation commitments and measures by some governments, plastic recycling rate is still very low universally [8]. Therefore, it is of urgency to deepen the understanding on the

* Corresponding author. College of Environmental Science and Engineering, Tongji University, Shanghai, 200092, China.

** Corresponding author. College of Environmental Science and Engineering, Tongji University, Shanghai, 200092, China.

E-mail addresses: fengting@tongji.edu.cn (F. Li), yingwang@tongji.edu.cn (Y. Wang).

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factors influencing plastic recycling behaviour, particularly in densely populated megacities of emerging economy.

Recycling behaviour, regarded as one of the pro-environment behaviours, has been explored by different theories, including the model of altruistic behaviour [10], theory of reasoned action [11], and theory of planned behaviour [12]. Among them, the Theory of Planned Behaviour (TPB) is the most widely used tool. It provides a framework of behavioural, normative and control beliefs by defining Attitude, Subjective Norm, and Perceived Behaviour Control that lead to Behaviour Intention and eventually specific behaviours of individuals. Many studies prove TPB can effectively predict recycling behaviours [13–15].

In terms of plastic recycling, there are a dilemma that consumers are facing. On one hand is the moral touch from seeing plastic waste pollution that might generate behaviour intentions [16]. On the other hand, the confusion consumers have over what can be recycled and who should take the responsibility (government, manufacturer, consumers), results in low recycling rate [17,18]. Some researchers explored how TPB can be adapted to include new factors to improve its explanatory power. Chan and Bishop [19] investigate the impact of moral norms in TPB, finding them positively link with a higher recycling intention. Wang et al. [20] also discover that moral norms are one of the most important variables predicting the use of recyclable packages among Chinese consumers. However, researchers argue that, the perception on how well the government is doing in providing knowledge and policy support to clear up the confusion on plastic recycling has mixed effects on individual behaviours. While a good perception on government governance positively links with behaviours [21,22], others find the performance of local government only has insignificant effect [23]. Thus, apart from attitude, subjective norms and perceived behaviour control, the impact from both moral norms and perceived sufficiency of knowledge and policy support, and their interlinkages, cannot be ignored when exploring plastic recycling behaviour.

Therefore, this research aims to investigate the factors influencing plastic recycling intention and behaviour, by extending TPB with two additional factors: moral norms, as well as perceived sufficiency of knowledge and policy support. The study takes Dhaka, one of the most densely populated cities in the world, as the study area. Currently, Dhaka has a population of more than 21 million and a density of 47,400 people/km². It is predicted that by 2030 the population will cross 25 million [24]. Plastic consumption and pollution are set to increase along the growing economy and population which will pose tremendous pressure on the city. The rest of the study is arranged as follows: Section 2 develops all the hypotheses based on literature review. Section 3 presents detailed methodology for data collection and analysis. Section 4 presents the results from the data analysis as well as the testing of hypotheses, Section 5 gives detailed discussion based on the findings and Section 6 states the conclusion and research implications.

2. Literature review and hypotheses development

2.1. Theoretical background

TPB consists of three independent variables to predict intention thus the behaviour: attitude, subjective norms and perceived behaviour control. Generally, higher level of the attitude and subjective norms towards a certain behaviour, and the more perceived behavioural control there is, lead to the stronger intention of an individual to perform the behaviour. Specifically, Attitude (ATT) refers to that to what extent a person favours certain behaviour. Subjective Norms (SN) indicates the social pressure on whether to perform the behaviour. And finally, Perceived Behaviour Control (PBC) refers to the how difficult a person perceives to actually perform the behaviour. TPB has been applied in many studies on pro-environment behaviour studies [14,25].

This study uses TPB as the theoretical framework, and extends it with two additional variables, moral norms as well as the perceived sufficiency of knowledge and policy support. We first established six hypotheses, and conducted a survey in the Dhaka Metropolitan Area. By employing partial least squares structural equation modelling (PLS-SEM) analysis with SmartPLS 3, the collected data is analysed to test the hypotheses, in order to better understand how consumer intention and behaviour can support circular economy.

2.2. Hypotheses development

2.2.1. Attitude

Attitude is a favourable or unfavourable evaluative reaction toward certain things or people, that exhibited in one's behaviour [26]. Studies indicate positive links between attitude and behaviour [27,28]. Aboelmaged [29] finds that attitude strongly predicted the recycling behaviour of e-waste among young consumer in the United Arab Emirates. Reijonen et al. [30] also show attitude explains plastic packaging recycling behaviour in Finland. However, discrepancy of attitude and behaviour intention also has been found in a number of researches, for example in green purchase behaviour [25], and in plastic return/recycling in Pakistan [31]. The current study employs the popular findings that support attitude has an impact on behaviour.

