ASM Sc. J., 19, 2024

https://doi.org/10.32802/asmscj.2023.1472

Predicting Minimal Usage of Plastic Bags Behaviour among Malaysian Adults

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Plastic bags consist of synthetic organic polymers that are produced for one-time usage to carry things around. They are lightweight, cheap for mass production and often distributed at no cost in places such as supermarket and shopping malls. There might be numerous factors that affect this increasing usage of plastic bags among the public. The overall objective of this study was to identify factors that influence plastic bag consumption among Malaysians using the Theory of Planned Behaviour. Data were collected by distributing an online questionnaire to the local community. Non-probability purposive sampling method was adopted to select the three states in Malaysia. The path analysis was performed to investigate the relationship between predictor factors (i.e., attitude, subjective norms, perceived behavioural control and intention) and minimal plastic bag usage. A total of 386 people from different ages and backgrounds in Malaysia participated in the research. The findings showed that an individual's attitude (β = 0.331) and perceived behaviour (β = 0.414) significantly influenced the intention to use plastic bags. The perceived behavioural control (β = 0.329) and intention (β = 0.486) have also significantly influenced the behaviour to minimise plastic bag usage. However, subjective norms did not significantly influence the intention (β = 0.060). This study showed that perceived behavioural control and intention are important predictors towards minimal usage of plastic bags. Therefore, it is recommended to enhance education and awareness programmes among the public in order to change the attitude, perceived behavioural control and intention towards minimal usage of plastic bags. High generation and mismanagement of plastic bag waste, which may lead to a negative impact on environmental health, are the main issues that should be addressed properly by the Malaysian population.

Keywords: plastic bags; attitude; perceived behavioural control; subjective norms; intention; Malaysian adults

I. INTRODUCTION

Plastic bags, synthetic organic polymers in composition, are used to carry things around and persist in nature for a longer time than their actual usage period (Proshad *et al.*, 2017; Romer, 2012). They are lightweight, cheap, have a single purpose as carryout bags, and are easily distributed at no cost in places such as supermarkets and shopping centres, which are among the reasons plastic bags are manufactured in large quantities (Proshad *et al.*, 2017).

Despite these advantages to the consumers, plastic bag poses risks to the environment and human health. Annually, about 13 million tonnes are improperly disposed of in the ocean, risking 100,000 sea creatures' lives (Alabi *et al.,* 2019). Improper disposal of plastic bags leads to blockage of drainpipes or found in the river as they are easily brought by the wind (Romer, 2012). Illegal open-air burning and unethical plastics disposal on land also can lead to releasing of toxic chemicals into the air, risking the health of the

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public. Animals that are contaminated by toxic elements from plastic wastes can adversely exert an influence on food supplies consumed by humans (Alabi *et al.*, 2019).

In addition, plastic bags not only have an impact on humans in the long run, but the unreasonable usage of plastics will also impact the macrofaunal and meiofaunal assemblages and biogeochemical processes of the sea. A field experiment conducted by Green *et al.* (2015) showed that the inability of plastic bags to degrade naturally may lead to anoxic conditions within the sediment around the seashore and significantly reduce the population of infaunal invertebrates. This indicates that, whether conventional or biodegradable plastic bags, both materials can disturb the balanced ecosystem.

A high number of littered plastic bags have been recorded due to society's excessive usage worldwide. This leads to multiple consequences due to the uncontrolled habitual littering of plastic bags, including affecting the marine environment (Civancik-Uslu *et al.*, 2019).

Although the actual amount of yearly plastic products produced in Malaysia is difficult to identify, the country is one of the largest plastic production industries globally and has been the world's largest importer of plastic waste since 2017 (Ministry of Housing & Local Government Malaysia, 2006; Chen *et al.*, 2021). Plastic bags have been shown as the third most solid waste generation trend in Malaysia over the past years (Moh & Manaf, 2014). Plastic waste made up 19% of the total waste produced in Malaysia in 2007 (Wahab *et al.*, 2007). Throughout the past 11 years, Malaysia's plastics industry has grown at a rate of 15% to 30% annually and has produced more than 0.94 million tonnes of plastic waste in 2018 (MESTECC, 2018; Khan *et al.*, 2020; Chen *et al.*, 2021). This could lead to improper disposal of plastic waste if there is no proper and adequate management to address the issue. Low awareness of separating the plastics at source and lack of knowledge or education on proper handling of waste plastics before recycling are among current issues in Malaysia that need to be tackled by many (Jereme *et al.*, 2015; Chen *et al.*, 2021).

