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Exploring Determinants Shaping Recycling Behavior Using an Extended Theory of Planned Behavior Model: An Empirical Study of Households in Sabah, Malaysia

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Abstract: Household waste and the exploitation of the environment are among the alarming and unsustainable consumption patterns that are harmful to the ecosystem. Hence, this study aims to determine the factors influencing recycling behavior by extending the theory of planned behavior (TPB) to an analysis of how recycling practices are fostered among citizens and how sustainable development goals (SDG) are upheld. The extended TPB model includes moral norms, convenience, and the cost of recycling. A total of 170 responses were received via the purposive sampling technique. The research model was analyzed using the partial least square structural equation modeling technique (PLS-SEM). Results show that subjective norms, moral norms, convenience, and the cost to recycle positively influenced recycling behavior. Environmental awareness was found to heavily influence attitudes, but attitudes were not found to translate into behavior. This research provides significant insight and a better understanding of recycling behavior and adds new momentum to the growing literature. The implications of these findings are further discussed.

Keywords: recycling behavior; household waste; extended theory of planned behavior; structural equation modelling

1. Introduction

In Malaysia, household waste generation has increased manyfold over the last few decades. It was found that 64% of the waste generated is accounted for by municipal solid waste, and about 80% of the municipal solid waste contains recyclable end products [1,2]. According to the latest data, household waste generated in 2018 doubled to 38,000 tons per day compared to 2005, although the recycling rate in 2018 was 17.5% [3] This is disturbing as the rate has surpassed the Japan International Cooperation Agency (JICA) study's proposed rate of 30,000 tons each day in the year 2020 [3]. In Malaysia, household waste is the primary source of municipal solid waste accounts for 44.5% of total solid waste collection, or 6.1 million tonnes per year, according to the Khazanah Research Institute. Food related waste accounts for 50% of overall waste composition [4].

A sustainable and effective approach to reduce generated waste is the embrace by individuals of recycling behavior or practice in daily life. Recycling is a process that requires an individual to collect and process the materials that would be thrown away in order to turn them into new products. The United Nations are focusing on recycling activity to achieve Sustainable Development Goals. The organization used separation collection percentage or rate and a metric tonne of recycled materials [5]. Recycling is associated with environmental benefits, such as reducing pollution, reducing land usage for landfills, and saving resources and energy [6].

In Malaysia, with the amount of waste being generated, it has been found that landfills are reaching maximum capacity; additionally, many of the dumps are planned to be shut down in the next couple of years [2,7]. The development of new disposal facilities causes

concern to the Malaysian government as there are limited disposal facilities available in the nation [7]. Thus, for Malaysia to achieve sustainability goals, the government and policymakers need to look seriously into recycling activities.

The Malaysian government aimed to achieve a 22% recycling rate by 2020, but it was found that the recycling rate has been low compared to the neighboring country, Singapore, for instance [8]. Generally, the citizens possess an awareness and knowledge in recycling matters, but they have been found to refuse to perform the behavior [9]. The belief that recycling is a responsibility of the municipality contributes to this low level of willingness level to engage in recycling; in addition, citizens also claim that there are no recycling facilities near their housing areas [9]. Thus, they have low motivation to performing recycling behavior.

The school education system has been instilling knowledge and raising awareness regarding the issue among students. These students are well equipped with knowledge, but they do not know how to utilize it in their daily routine [10]. It has been found that environmental knowledge and awareness can positively affect recycling behavior and can motivate an individual to conduct a waste segregation routine; however, the government's initiative, which is based on education and persuasion, causes the public to be unwilling to perform recycling behavior [8].

Hence, this study aims to determine factors that encourage or influence individuals in Malaysia to practice recycling in order to deepen our understanding of the factors which could minimize household waste and achieve a higher recycling rate in the country. The theory of planned behavior is employed and extended by operationalizing the category of subjective norms to capture both the moral norms and subjective norms, while perceived behavioral control is operationalized to capture the facility availability and cost of recycling. Attitude and awareness are also incorporated into the model.

The remainder of this paper is structured as follows. In the next section, literature on factors influencing recycling behavior is reviewed and hypotheses are developed. Following the literature review, the study's methodology is explained, followed by the analyses conducted. Finally, the findings are discussed along with implications, limitations, and suggestions offered for future research.