H1. Attitude (ATT) is positively related to residents' behaviour intention (BI) of plastic recycling.

2.2.2. Subjective norms

Subjective norms are the result of normative beliefs which perceives the social pressure to perform certain behaviour. It refers to that to what extent the respondents think their significant others (including family members, friends, neighbours and people who they look up to) would agree or disagree the given behaviour. Studies have mixed findings on whether subjective norms have a positively impact on behaviour intention. Some researchers prove subjective norms are one of the most important factors [20,31], others find them showing insignificant effects [32,33]. This study makes the hypothesis that subjective norms are important explaining factors of behaviour intention.

H2. Subjective Norms (SN) are positively related to residents' behaviour intention (BI) of plastic recycling.

2.2.3. Perceived behavioural control

Perceived behavioural control is referred to how difficult consumer perceives to perform certain behaviour, and whether past experience would impede the perception [12]. It is an added variable to the theory of reasoned action [11] that formed TPB, given behaviours are often constrained by perceived opportunities, skills and resources [34]. Although it's found not significant in some studies [13,35], positive impacts are indicated in many researches [20,25,36,37]. In this study, perceived behavioural control is considered as a positive factor to behaviour intention.

H3. Perceived behavioural control (PBC) is positively related to residents' behaviour intention (BI) of plastic recycling.

2.2.4. Moral norms

The impact of moral norms on behaviour intention have long been discussed in various behavioural theories, including altruism research [19], value-belief-attitude framework [38], TPB [19] and the intention-behaviour gap [39]. Many researchers suggest moral norms are significantly impacting recycling intention and behaviour [40–42], although Khan et al. [31] find them only insignificantly related to plastic return/recycling intention. Some studies argue that the TPB model that extended with moral norms is even more applicable in predicting pro-environment behaviour intention than the original framework [43,44]. In the current study, moral norms are added as an additional variable in the classic TPB model to explain plastic recycling intention and behaviour in Dhaka.

H4. Moral norms (MN) are positively related to residents' behaviour intention (BI) of plastic recycling.

2.2.5. Perceived sufficiency of knowledge and policy support

The perception of whether central and local governments are providing necessary support for individual pro-environment behaviour is considered to be relevant in examining behaviours intentions [45]. For example, Chen and Tung [21] extend TPB with perceived lack of facilities and find it exerts moderating effects on consumers' recycling intention. Wan et al. [46] also reveal similar negative moderating effects of perceived policy effectiveness on the relationship between subjective norms and recycling intention among Hong Kong citizens. Plastic products, due to its myriad changes of forms, requires specific knowledge and guidance for proper and efficient recycling. Thus, in this study, perceived sufficiency of knowledge and policy support is taken in to consideration as a positive impact on perceived behavioural control and recycling intention. On the contrary, if consumers perceive that there are not enough knowledge and policy support, their perceived behavioural control and recycling intention are negatively affected.

H5. Perceived sufficiency of knowledge and policy support (KP) is positively related to residents' Perceived Behavioural Control (PBC).

H6. Perceived sufficiency of knowledge and policy support (KP) is positively related to residents' behaviour intention (BI) of plastic recycling.

The proposed TPB model with two extended variables is shown in Fig. 1.

3. Methodology

This section introduces the methodology applied in this study, including questionnaire design, sampling and data collection, as well as data analysis based on reliability testing, convergent validity testing, discriminant validity testing and predictive ability.

3.1. Questionnaire design

The survey questionnaire is divided into two parts. Part 1 is designed based on research model and hypotheses, with measurement variables of ATT, SN, PBC, MN, and KP, as well as dependent variable BI. The measurement instruments are adapted from previous literatures (Table 1). The questions adopt a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Part 2 of the questionnaire is to collect the basic personal information of respondents, including their gender, age, educational and income

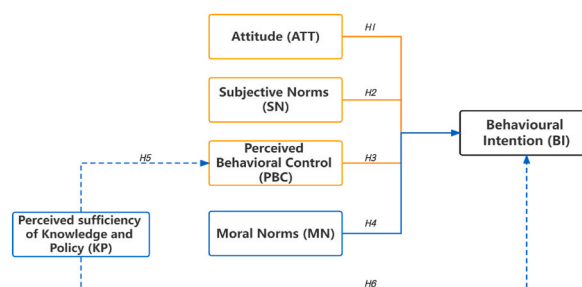


Fig. 1. Research model based on extended TPB (Hypotheses).

level. The first draft of the questionnaire was evaluated by five experts and validated by a pilot survey testing, which met the reliability requirements.