Although not using plastic bags at all in daily living is difficult to attain, even there is a problem in minimising the usage of plastic bags. Despite efforts to educate the community on reducing the negative impacts of plastic bags, frequent use of plastic bags is occurring, which may contribute to high waste generation (Moh & Manaf, 2014; Chen *et al.,* 2021). This problem has negatively impacted environmental health because of the mismanagement of plastic bag waste (Jambeck *et al.,* 2015). Possible causes of this problem are lacking attitude, influence from social norms and poor behaviour control including intention towards minimising the usage of plastic bags. Perhaps a study which investigates the relationship between the predictors (i.e. attitude, social norms, behaviour control and intention) of minimising plastic bag usage could give a better insight into understanding this gap of knowledge.

The Theory of Planned Behaviour (TPB) is a well-known social psychology theory that is used to explain how people make decisions about what they do and how they think about their own behaviour (Ajzen, 1991; Vina & Mayangsari, 2020). It consists of three components: attitude, subjective norm, and perceived control over behaviour (Sun *et al.*, 2017). Whereas, the intention is a crucial precursor of habit, indicating the efforts made by those who will carry out the behaviour (Firdaus, 2020).

Attitude is seen as a deciding factor in accepting a certain behaviour, and in this context, those with a more favourable attitude toward the behaviour will have a greater intention, which in turn leads to an actual behavioural response (Ajzen, 1991; Teng & Wang, 2015). Consumers' attitudes toward plastic bags have been proven to be positively associated with their intention to use them (Sun *et al.*, 2017). Some studies have shown that human attitude is strongly related to the behavioural intention on minimising plastic bag usage. For example, Van *et al.* (2021) found that the attitude of the local residents in Batu Pahat, Johor, significantly acted as an influential factor which impacted the residents' intention toward minimising the usage of plastic bags. Studies elsewhere supported that attitude is one of the main reasons affecting the individual's behaviour intentions toward plastic bag usage (Vimal *et al.*, 2020; Bursan *et al.*, 2021). Subjective norms refer to individuals' perception of whether to implement a behaviour or not as a result of social pressures from their significant others (Ajzen, 1991; Maichum *et al.*, 2016). Studies have shown that subjective norms have a positive correlation with behavioural

intentions in reducing plastic bag usage (Ari & Yilmaz, 2016; Sun *et al.*, 2017; Vina & Mayangsari, 2020).

Perceived behavioural control is defined as an individual's impression of the difficulty or easiness of carrying out a behaviour of interest, which can impact the intention either favourably or adversely (Ajzen, 1991; Chang & Chou, 2018). According to Ajzen (1991), perceived behavioural control strongly relates to the perceived ease and difficulty of performing the behaviour and is considered to be influenced by previous experiences, hence exerting a positive intention as well as behavioural control towards a particular behaviour. When individuals perceive more resources and fewer barriers, they perceive more behavioural control and greater intention to perform those behaviours (Azjen & Madden, 1986). In their study among Thailand university students, Vassanadumrongdee *et al.* (2020) showed that perceived behavioural control acted as a strong influence factor on the intention towards a programme to reduce the usage of plastic bags among Thailand youths. Ajzen (2011) further postulated that PBC also has an influence on actual behaviour, an assumption that is also reasonable concerning minimising plastic bag behaviour. This theory was supported by a study conducted by Muposhi and colleagues (2022), where PBC was positively and significantly related to the behaviour of using green shopping bags instead of plastic bags. Elsewhere, perceived behavioural control was proven as the strongest predictor towards actual behaviour compared to other variables studied (Syed Hasan *et al.*, 2015). In addition, actual behaviour can be impacted by intention, which is influenced by attitude and subjective norms (Teng & Wang, 2015). An individual's behavioural intention exists when that person takes a specific course of action following a decision they have made. This study gives opportunities to explore the predictor factors that are able to explain the behaviour to minimise the usage of plastic bags among the local community in the Malaysian setting. It also offers new information to formulate relevant managerial strategies for the government, local authorities, and non-government organisations to promote favourable preventive behaviour toward minimising the use of plastic bags and to implement relevant activities to protect the environment.

