Modelling the Adoption of Waste Separation among Households in Malaysia

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Abstract

Malaysia, as one of the countries committed to achieving the 17 Sustainable Development Goals (SDGs) set forth by the United Nations, has set a goal of achieving all of them by 2030. (UN). When the Separation at Source Initiative (SSI) under the Solid Waste and Public Cleansing Management Act 2007 (Act 672) was launched and became effective in September 2015, Malaysian households were required to take part by practising waste separation at home, which fell under the category of responsible consumption and production goals. Many Malaysian homes, on the other hand, are adamant about not taking part. Considering that the local government has adopted an extrinsic motivation approach through SSI, this study will investigate the impact of intrinsic motivation among the households. The objective of this study is to highlight the role of intrinsic motivation in influencing household waste separation behaviour by using the Theory of Planned Behaviour as a framework. A questionnaire study was done among residents of residential units in the Malaysian state of Selangor, and a total of 361 valid questionnaires were returned. The Smart PLS software is used to do the analysis of the data. The findings demonstrate that all of the variables from the model, which include attitudes toward waste behaviour, subjective norms, and perceived behaviour control, are statistically significant in predicting waste behaviour. Based on the outcomes of this study, recommendations are made in this paper to encourage waste separation behaviour among households. Additionally, the current study makes a substantial contribution to the body of knowledge regarding the behaviour of households when it comes to waste separation. From

a practical standpoint, it is critical for the local government in Malaysia and around the world to encourage greater household participation in waste separation in order to safeguard the environment and reduce pollution.

Keywords: Waste Separation, Sustainable Development, Consumption, Production, Motivation

Introduction

Pollution, combined with population increase, rapid and unplanned urbanisation, and other environmental issues have emerged as major environmental concerns in urban areas with high population density. In light of the problems connected with an increasing volume of garbage, it is important to emphasise the importance of waste management oriented towards manufacturing and consumer activities that generate little or no waste. An inadequate value placed on waste control, irregular dumping of waste into nearby settlements, as well as land and water disposal, pose a threat to the protection of the environment and the preservation of nature. As a result, it is necessary to collect garbage, and process and dump it before rendering it harmless by putting it to beneficial use. Because of this, people should practise trash separation to guarantee that their garbage is correctly managed in order to reduce waste contamination, which is already a significant environmental problem (Aksan & Elikler, 2019).

Waste separation is also known to be called waste segregation and waste classification. When waste is separated into multiple parts, it can be done manually in the home or through curbside pickup programs. (Xue et al., 2017). Waste segregation means sorting waste into dry and wet waste. The term "dry waste" refers to materials such as glass, wood, and metal that fall into this category. While for the category of wet waste it contains the organic waste commonly formed from food waste and is heavy in weight due to wetness. Each waste gets into its category at the place of dumping or pickup (Chen et al., 2019). Household wastes are separated into two groups according to (Chen et al., 2017) which are residual waste and recyclable waste. Residual waste comprises of kitchen waste, contaminated items, food waste and disposal diapers. This type of waste must be packaged neatly into plastic bags or containers and placed inside the trash receptacle provided which will be collected twice a week. While for recyclable waste it comprises of paper, plastics, bulky waste, garden waste and other items that can be recycled. The recyclable waste that has been separated must be packed inside suitable plastic bags or containers and placed next to the trash bin. While for the bulky waste must be dumped neatly by the roadway in front of the premise and the garden waste must be packaged neatly inside a plastic bag or container and be placed by the roadside in front of the premise.