3.2. Sampling and data collection

The sampling method of this study adopts a combination of random sampling and convenience sampling [43,47]. First the sample size was calculated using the following modified Cochran’s formula [47,48]:

$$n = \frac{z^2 P(1 - P)}{e^2 + \frac{z^2 P(1 - P)}{N}}$$

where n is the sample size, z represents the z score of confidence level, P is the estimated proportion of population, e is the margin of error and N is the overall population on a certain area. In this study, the confidence level is set as 50% (z = 1.96), the estimated percentage is 50%, and the confidence interval is 5% (e = 0.05). The population of Dhaka Metropolitan Area in 2021 is 21,741,000, and the sample size is calculated as 385. Questionnaire was collected from online and offline interview between February to April 2022 among residents in Dhaka. 200 of the samples were collected online. Another 410 samples were collected offline in five main districts of Dhaka Metropolitan Area, which are Mirpur, Bashundhara, Tejgaon, Old Dhaka area, and JatraBari. We have chosen these areas because they are relatively representative in terms of the industrial area, old town, residential communities, and university area, which is helpful to collect diversified data with better quality (Fig. 2). Among the 610 collected samples, 33 samples were excluded due to incomplete information. Thus, 577 valid responds have been used as the final data for analysis. Table 2 shows the demographic characteristics of the final samples.

3.3. Data analysis

Employing the software of SmartPLS 3, we tested the data through structural equation modelling (SEM) based on partial least squares (PLS) approach, which has been used by related studies exploring recycling behaviour and TPB [29,31].

The data and measurement model are first verified by convergent validity and discriminant validity. Convergent validity refers to whether same or similar structures are actually highly related, and is tested by loading of every indicator item, their composite reliability (CR), as well as the value of average variance extracted (AVE). Loading value above 0.7 confirms the reliability of each indicator, while CR above 0.7 shows the internal consistency of a set of indicators, and AVE above 0.5 indicates the convergent reliability [49]. Our variables have an CR of 0.803–0.898, and an AVE between from 0.566 to 0.737. The loading factors are statistically close or above 0.7 except one item (PBC2, 0.295), which was deleted without affecting other variables. Thus, our model satisfied the criteria of reliability and convergent validity (Table 3).

Discriminant validity measures the divergence of variables that should not be highly related to each other [49], by cross loading and Fornell-Larcker criterion [50]. Fornell and Larcker criterion suggests that the variance of AVE of every latent variable should be more than those of other constructs in the same model, while cross-leading of each item should be highest on its associated constructs [50]. Table 4 and Table 5 show satisfactory results of discriminant validity.

However, due to some insensitivity of Fornell-Larcker criterion and cross loading detected, Henseler et al. [50] further suggests to use Heterotrait-Monotrait Ratio (HTMT) to compare the correlation of variables across constructs in different phenomena and the correlation of variables in the same construct. The discriminant validity is established when HTMT value is below 0.85 or 0.90 [50]. Table 6 shows the results of discriminant validity of our model confirmed by HTMT test.

4. Results

Based on the data analysis, the measurement model is validated. Therefore, the data is further tested for structure model and whether the hypotheses proposed are supported by the results. First the predictive power of the model is evaluated by the co-efficiency of determination (R²) [51], which shows the overall impacts of exogenous variables on endogenous variables. The value of R² needs to be no lower than 0.02 [52,53]. Cross-validated redundancy (Q²) assess the predictive relevance of the structure model, which should be higher than 0 [51,52]. Table 7 shows the results of R² and Q², which satisfy the requirement, thus proves the fitness of the model.

There are six hypotheses proposed in the research model, which are examined by the structural equation model computed by SmartPLS 3. A Bootstrap Test was performed with 5000 sub-samples with resampling technique to test the hypotheses (Table 8). We

Table 1
Literature for instrument adaptation.