The Theory of Planned Behaviour is a model that explains an individual's behaviour is influenced by behavioural intention, which in turn is determined by attitude, subjective norm and perceived behaviour control, as depicted in Figure 1. (Azjen, 1991). This model has been widely used to explore individual's pro-environmental behaviours (Sun *et al.*, 2017; Glantz *et al.*, 2008), and minimising plastic bags usage is one such behaviour (Al Salmi *et al.*, 2022). Therefore, it is reasonable and appropriate to use TPB as the basic theoretical framework for this current study. Moreover, the intention to use plastic bags is influenced by attitude, subjective norms and perceived behaviour control (Sun *et al.*, 2017; Van *et al.*, 2021). Hence, this effect has significance influence on the minimal plastic bag usage behaviour (Geetha, 2022; Gulid & Yansomboon, 2022). Based on the literature discussed above, this current study posits the conceptual framework as shown in Figure 2.

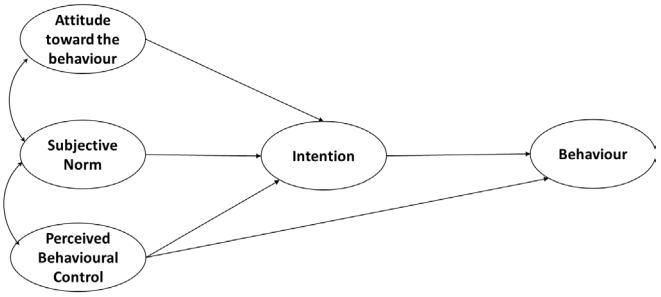

Figure 1. Theory of planned behaviour (Adapted from Ajzen 1991).

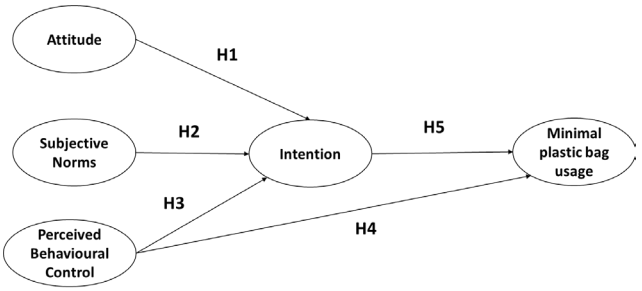

Figure 2. The conceptual framework of the current study.

The purpose of this study is to determine the relationship between the predictor factors (i.e. attitude, social norms, behaviour control and intention), that is, an individual's attitude, subjective norms, perceived behavioural control, intentions and behaviour to minimise the usage of the plastic bags among the general public in Malaysia. Hence, the following hypotheses are formulated:

H1: Attitude positively influences the intention;

H2: Subjective norms positively influence the intention;

H3: Perceived behavioural control positively influences the intention;

H4: Perceived behavioural control positively influences the minimal usage of plastic bags behaviour; and

H5: Intention positively influences the minimal usage of plastic bags behaviour.

II. MATERIALS AND METHOD

A. The Population, Setting and Sampling

The present study conducted a cross-sectional community-based study. The respondents, irrespective of gender, aged 18 years and above, were selected through a nonprobability sampling method from three states in Malaysia, namely Selangor, Sarawak and Perak. The study was conducted from January 2021 to May 2021. Due to the enforcement of the Movement Control Order (MCO) during the study period and limited time to complete the data collection, the investigators had to carry out data collection at their respective home regions.

A proportion formula using OpenEpid calculator online was employed to calculate the sample size with the following variables entered: (1) an estimated population of adult Malaysians 22 million, (2) an expected proportion of 50% of Malaysians to minimise the plastic bag usage, (3) confidence limits of 5% and (4) design effect of 1. The calculated sample size was 385. To anticipate non-responses, 20% was added, which gave a total of 462 respondents needed for this present study.

B. Data Collection Instruments

Data were collected using an online survey structured questionnaire, which is in Malay language version. The questionnaire consisted of demographic characteristics and five components of the TPB towards reducing plastic bag use, namely attitude (Ohtomo & Ohnuma, 2014; Sun *et al.*, 2017), subjective norms (Ohtomo & Ohnuma, 2014), perceived behavioural control (Ohtomo & Ohnuma, 2014; Sun *et al.*, 2017), intention (Ohtomo & Ohnuma, 2014; Chen *et al.*, 2014) and actual behaviour (Ohtomo & Ohnuma, 2014; Ferdous *et al.*, 2014) and were adapted from the sources cited.