Total worldwide waste was reported to rapidly grow up to 28 percent where the rate climbed from 5.6 Mt to 7.65 Mt in 1997 till 2007. Not only is that but also projected to carry on increasing up till 30 percent in the year 2020 (Tan et al., 2015). A total of 2.01 billion tonnes of municipal solid waste was collected yearly. It is stated that 33 percent out of the total municipal solid waste collected is considered as very badly handled which had generated various pollution (Struk, 2017). Based on the statistics from (Daniel & Perinaz, 2012), the solid waste generated from East Asia and the Pacific Region such as Malaysia is roughly 270 million tonnes per year. The amount of waste created is predicted to expand considerably, parallel with the continuously increasing population and development. According to Moh & Abd Manaf (2017), the rate of recycling among the Malaysians is found out to be only approximately 24.6 percent back in 2017. Surprisingly, an approximate of 80 percent of the

solid waste that has been generated in the country are actually recyclables however most of the waste are being disposed directly into the landfills without proper management of waste even though the nation knows the negative impact of their way of disposal towards the environment also towards their health. (Moh & Abd Manaf, 2017)

Processing of waste such as undesirable or dangerous by-products is an inevitable conclusion. According to the Wilson and Velis (2015) the sum of municipal solid waste that is created annually throughout the world is totalling up to 7 to 9 million tonnes. Municipal Solid Waste (MSW) is a particular residential waste category which, depending on the reporting standard, may include commercial and industrial waste (Wilson & Velis 2015). Out of the total waste generated in 2016, it is documented that Municipal solid waste accounted for 2 billion tonnes. (David et al., 2020).

Most earlier articles addressed the recycling intentions and practise among households. This paper uses the Theory of Planned Behaviour in investigating the waste separation at source behaviour. The study was done among residents in Selangor, Malaysia. The study being held after the adoption of SSI to understand the impact that the rule has on Malaysian households. The influence that this paper focuses on is through the households psychological and behaviour desire towards waste separation at source behaviours. Based on the findings of the study, the list of proposal for the improvement of waste separation at source among households is clarified. The structure of this document is as follows. Following this introduction phase, the literature review of Theory of Planned Behaviour is explained and result with the formation of hypotheses for the research. Then, the explanation of the data and technique followed by the data analysis and results of the research. After the results are emphasised, the debate and proposition from the results are justified. Lastly, the conclusions and limitations of the study are described.

Literature Review and Hypothesis Development
Theory of Planned Behaviour
This research relies on the Theory of Planned Behaviour. It has been found there are three parts in the Theory of Planned Behaviour initially established by Ajzen (1985) to increase the predictive capacity of the Theory of Reasoned Action (TRA) was also suggested by Icek Ajzen with Martin Fishbein in1980. TRA found that people's attitudes and subjective norms were the determinants for the performance of the conduct (Ajzen, 1985). However, the TRA model exhibits several flaws when utilised in behavioural investigations in prior research. As mentioned by Terry et al. (1993), that TRA model inadequately predicted the particular conduct which needs abilities, resources, availability and control. Due to the weakness of TRA, Icek Ajzen comes up with the Theory of Planned Behaviour in 1985 to broaden the bounds of TRA. The Theory of Planned Conduct (TPB) anticipates an individual's intention to engage in the behaviour at a certain time and location. It shows that intentions drive individual activity, and three variables impact the intentions which are an individual's attitude toward the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). TPB posit that attitude, subjective norms, and perceived behavioural control of each person lead to human behavioural intentions that eventually will change the behaviour of the person, while perceived behavioural control is the predictor that directly predicts behaviour (Xu et al., 2017). Research by Tonglet et al (2004) found TPB as an advantageous theory to be utilised in a conceptual framework to examine the recycling and waste reduction behaviour. Moreover, TPB is a theory that is usually utilised by researchers to examine the intents and behaviour of individuals (Armitage & Conner,2001).