Variables	Items	Literature source
Attitude (ATT)	3	[12,19]
Subjective Norms (SN)	4	[14,30]
Perceived Behavioural Control (PBC)	4	[12,29]
Moral Norms (MN)	3	[40,43]
Perceived knowledge and policy support (KP)	3	[20,22,45]
Behaviour Intention (BI)	3	[30,45]

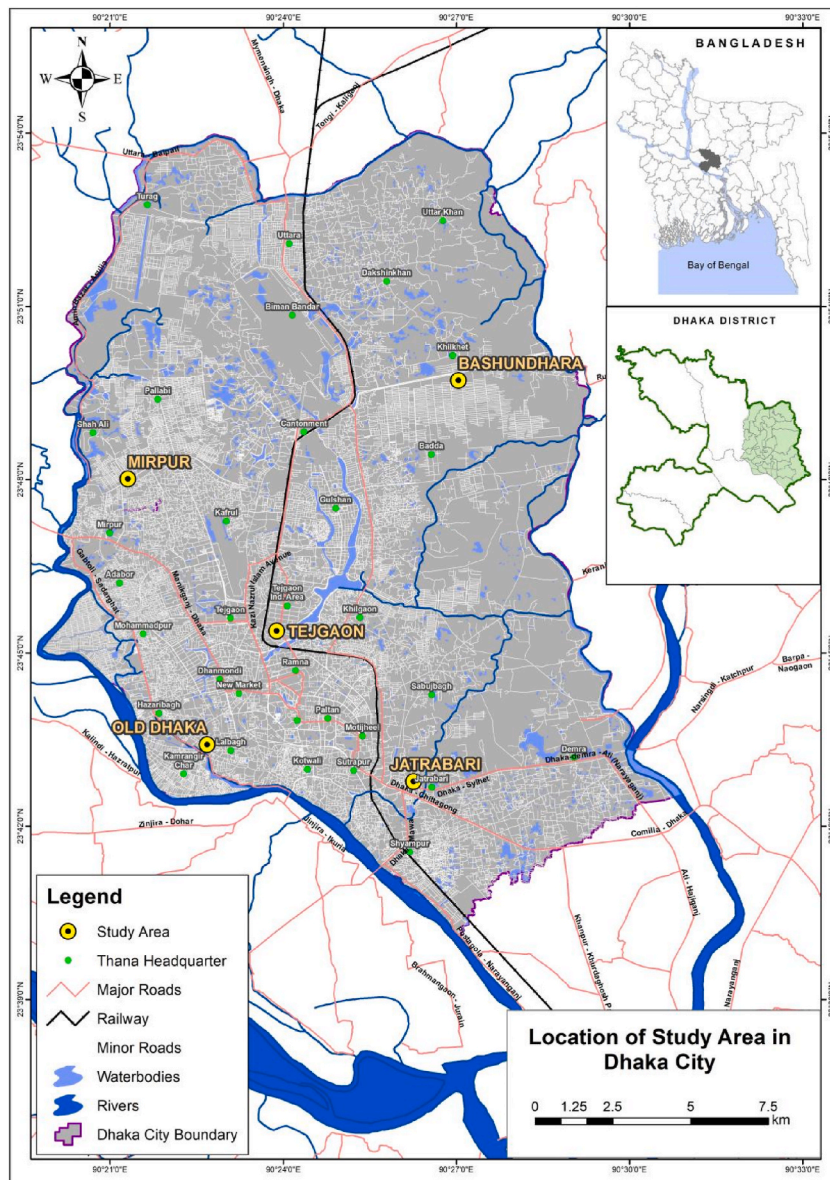


Fig. 2. Study area, Dhaka, Bangladesh.

found that Attitude (ATT), Perceived behavioural control (PBC) and Moral norms (MN) all have significant impacts on behaviour intention (BI) of recycling at $p < 0.001$, with an estimated value of 0.262, 0.253 and 0.148. Attitude, Perceived behavioural control and Moral norms are all major predictors. Moreover, Subjective norms (SN) are also significantly affecting the behaviour intention at an estimation of 0.12 ($p < 0.05$). Paradoxically, Perceived sufficiency of knowledge and policy support (KP) impacts positively on perceived behavioural control ($\beta = 0.188$, $p < 0.001$), but it seems to have a significant negative impact on the recycling intention ($\beta = -0.091$, $p < 0.1$), which rejected **H6**. Fig. 3 illustrates the final testing results with the original hypotheses model.