Two items assess respondents' attitude (ATT) towards reducing the usage of plastic bags, such as “I think I should take action to reduce the plastic bag usage”. The respondents' subjective norms (SN) towards reducing the usage of plastic bags were assessed with two items, for example, “If my friends use plastic bags instead of paper bags, I would more likely use plastic bags”. The perceived behavioural control (PBC) to reduce plastic bag usage was measured with a single item, “It is easy for me to decline free plastic bags”. The intention (INT) was assessed with three items such as “In the next three months, I am willing not to use plastic bags for personal use”. For the actual behaviour towards minimising the use of plastic bags (MU), it was assessed with two items, for example, “I decline to use plastic bags for everyday use”. Each statement item was scored using a Likert scale, ranging from 1= ‘strongly disagree’, 2= ‘disagree’, 3= ‘agree’, and 4= ‘strongly agree’. Summative scores for each component, except for PBC, were calculated, and the higher the scores indicated better ATT, SN, INT and the actual behaviour of respondents towards MU.

All the items from each of the subscales have been assessed systematically to determine the subscales’ internal consistency. The Cronbach alpha of the ATT subscale increased from -0.278 to 0.672 after one out of three items were removed. Similarly, the Cronbach alpha or the SN subscale increased from 0.743 to 0.934. In addition to that, the item-to-total-items correlation of the SN subscale also improved from 0.294 to 0.759. In view of alpha increasing slightly after two or three items were removed from the PCB subscale, only one item was decided to be retained after consulting a specialist’s opinion. The Cronbach alpha increased from 0.394 to 0.760 after two out of four items were removed from the MU subscale. Only the INT subscale, where all items were retained as the alpha value, obtained 0.851. The total Cronbach alpha was improved from 0.660 to 0.775.

C. Data Entry and Analysis

The questionnaires were distributed online. The data was extracted from Microsoft Excel. The data was checked for

any incompleteness, duplications and inconsistencies of data. Exploratory data analysis was carried out to check for normality, multicollinearity, and outliers. The Anderson-Darling (AD) normality test confirmed that the p-values <0.05 for all the scores of ATT (AD test = 67.955), SN (AD test = 12.568), INT (AD test = 11.797), PBC (AD test = 24.064) and MU (AD = 11.667) subscales, indicated the data were non-normal distributed. The multivariate normality was tested using the Mardia skewness test and Mardia kurtosis test. For these two (skewness=955.363 and kurtosis=10.062), the p-value was <0.05, indicating non-normality. The assumption of normal distribution was violated in both univariate and multivariate analyses conducted using the "MVN" package in R Statistical Software version 4.2.1 (Korkmaz *et al.,* 2014; R Core Team, 2022). The current study's data exhibited non-multivariate normal distribution, as evidenced by the Mardia's multivariate skewness (z= 595.363, p<0.05) and Mardia's multivariate kurtosis (z = 10.062, p<0.05).

In view of the current study attempts to examine the relationship between factors (i.e. attitude, subjective norms, perceived control behaviour and behavioural intention) that predict the behaviour of minimal plastic bag usage, partial least squares-structural equation modelling (PLS-SEM) was applied (Hair *et al.,* 2011). The PL-SEM approach is able to analyse both the observed and latent variables compared to other techniques, such as multiple regression (Kline, 2016). It is useful when there are a limited number of participants, and the data distribution is nonnormal (Wong, 2013). Because of these reasons, the PLS-SEM was conducted using Smart-PLS v3.3.3, a non-parametric analysis software (Ringle *et al.,* 2015; Ramayah *et al.,* 2017).

The analysis carried out in the PLS-SEM model can be divided into two steps approach, the assessment of the measurement model and the assessment of the structural model (Anderson & Gerbing, 1998). The bootstrapping method of 10,000 resamples was used to evaluate the statistical significance and relevance of the path coefficients. The significant values of the structural model were set to p-value < 0.05.

D. Ethical Considerations

Participation in the current study was voluntary. The instructions and information regarding this study were described in the online form for the participants to read. They gave their consent by ticking an option that they fully understood and agreed to take part in. The study's ethical approval was approved by the ethics committee of the Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Malaysia [UNIMAS/NC-21.02/03-02 Jld.5 (33)].