Attitude towards Behaviour

When it comes to the attitude towards acts or behavioural aspects, an individual's belief in whether a specific behaviour provides a good or bad contribution to his or her life is reflected. Ajzen (1991) argues that attitudes may be classified into two categories: positive and negative. First and foremost, it involves the person's emotions, and second and foremost, it involves the person's awareness of the particular behaviour. In order to evaluate individual behaviour, it is necessary to consider one's attitude, since the principle of compatibility suggests that some attitudes may have a positive impact on the execution of the associated behaviour (Conner & Armitage,1998). The principle of compatibility explains the difference between attitudes and behaviour; attitudes are more accurate predictors of behaviour when the measurements of attitudes are representative of the individual's expected behaviour. When both a person's attitude toward behaviour and his or her subjective norms are strong, the individual will acquire a strong desire to engage in the behaviour in question (Lam et al., 2003; Oteng-Peprah et al., 2020). For a person to be dedicated to engaging in pro-environmental behaviour such as waste separation, their attitude must be positive and supportive of their efforts (Razali et al., 2020; Alhassan et al., 2020).

Hypothesis 1: Waste separation behaviour is positively connected to one's attitude toward waste.

Subjective Norms

The subjective norm element, on the other hand, is concerned with everything that surrounds the person; in other words, his or her social norms, social pressure, cultural norms, or group beliefs are all considered (Fornara et al., 2011). A social pressure factor that impacts behaviour in situations when people may engage in such behaviour with the approval of their social peers is discussed in more detail below (Wang et al., 2014). Subjective norm is a social norm that is used to comprehend municipal solid waste minimization through social norms since it takes into consideration general public hurdles such as a lack of information, motivation, and influences (Maycox, 2003). An individual's significant people, such as their family, friends, neighbours, and members of their community, according to Ajzen (1991), are the major source of social influence in their lives. The significance of subjective norms, as well as their considerable link with waste separation behaviour, are discussed in this study.

Based on research conducted by Yuan et al. (2016), social influences from important people can either promote or discourage individual behaviour in some cases. According to the findings of Ramayah et al (2012), where the study was conducted in a poor waste management location, subjective norms and attitudes are the most important determinants of recycling behaviour. Several previous research discovered that individual recycling behaviour is substantially impacted by social norms that are derived from the perception or conduct of others toward recycling behaviour (Bortoleto et al., 2012; Mondejar-Jimenez et al.,2016; Razali et al., 2020). As a result, the subjective norm has a direct influence on and improves the waste separation behaviour among families whereas the social norm, on the other hand, provides good role models and support for the act of waste separation.

Hypothesis 2: Subjective norm is positively connected to waste separation behaviour

Perceived Behavioural Control

Third, perceived behavioural control (PBC) is a component of TPB. PBC shows a person's perception about how simple or difficult it is to demonstrate a specific behaviour; it is thought to reflect past experiences as well as expected barriers (Ajzen, 1991). Numerous other

research have shown the existence of a favourable connection between subjective norm and perceived behavioural control. This indicates that if the subjective norm of the individual is favourable, the personal belief in the ease with which the waste separation behaviour (PBC) may be implemented will grow (Quintal et al., 2010; Peters et al., 2011; Lopez-Mosquera et al., 2014).

Apart from that, the more favourable the individual's attitude and subjective norm toward the behaviour, the larger the effect of PBC, which results in the stronger the individual's intention to engage in the behaviour, according to the research (Ajzen, 1985). PBC also has a substantial direct link with trash separation behaviour among families, which is further supported by research (Carrus et al., 2008; Mondejar-Jimenez et al.,2016). The intents of a person for waste separation behaviour are dependent on their PBC and attitudes (Tonglet et al., 2004), which is especially true in a region with insufficient recycling facilities (Knussen et al., 2004). As a result, it is predicted that the relative relevance of attitude, subjective norm, and perceived behavioural control in the prediction of intention would differ across different behaviours and contexts. In spite of this, more recent research has demonstrated the relevance and significance of the PBC factor in affecting behaviour, particularly waste separation behaviour (Oztekin et al., 2017; Razali et al., 2020; Stoeva & Alriksson, 2017).