Based on the testing, Hypotheses 1–5 are supported while **H6** is rejected. The effect coefficients on behaviour intentions of perceived behavioural control, attitude, moral norms and subjective norms, are 0.262 ($p < 0.001$), 0.253 ($p < 0.001$), 0.148 ($p < 0.001$), 0.12 ($p < 0.05$), indicating that these four factors significantly affecting the plastic recycling intention of people in Dhaka in a positively way, supporting Hypotheses 1–4. Perceived sufficiency of knowledge and policy support also positively affects perceived behavioural control at a coefficient of 0.188 ($p < 0.001$), supporting **H5**, but negatively affects behavioural intention with a -0.091 coefficients ($p < 0.1$), rejecting **H6**.

Table 2
Sample description (N = 577).

Characteristic	Demographic	Frequency	Percent (%)
Gender	Male	408	68%
	Female	174	32%
	Prefer not to say	2	~0%
Age	24 or younger	258	44%
	25–35	202	35%
	35–50	88	15%
	51 or elder	36	6%
Educational level	Postgraduate level	119	20%
	Undergraduate level	226	39%
	Vocational	15	3%
	Secondary education level	137	23%
Monthly income	Primary level	87	15%
	<20,000 Taka ^a	423	72%
	20,001–40,000 Taka	91	16%
	40,001–100,000 Taka	57	10%
	100,001–250,000 Taka	8	1%
	>250,000 Taka	5	1%

^a 1 US Dollar ≈ 104 Taka.

Table 3
Reliability testing and convergent validity.

Construct	Items	Loading ^a	CR	AVE
ATT	ATT1	0.887	0.898	0.746
	ATT2	0.867		
	ATT3	0.835		
SN	SN1	0.712	0.820	0.533
	SN2	0.771		
	SN3	0.750		
	SN4	0.684		
PBC	PBC1	0.810	0.858	0.669
	PBC3	0.779		
	PBC4	0.854		
MN	MN1	0.708	0.803	0.578
	MN2	0.863		
	MN3	0.699		
KP	KP1	0.886	0.807	0.586
	KP2	0.719		
	KP3	0.675		
BI	BI1	0.773	0.772	0.53
	BI2	0.688		
	BI3	0.722		

^a P = 0.000.

5. Discussion

This research focuses on the interlinkages between plastic recycling intention of consumers in Dhaka, and their impacting factors based on an extended Theory of Planned Behaviour. From the results of data analysis, attitude, perceived behavioural control, moral norms and subjective norms are significant factors. Among them, moral norms act even more strongly than subjective norms. Moreover, low perception of knowledge and policy support makes people perceive less control over recycling behaviour, but actually reinforce their recycling intention.

In our extended TPB model, Attitude is the strongest contributing factor that enables people to recycle ($\beta = 0.262$, $p < 0.001$). With a more pro-environment attitude toward plastic pollution, people are more likely to participate in plastic recycling. When people think recycling is necessary to prevent pollution and it relies on every individual's contribution, instead of a pure government job, they are more likely to recycle. This is also found in other similar research [44,54]. Perceived behavioural control follows right after as the second strongest factor for people to recycle plastic waste ($\beta = 0.253$, $p < 0.001$), which shows how convenient it is to recycle and how capable people perceive themselves to participate. When they think they have the time and opportunity to recycle, and when they can control it whenever and wherever they want to, they are more likely to do it. This is consistent with previous studies [37,43].

Moreover, Moral norms also significantly affect behaviour intention ($\beta = 0.148$, $p < 0.05$). When people actually feel bothered to see plastic pollution in nature or feel guilty when they throw away plastic waste knowing it will hurt the environment, they are more willing to recycle. Chan and Bishop [19] and Tingchi et al. [44] find similar results of Subjective norms ($\beta = 0.12$, $p < 0.05$), which also has a significant and positive impact on whether people intend to recycle their plastic waste. It means people in Dhaka are more likely

Table 4
Factor analysis.