III. RESULTS

A. Demographics of Respondents

A total of 386 (83.5%) respondents completed the online survey. The mean age of the respondents was 22.65 years (standard deviation (SD), 6.3), with 75% being females and 25% being males. The majority of the respondents were of the Malay ethnicity (45%), followed by the Chinese (37%), the East Malaysia indigenous (17%), and others (3%). About 93.3% of the respondents had received higher learning education, followed by 6.5% who had received a secondary education level, and one respondent had no formal education.

The mean scores for ATT was 7.569 (SD=0.832), SN was 5.139 (SD=2.029), PBC was 2.901 (SD=0.951), INT was 9.518 (SD=2.146) and MU was 6.085 (SD=1.558). The non-parametric Mann-Whitney U-test was used to test differences in the scores of the five latent variables (i.e Attitude, Subjective Norms, Intention, Perceived Behavioural Control and Minimal Usage) between male and female respondents. The results indicated no significant differences between the gender's scores of Attitude (U=12731, Z=−1.726, p=0.084), Subjective Norms (U=12697, Z=−1.418, p=0.156), Intention (U=12523.5, Z=−1.603, p=0.109), Perceived Behavioural Control (U=13599, Z=−0.461, p=0.645) and Minimal Usage (U=12453.5, Z=−1.684, p=0.09).

Table 1. Overall estimated model fit values.

Model fits	Original value		HI95		HI99	
	EM	SM	EM	SM	EM	SM
SRMR	0.062	0.062	0.037	0.035	0.081	0.086
d_{ULS}	0.215	0.208	0.114	0.092	0.357	0.403
d_G	0.204	0.202	0.192	0.190	0.620	0.648

SRMR = Standardised Root Mean Squared Residual; d_{ULS} = squared Euclidean distance; d_G = geodesic distance; NFI = Normed Fit Index; bootstrapped with 10,000 subsamples; HI95 = 95% bootstrapping quantile; HI99 = 99% bootstrapping quantile; EM = Estimated Mean; SM = Sample Mean

1. Measurement model

First, the overall goodness of model fit was assessed by the standardised root mean squared residual (SRMR), the squared Euclidean distance (dULS) and the geodesic distance (dG) (Henseler *et al.,* 2016; Cepeda-Carrión *et al.,* 2019). Table 1 shows that SRMR values for both estimated and saturated models were less than 0.08 (Henseler *et al.,* 2016). Although the SRMR, dULS and dG values exceeded the bootstrap-based percentile of 95% (HI95), the values do not exceed the 99% (HI99) percentile of their bootstrap distribution, suggesting a good fit of the measurement model (Benitez Amado *et al.,* 2020).

The measurement model, which consists of the indicators (measures) and corresponding latent constructs, were evaluated by indicator reliability, internal consistency, convergent validity, and discriminant validity. The indicator reliability is reflected by assessing the outer loadings which the acceptable values should be above 0.700 (Hair *et al.,* 2012; Hulland, 1999). The loadings for the model were between 0.826 and 0.971.

The internal consistency of the model was examined with Cronbach's alpha (α) and composite reliability (CR). When investigating and evaluating the internal consistency reliability of a measure, the true reliability typically lies

Table 2. The internal consistency, outer loadings, AVE of the measurement model.

Construct	Item	Outer Loadings	α (>0.7)	CR (>0.7)	AVE (>0.5)	VIF (<5.0)
ATT			0.674	0.857	0.751	
	att1	0.905				1.348
	att2	0.826				1.348
SN			0.934	0.968	0.938	
	sub1	0.965				4.284
	sub2	0.971				4.284
INT			0.853	0.911	0.773	
	int1	0.898				2.253
	int2	0.889				2.204
	int3	0.850				1.935
MU			0.760	0.893	0.807	
	min1	0.899				1.602
	min2	0.897				1.602
PBC						
	pbc1	1.000	1.000	1.000	1.000	1.000

ATT=Attitude; SN=Subjective Norms; INT= Intention; MU=Minimal usage; PBC=Perceived Behavioural Control; α=Cronbach's alpha; CR=Composite Reliability; AVE= average variance extracted; VIF = Variance Inflation Factor

between Cronbach's alpha (which represents the lower bound) and the composite reliability (representing the upper bound) (Hair *et al.,* 2017).

A value of 0.700 and more for Cronbach's alpha and composite reliability are considered adequate (Henseler *et al.,* 2016) and others recommend a value of 0.500 and above also considered acceptable (Hinton *et al.,* 2014). All internal consistency measures for ATT, SN, INT, and MU constructs fall between 0.674 and 0.968 are above the recommended minimum values. Hence, the reliability and consistency of each construct are met.