Hypothesis 3: Perceived behaviour control is favourably associated to waste separation behaviour.
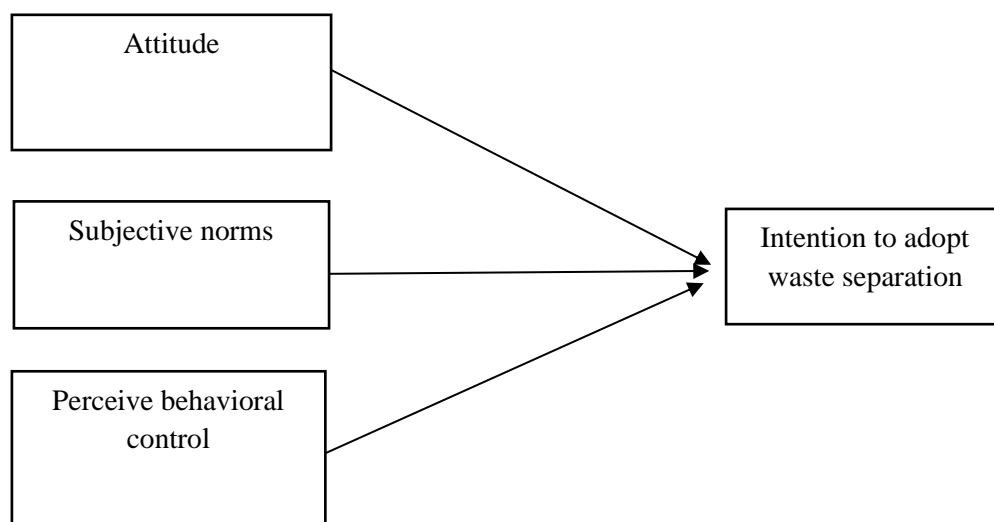

Figure 1: Research framework

Research Methodology
Development of Instruments

The development of the instrument for this study based on latent components that were specified in the research model. All of the construct items were taken from prior research and used in this one. To measure attitudes, questions were taken from Razali et al. (2020), subjective norms were taken from Razali et al (2020), and items evaluating perceived behavioural control were taken from Tonglet et al (2004). Whereas the waste behaviour elements selected from (Razali et al., 2020).

Sampling and Data Collection

Due to the fact that the current study only examined the theoretical influence of variables within the research framework, convenience sampling would be sufficient for this purpose

(Hulland et al., 2017). For the study, a survey was created using Google Forms and distributed online through the Selangor Official Facebook page from January 20th to Mac 20th, 2020, a period of over one month. In the opinion of Hair et al (2017), the sample size should be selected based on the power of analysis, which is based on the number of predictors in the study. According to Gefen et al (2011), the minimal sample size required with an 80 percent power, a medium effect size, and a p value of 0.05 is 84 participants. Since a total of 361 completed questionnaires were returned for processing, the sample size for this study did not pose a problem for the researchers.

According to the findings of the survey, 85.7% of those who participated were female, with the remaining 14.3 percent being male. All respondents' nationality is Malaysian. Next, the race of the respondent majority is Malay which is 85%, followed by Chinese 10% and Indian 5%. Then the age of the respondents, majority of the respondents is between the ages of 25-39 years old and followed by 40-49 years old.

Analysis of the Data

In the opinion of Hair et al (2019), the PLS-SEM technique was appropriate for the investigation since it concentrated on the prediction between variables in the research model. To evaluate the hypotheses, the Smart Partial Least Squares (PLS) approach was utilised, which was chosen because the study is primarily concerned with prediction.

Common Methods Bias (CMB)

The information for this study was gathered from a single source in which both the independent and dependent variables were generated from the same respondents at the same time, as described above. The study's CMB problem was addressed by the use of procedural and statistical approaches MacKenzie & Podsakoff (2012). In terms of the procedural technique, the researchers used a variety of anchor scales to assess the independent variables (5 likert) and dependent variables (7 likert) in the study (MacKenzie & Podsakoff, 2012). In order to test for common method bias (CMB) in the statistical approach Harman's single factor showed that 40.06% of total variance was explained. Hence, CMB is a non-issue.