	ATT	SN	PBC	MN	KP	BI
ATT1	0.887	0.389	0.279	0.246	-0.082	0.401
ATT2	0.867	0.376	0.319	0.292	-0.053	0.413
ATT3	0.835	0.412	0.340	0.335	-0.107	0.394
SN1	0.232	0.712	0.431	0.120	0.067	0.262
SN2	0.502	0.771	0.337	0.225	0.042	0.345
SN3	0.234	0.750	0.320	0.052	0.063	0.237
SN4	0.298	0.684	0.315	0.129	-0.055	0.259
PBC1	0.350	0.416	0.815	0.212	0.070	0.393
PBC3	0.222	0.273	0.777	0.212	0.245	0.238
PBC4	0.305	0.463	0.859	0.203	0.165	0.393
MN1	0.191	0.004	0.091	0.708	-0.107	0.197
MN2	0.352	0.274	0.301	0.863	-0.200	0.355
MN3	0.159	0.057	0.105	0.699	-0.140	0.163
KP1	-0.098	0.023	0.176	-0.134	0.886	-0.149
KP2	-0.116	0.037	0.110	-0.189	0.719	-0.012
KP3	0.015	0.047	0.133	-0.197	0.675	0.020
BI1	0.361	0.465	0.469	0.203	0.055	0.773
BI2	0.292	0.155	0.192	0.303	-0.126	0.688
BI3	0.361	0.156	0.214	0.266	-0.179	0.722

Table 5
Correlation of discriminant validity (Fornell-Larcker Criterion).

	ATT	SN	PBC	MN	KP	BI
ATT	0.863					
SN	0.454	0.730				
PBC	0.362	0.479	0.818			
MN	0.337	0.192	0.254	0.760		
KP	-0.093	0.041	0.188	-0.205	0.766	
BI	0.466	0.385	0.426	0.342	-0.093	0.728

Table 6
Discriminant validity (Heterotrait-Monotrait Ratio, HTMT).

	ATT	SN	PBC	MN	KP	BI
ATT						
SN	0.564					
PBC	0.452	0.642				
MN	0.407	0.251	0.305			
KP	0.147	0.117	0.258	0.323		
BI	0.673	0.542	0.595	0.523	0.293	

Table 7
Predictive power of construct.

	R ²	Q ²
BI	0.33	0.166
PBC	0.034	0.023

Table 8
Hypotheses testing (Bootstrapping = 5000).

Hypotheses	Estimates (β)	Mean	Std. Error	T Statistics	P values	Findings	
H1	ATT -> BI	0.262	0.261	0.053	4.97	0	Supported
H2	SN -> BI	0.12	0.122	0.044	2.755	0.006	Supported
H3	PBC -> BI	0.253	0.254	0.041	6.134	0	Supported
H4	MN -> BI	0.148	0.152	0.043	3.409	0.001	Supported
H5	KP -> PBC	0.188	0.191	0.048	3.908	0	Supported
H6	KP -> BI	-0.091	-0.091	0.052	1.75	0.08	Not supported

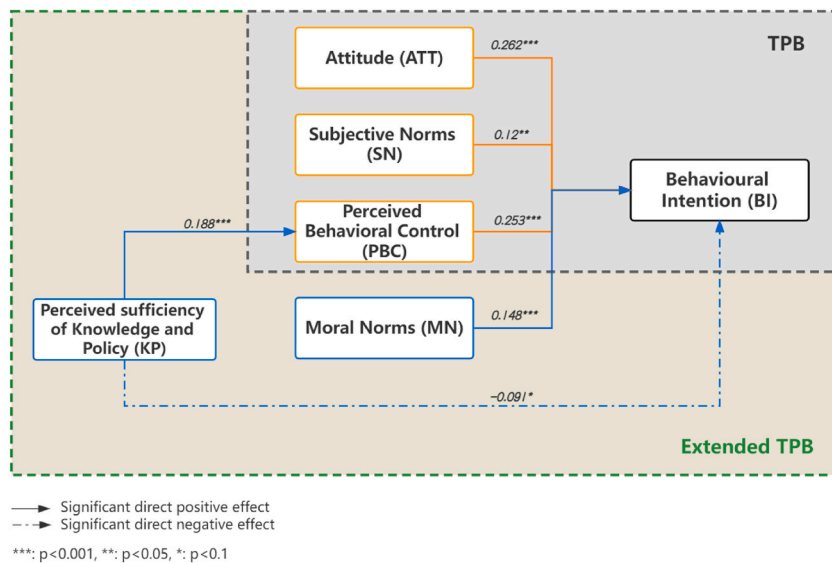


Fig. 3. Data analysis results and hypotheses testing.

to join plastic recycling, if they think people who are important to them would do the same. They can be their family members, friends, colleagues, people they like or look up to, or their neighbours in the community. This is also found in other studies [15,55,56]. However, compared to three factors mentioned above, the impact from Subjective norms seems to be slightly weaker on Dhaka people. Interestingly, as one of the original constructs in TPB, the impact from Subjective norms acts less strongly than Moral norms, which indicates people tend to recycle plastic waste more from their intrinsic norm other than social pressure. Similar weak influence from extrinsic factor can also be found in other study [57].