Furthermore, the Average Value Extraction (AVE) for all the constructs is acceptable as all the calculated values are above the cut-off point, >0.500 (Henseler *et al.,* 2009), indicating convergent validity in all exogenous constructs and the endogenous constructs. Table 2 shows the result of the measurement model's internal consistency, the AVE and indicator loadings. To test the discriminant validity between constructs, Fornell and Larcker (1981) recommended that the square values of the AVE for each construct should be higher than the correlation values between the latent constructs and the Heterotrait-Monotrait (HTMT) ratio of correlations (Henseler *et al.,* 2015) were used.

As shown in Table 3, the diagonal values, which are the AVE's square root, are higher than that of the off-diagonal values, which are the correlation values between the latent constructs. According to Henseler *et al.* (2015), the HTMT value should be less than 0.900 to indicate discriminant validity. Table 3 shows that the HTMT ratios for all the constructs were less than 0.900. Hence, the discriminant validity for all constructs is met. Based on these results, the measurement model was reliable, internally consistent, and adequately discriminant validity.

Table 3. Discriminant validity findings: the Fornell-Larcker criterion and Heterotrait-Monotrait (HTMT) ratio.

Fornell-Larcker criterion

Construct	**ATT**	**SN**	**PBC**	**INT**	**MU**
ATT	0.867				
SN	-0.035	0.968			
PBC	0.155	0.016	1.000		
INT	0.393	0.055	0.467	0.879	
MU	0.280	-0.000	0.556	0.640	0.898

Heterotrait-Monotrait (HTMT) ratio

Construct	**ATT**	**SN**	**PBC**	**INT**	**MU**
ATT					
SN	0.062				
PBC	0.191	0.017			
INT	0.516	0.068	0.503		
MU	0.390	0.024	0.638	0.787	

ATT=Attitude; SN=Subjective Norms; INT= Intention; MU=Minimal usage; PBC=Perceived Behavioural Control

2. Structural model

After confirming that the construct measurements were satisfactory, the structural model was evaluated. The collinearity among the constructs was examined before proceeds to assess the structural model to ensure it did not bias the regression results. The variance inflation factor (VIF) values, which should be less than 5, were used to determine multicollinearity (Hair *et al*., 2019). In Table 2, the VIFs for all items were less than 5, indicating that the structural model results were not affected by collinearity. The bootstrapping method with bias-corrected and accelerated bias (BCa) for 10,000 subsamples and a two-tailed test with a significance level of 0.05 was used to evaluate the statistical significance and relevance of the path coefficients. Table 4 shows the ATT (H1: β=0.331; p=0.000) and the PBC

(H3: β=0.414; p=0.000) significantly predict the intention of using plastic bags. However, the intention was not significantly predicted by the SN (H2: β=0.06; p=0.196). Both the PBC (H4: β=0.329; p=0.000) and the INT (H5: β=0.486; p=0.000) were strong significant predictors for the minimal plastic bag usage behaviour among the public.

The assessment of predictive power of explanatory model was assessed using the coefficient of determination (R^2) and the model's out-of-sample predictive power (Shmueli *et al.,* 2016; Shmueli *et al.,* 2019). To measure the level of R^2, a value of 0.75 is said to be high, 0.50 is moderate, and 0.25 is weak (Hair *et al.,* 2011; Henseler *et al.,* 2009). This current study's R^2 for INT and MU were 0.37 and 0.49 respectively. This indicate that the model has a moderate predictive power. This also explained that 37% of the variance associated with intention to use plastic bags is explained by ATT, SN and PBC. Whereas 49% of the variance associated with behaviour to minimise plastic usage was explained by PBC and INT.

Following steps recommended by García-Machado *et al.* (2021), the first step is to assess the Stone-Geisser's Q^2 values for indicators of the dependent variables of interest. The Q^2 values above zero indicate that the model has out-of-sample predictive power for a certain endogenous construct. Furthermore, according to Hair *et al.* (2019), a Q^2 value that is above 0 is considered low, a value above 0.25 is medium and above 0.5 is high. The endogenous constructs for the current study, the INT and MU, were assessed using the PLSpredict procedure (Shmueli *et al.,* 2016; Shmueli *et al.,* 2019) to determine the Stone-Geisser's Q^2 values for all its indicators. The result of the analysis is shown in Table 5.