Measurement Model

Hair et al. (2019) developed a two-stage method, which was used in the current investigation. The method is comprised of two models: a measurement model and a structural model, respectively. According to Hair et al. (2019), two validities need be proven in the measurement model, namely convergent validity and discriminant validity, before the model can be considered valid. In order to attain convergence validity, the loading must be more than 0.708, the average variance explained (AVE) must be greater than 0.5, and the Composite Reliability (CR) must be greater than 0.7 (Hair et al. (2019). The findings of the convergent validity test are depicted in the Table 1. All of the loadings, as well as the AVE and CR, were greater than the threshold values, indicating that convergent validity was not a concern in this investigation, as previously stated.

Table 1
Measurement Model

Constructs		Items	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Attitude	I am interested in separating my household waste	ATT1	0.758	0.754	0.746	0.515
	For me, waste separation at source is useful	ATT2	0.882			
	Source separation is sensible and rewarding	ATT3	0.824			
	Waste separation at source is good for the environment	ATT4	0.753			
	it's a good activity to separate household waste	ATT5	0.724			
Perceive Behavioral Control (PBC)	Waste separation at source is easy	AF1	0.787	0.898	0.920	0.506
	I know how to separate my household waste	AF2	0.825			
	I know what household waste that can be recycled	AF3	0.852			
	I know where to put my household waste after separation	AF4	0.795			
	Waste separation at source doesn't take too much of my time	AF5	0.828			
		AF6	0.784			
Subjective Norms	My family think that I should separate my household waste	SN1	0.846	0.845	0.816	0.690
	My friends think that waste separation is a good thing to do	SN2	0.801			
	My colleagues think that I should be involved in waste separation at source	SN3	0.725			

	My community think that I should separate my household waste	SN4	0.756			
Waste Separation	I usually separate my household waste	WSB 1	0.840	0.820	0.804	0.523
	I regularly separate certain parts of my household waste by putting them inside the recycling bins	WSB 2	0.752			
	I am involved in waste separation activities	WSB 3	0.712			
	I have practice waste separation for some time	WSB 4	0.712			

Next, the discriminant validity was measured by the heterotrait-monotrait (HTMT). Table 2 depicts the values of HTMT are lower than the required threshold value of 0.9 as suggested by Franke & Sarstedt (2019). Hence, the discriminant validity was not an issue in this study.

Table 2
Discriminant Validity (HTMT Criterion)

Variables	Waste Separation Behaviour	Attitude	Perceive Behavioral Control	Subjective Norms
Waste Separation Behaviour	**0.832**			
Attitude	0.570	**0.825**		
Perceive Behavioral Control	0.713	0.325	**0.710**	
Subjective Norms	0.187	0.210	0.188	**0.721**
Mean	5.780	3.780	6.012	3.978
Standard Deviation	0.710	1.290	0.732	0.768

Structural Model
Once the measurement model was examined and the model's reliability and validity established, the next step was to evaluate the structural model. The process involved evaluating the relationships between the variables and the structural model's predictive abilities. Hair et al. (2019) suggested that before assessing the structural model, collinearity should be examined to ensure that collinearity is not a problematic factor. The results show that there is no collinearity among the predictor constructs in the structural model as the VIF values are clearly below the threshold of 5 (Hair et al., 2017).

Hipotesis Testing
The hypotheses were tested by running a bootstrapping technique with resampling of 5000. The results show that for the direct effect, all of the purpose hypotheses are supported. With ATT -> WSB (β = 0.760, p < 0.001), SN -> WSB (β = 0.705, p < 0.001), and PBC and WSB (β = 0.625, p < 0.001) thus confirming that there are positive effects between the variables representing the ATT, PBC and SN. Thus, H1 H2 and H3 of the study are supported. Table 3 present the results for the study.