Finally, Perceived sufficiency of knowledge and policy support has mixed effects on perceived behavioural control and recycling intention. While affecting whether people perceive they have the capability to recycle plastic waste positively ($\beta = 0.188$, $p < 0.001$), it seems to have a direct negative impact on people's intention to recycle ($\beta = -0.091$, $p < 0.1$). If people feel they have access to knowledge or information for them to learn how to recycle, or think there are enough guidance, facilities, and incentive policies, they feel to have more control over their recycling behaviour, which is in accordance with previous studies [13,41]. However, the recycling intention seems to be reinforced, even consumers in Dhaka are not satisfied with the support of plastic recycling knowledge and policy support from the government.

This research provides both theoretical and managerial implications in understanding and guiding consumers' plastic recycling behaviour. First, to build and reinforce a positive attitude of plastic recycling, government and educational institutes can launch campaigns to raise people's awareness. To improve perceived behavioural control, central and local governments need to establish a plastic recycling policy toolkit, with relevant law and regulations, as well as clear guidelines for the enforcement and help people recycle properly. Local authorities can make use of both formal and informal waste collection methods, thus try to make plastic recycling more convenient, inclusive and attractive. Actions also can be taken to motivate more moral attachment or empathy of plastic pollution. Finally, knowledge and policy support in the local communities can significantly improve consumers' perceived behavioural control if they find them easily accessible. Educational programmes need to be organised from either bottom-up or top-down way, to increase residents' knowledge on the severe outcomes of plastic pollution, in order to motivate their moral norms, reinforce positive attitude and change negative attitude. Key opinion leaders in different fields can be invited in these campaigns, to create subjective norms and make a wider influence.

Importantly, this study supports TPB as a useful method in understanding the factors influencing people's plastic recycling behaviour, and further extended TPB by adding two variables of moral norms and the perception of knowledge and policy support. In Dhaka's case, moral norms even have a bigger impact than that of subjective norms, which should be considered in the TPB model. The moderating and reinforcing effects of people's perception of knowledge and policy support should not be neglected, and needs more empirical investigations. This theoretical extension contributes to a deeper understanding in behaviours and help create more practical measures in coping with plastic pollution challenge in developing countries.

6. Conclusion and research limitations

6.1. Conclusions

Based on quantitative data analysis through an extended TPB model, this study explored factors influencing people's plastic recycling intention in Dhaka, the world's most densely populated megacity. The findings suggest attitude, perceived behavioural control, moral norms and subjective norms significantly impact whether people intend to recycle their plastic waste, while moral

norms play a bigger role than subjective norms. Moreover, the perception of whether knowledge and policy support are sufficient significantly affects whether people perceive they have a strong or weak behavioural control. Further investigations can explore the moderating effects of policy effectiveness on consumers' recycling intention and behaviour. Cross-national and comparative studies are also necessary to examine whether the impact of factors may vary in different contexts.

Subsequent studies can also be done regarding specific plastic waste according to different demographic characteristics (age, income, educational level, etc.), different plastic applications (food, house appliance, manufacturing, etc), or different polymers, in order to help fine-tuning policy interventions to encourage recycling behaviours.

6.2. Research limitations

This study has certain limitations that requires further investigation. First of all, male populations constitute the bulk of the sample, that may restrict the variability and affect the correlations. Further investigation can be conducted within specific demographic groups to complement this study. Second, due to data availability, recycling behaviour is self-reported through behaviour intention instead of field investigation, while the intention-behaviour gap may exist. Finally, due to sampling methods, the results cannot be guaranteed that could represent the whole population at large. However, considerable relations between intrinsic and extrinsic factor have been statistically proved to be significant, which will contribute to the discussion of behavioural science and circular economy.

Author contribution statement

Dr. Ying Wang, Dr. Fengting Li and Qian Jia conceived and designed the experiments; Qian Jia, Md Sahidul Islame and Md Shahadat Hossainf performed the experiments; Qian Jia analysed and interpreted the data; Md Sahidul Islame contributed reagents, materials, analysis tools or data; Qian Jia wrote the paper.

Data availability statement

Data will be made available on request.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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