The next step is to analyse the prediction errors' skewness and whether they were symmetrically distributed. The visual inspection of the prediction errors and the absolute skewness values are less than 1, suggested that the distribution is not asymmetric, therefore the Root Mean Squared Error (RMSE) was used as a criterion for the prediction error. In the final steps, the differences in the errors between the RMSE and the linear regression model (LM) were calculated. A 10-folds and 10-repetitions were applied to predict the RMSE and LM benchmark's errors (Shmueli *et al.,* 2019).

Table 4. Hypothesis testing.

		Path		95% BCa CI		
Hypothesis	**Paths**	**coefficients**	**T-Statistics**	**2.5%**	**97.5%**	**Decision**
H1	ATT -> INT	0.331	7.602*	0.241	0.412	Supported
H2	SN -> INT	0.060	1.293	-0.049	0.136	Not supported
H3	PBC -> INT	0.414	9.545*	0.327	0.497	Supported
H4	PCB -> MU	0.329	7.708*	0.245	0.412	Supported
H5	INT ->MU	0.486	12.415*	0.405	0.559	Supported

ATT=Attitude; SN=Subjective Norms; INT= Intention; MU=Minimal usage; PBC=Perceived Behavioural Control; CI = Confidence Interval
**significant at p<0.05; two-tailed.*

When assessing the out-of-sample predictive power of the model for a certain endogenous construct, the RMSE values should be lower than the RMSE values of the LM benchmark for the construct's indicators. Furthermore, if the values of RMSE of the PLS model are lower than the RMSE values of the LM for all items, it indicates a high predictive power; if the values of RMSE of the PLS model are lower than that of the RMSE values of the LM for most the items, it indicates a medium predictive power; if the values of RMSE of the PLS model are outperformed that of the RMSE values of the LM for a few of the items, it indicate a low predictive power and if the values of RMSE of the PLS model are higher compared with the RMSE values of the LM for all items, it indicate a poor predictive power (Hair *et al.*, 2019; Shmueli *et al.*, 2019).

As shown in Table 5, the Q^2 prediction values were positive for all indicators of INT and MU constructs, ranging from 0.244 to 0.285, indicating a moderate external predictive capability. Moreover, the RMSE errors for the PLS model were smaller than the LM RMSE errors for all indicators of

Table 5. The Q^2 predict values and differences in RMSE errors between the PLS model and LM (predictive power).

Variable	RMSE		Q^2 predict	Differences
	PLS model	LM		(RMSE PLS model)-(RMSE LM)
INT				
int1	0.756	0.759	0.235	-0.003
int2	0.739	0.742	0.244	-0.003
int3	0.631	0.628	0.244	0.003
MU				
min1	0.725	0.729	0.285	-0.004
min2	0.757	0.761	0.260	-0.004

INT= Intention; MU=Minimal usage

MU, which indicates it has a high out-of-sample predictive power.

As for INT indicators, the RMSE errors for the PLS model were lower than that of the LM RMSE errors for most of the items, which indicates the construct has a medium predictive power. Therefore, the PLS model of the current study has an overall moderate to high out-of-sample predictive power. Figure 3 shows the final model.

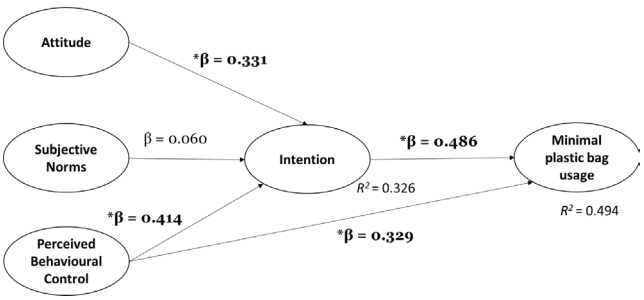

Figure 3. Path analysis of the result after bootstrapping with 10,000 subsamples; *significant at p< 0.05.

IV. DISCUSSION

The study's objective was to assess factors that predict the behaviour of minimising the usage of plastic bags using the extended Theory of Planned Behaviour model. The TPB is an extension of the theory of reasoned action by adding the construct of perceived behavioural control (Ajzen, 1991). Individual attitudes, subjective norms, perceived behavioural control, and intentions were the predictor factors that were currently assessed. One study showed that single-use plastics during the COVID-19 pandemic period have increased as a result of more plastic bags being used in the delivery services to deliver food and items to the people (Leal Filho *et al.,* 2021).