Table 3
Hypothesis testing

Relationships	Standardized Beta	S.E.	*t*-value	BCI LL	BCI UL	f^2	Q^2	VIF	Decision
Attitude -▢ Waste Separation	0.760	0.050	3.023	0.056	0.275	0.017	1.253	1.028	Supported
Perceive Behavioral Control -▢ Waste Separation	0.705	0.056	4.153	0.135	0.317	0.080	0.521	1.626	Supported
Subjective Norms -▢ Waste Behavior	0.625	0.054	2.056	0.061	0.466	0.156	0.095	1.946	Supported

The present study also looked at the assessment of the coefficient of determination (R^2), predictive relevance (Q^2) through the blindfolding technique, and effect size (f^2). The R2 value of 0.583 for ATT, 0.492 for SN, and 0.698 for PBC indicate that ATT explains 58.3% of the variance of the WSB, and SN explains 49.2% of the WSB variance. As for SN explain 69.8% of the variance of WSB. As for predictive relevance, a value of Q^2 higher than 0 indicates that the model has good predictive relevance Hair et al. (2017). From the blindfolding technique, the study found that Q^2 is 0.524, 0.417, and 0.565 for the ATT, SN, and PBC, respectively, confirming that the model has good predictive power for the subject matter of the study.
Lastly, the effect size of f^2 was assessed. According to Cohen (1988), an effect size of 0.35, 0.15, and 0.02 are considered as large, medium, and small effect size, respectively. ATT was found to have a large effect size towards the WSB with a value of 1.253, respectively. The SN has a large effect size (with a value of 0.521,) on WSB. On the contrary, the PBC has a small effect (0.094) on WSB.

Discussion and Conclusion
According to the findings of this study, all of the variables in the TPB are significant and have a favourable impact on waste separation behaviour (WSB) among household members. It was discovered that of all the factors included in the model, attitude (ATT) was the one with the most influence. When comparing the direct impact between ATT and WSB to the other determinants, the greatest value of the direct effect between ATT and WSB demonstrates the significant link. This finding is confirmed by previous research conducted by (Xu et al., 2017b; Yuan et al., 2016; Nguyen et al., 2015). The link between ATT and household waste separation was confirmed in a study conducted by (Xu et al., 2017b). According to the results of the study conducted among Eastern China households, the relationship between ATT and WSB is substantial.
The link between PBC and WSB is also determined by the research conducted by (Yuan et al., 2016). Aside from that, a research by Nguyen et al (2015), based on the results of a waste separation intention study, demonstrated the relevance of the link between them. The research was focused on residential families in the Vietnamese capital of Hanoi. The findings of the study revealed that perceived behavioural control (PBC) are associated with waste separation intentions among families, which would eventually lead to behaviour changes in the future.
Following that is the subjective norm (SN), which has a favourable relationship with WSB. According to the findings, SN is the third most important variable that impacts WSB, despite

the fact that the direct effect value is just a little less than the quantity of the PBC. Their family, friends, and co-workers are asked if they believe that WSB is a worthwhile thing to do and whether they believe that they should be active in WSB. These are the variables that make up the SN determinant.

According to the findings of a previous study conducted by Wan et al (2017), SN is a significant factor that influences recycling behaviour. A street survey was carried out in Hong Kong to gather data for the research. People's recycling intentions were shown to be most influenced by social norms when they already had a positive attitude toward recycling behaviour in place. Graham-Rowe et al (2015) provide evidence to support the importance of SN through their study. The research seeks to identify the elements that have an impact on the decrease of household food waste. Accordingly, social networking is regarded an essential factor in influencing people's pro-environmental behaviour since the opinions of others might influence people's behaviour and intentions toward a certain activity.

Based on the findings of this study, it is hoped that the local authorities in Malaysia will be able to enhance the rules and implementations of waste separation, which should place a greater emphasis on the intrinsic motivation of the family members. When it comes to extrinsic incentives, they should be considered the fuel that ignites the behaviour; on the other hand, intrinsic motivations such as personal characteristics should be considered the fuel that keeps the behaviour consistent throughout time in subsequent endeavours.

The factors examined in this study were limited to three: attitude, personal belief system, and subjective standards. Future research should investigate additional characteristics that may impact families' attitudes about trash separation, as well as include communities from various locations, particularly those in Malaysia.

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