In the current study, there is a strong positive relationship between the attitude factor and intention factor towards the usage of plastic bags. The results also correspond to the other studies (Sun *et al.*, 2017; Wang *et al.,* 2018; Ma *et al.,* 2018; Vina & Mayangsari, 2020), where consumers' attitudes positively influenced the intention to use plastic bags. This could be explained by the fact that the majority of the respondents do not intend to use plastic bags as they perceive it is bad for their health, which indirectly reflects a positive attitude toward being environmentally friendly. Having an unfavourable attitude towards plastic bags and realising that plastic bags are detrimental to the environment, the desire to use plastic bags also decreases. Such good attitude can be instilled through health promotion and education about plastic pollution and its negative effects on the ecosystem (Hynes *et al.,* 2021). However, the subjective norms factor was found to insignificantly influence the individual's intention. This finding could be explained by the cultural dimension theory (Hofstede, 2001), where there is a high-power distance oriented between the government and individuals that exists in the societal norm (Chang & Chou, 2018). This may lead to the fact that societal norm on minimal usage of plastic bags was already established but did not significantly affect the intention of reducing the usage of plastic bags.

Another reason is that minimising using plastic bags has not become a social norm among the studied population in

general (Wicaksono *et al.,* 2020). However, studies done elsewhere showed that the intention has a positive significant influence on limiting plastic bag usage due to cultural pressure (Sun *et al.,* 2017; Vina & Mayangsari, 2020).

The current study also found that there is a positive correlation between perceived behaviour control factor, intention factor and minimising the usage behaviour factor. This indicates that if the public perceives that they are able to control the usage of plastic bags, their intention to use plastic bags will be reduced. A study done elsewhere showed that perceived behaviour control is highly related to the intention to reduce plastic bag usage among youths (Firdaus, 2020). A study by Sun *et al.* (2017) found that if plastic bags are provided at certain prices, this might cause consumers to have less interest in using plastic bags. One of the measures that the Malaysian government is currently implementing is the "No Plastic Bag Day" initiative (Asmuni *et al.,* 2011). Through this initiative, the shop retailers impose a price of MYR0.20 (USD0.06) on each plastic bag with the intention that it will cause the consumers to use less plastic bags. In addition, it also educates the public to bring their own plastic bags or reusable shopping bags when going to grocery shops or supermarkets (Chang & Chou, 2018). Many of the respondents in the current study intended not to receive free plastic bags or use them as they perceived that they were able to refuse to use plastic bags in the next three months. This intention factor is strongly associated with the minimal use of plastic bags behaviour and, hence, supports the TPB model (Ajzen, 1991).

This data for the current study was collected through an online method and, therefore, has several limitations. The selection of representative sampling can be said to be biased due to the respondents being identified through the snowball sampling method. The presence of information bias as well as confounding factors must be taken into consideration because the respondents that were chosen and identified were a young group population who were literate, had access to the internet and were interested in the topic, thus, they have more time and bother to respond compared to others (Lefever *et al.,* 2007; Janssens & Kraft, 2012; Andrade, 2020).

The findings obtained in this study cannot be generalised to include all Malaysian populations regarding their behaviour toward plastic bag usage as only three states were selected in this study findings (Lefever *et al.,* 2007; Janssens & Kraft, 2012).

V. CONCLUSION

The current study investigated the factors influencing plastic bag consumption among adult Malaysians using an integrated model drawn from the classical theory of Planned Behaviour.

The study's findings identified several factors that influenced the behaviour to minimise the usage of plastics. The factors, i.e. attitude, and perceived behavioural control, are positively correlated with the intention to reduce plastic bags. In addition, the intention also positively correlates with the minimising of plastic bag usage. However, the intention is not influenced by subjective norms. Therefore, it is suggested that policymakers should enhance promotion and education resources in influencing the consumers' attitude and perceived behavioural control since both factors are related to the intention. More workshops or seminars, for example, are to be conducted by the relevant agencies so that the public is able to exert control over themselves towards minimising plastic bag usage.

VI. ACKNOWLEDGEMENT

The authors would like to thank the UNIMAS Medical Ethics Committee for their ethical approval and the respondents for their participation in this present study.

VII. CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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