2. Literature Review

2.1. Theory of Planned Behavior

TPB (theory of planned behavior) has been used in several studies that are related to environmental or green behavior such as the usage of green e-books [11], predicting green behavior [12,13], and the willingness to buy appliances that save energy consumption [14]. Another study of waste separation behavior was conducted in Malaysia that utilized the TPB and showed that subjective norms, attitudes, and perceived behavior control positively affect waste separation behavior among households in Malaysia [15].

Boldero [16] stated that recycling is a behavior that requires considerable effort from an individual, where the person will be needed to sort, prepare, and store the waste. Due to this, the decision or intention to perform this behavior will require a series of factors to be considered [8]; with this in mind, TPB can lay out factors to analyze the predictors of recycling behavior as shown in Figure 1.
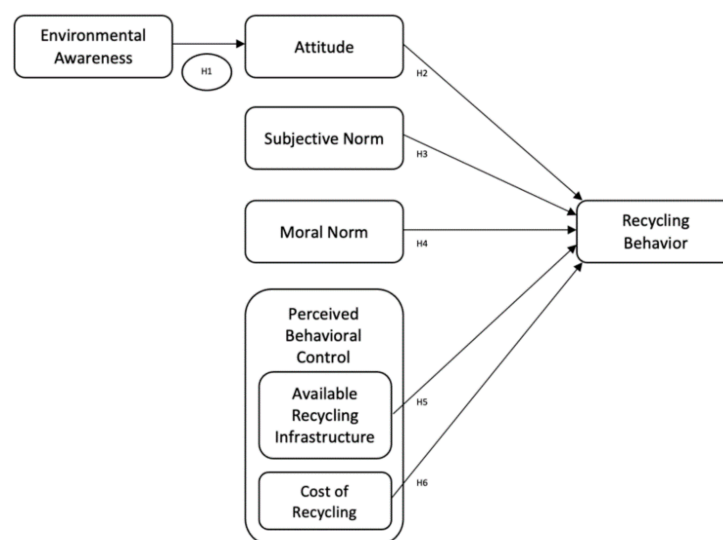
Figure 1. Theoretical Framework.

2.2. Impact of Environmental Awareness on Attitudes towards Recylcing

Environmental awareness includes knowledge, understanding, apprehension, and concerns regarding environment conservation, solutions to environmental problems, and ways of maintaining and improving environment quality [17]. Several studies have stated that a user with high environmental awareness is likely to pursue environmentally friendly actions [18,19]. Ramayah et al. [8] stated that environmental awareness contributes to recycling behavior as the awareness motivates individuals to perform recycling activity. It was found that, in China, where there are worries that the quality of desalinated water does not reach the quality of the national standard, people with less knowledge on desalinated water influence other people to use desalinated water [20].

It has been found that environmental awareness has a positive relationship with recycling [21,22]; this is due to the fact that information and knowledge obtained by a person can motivate them to perform a behavior, and knowledge and awareness of the environment would specifically allow a person to analyze whether or not to perform a recycling behavior. Environmental knowledge allows a person to be aware of the issues regarding climate or environment; this also includes the importance of recycling, government initiatives, and the availability of recycling facilities. This awareness enhances public participation in recycling activities [8].

One study was conducted among contractors regarding waste management, and it was found that the attitudes of the contractors differed based on their environmental awareness or environmental knowledge [23]. Another study conducted among students found that they had high environmental awareness. Yet, interestingly, they were not able to utilize their knowledge to practice recycling in their normal daily routine [10]. When looking into the influence of environmental awareness on attitudes towards recycling, a significant relationship between both the variables can be seen.

Hypothesis 1 (H1). *Environmental awareness is positively related to attitude towards recycling.*

2.3. Attitude towards Recycling Behavior

Attitude relates to human behavior; but, according to Ajzen [24], attitude depends on the presence of other factors. Ajzen [24] defines attitude as the degree to which a person makes a favorable or unfavorable judgment of a behavior. A favorable attitude would stimulate an individual to perform a behavior. Several studies have been conducted in which it was found that attitude plays an important role in an individual's decision to practice pro-environmental behavior [25,26]. People tend to favor behavior that provides positive consequences and form an undesirable attitude towards behavior that has negative

effects [24]. In Malaysia, environmental awareness, including the importance of recycling, is taught in schools; this instils a favorable attitude towards recycling, like that which, as Mapa [9] found, individuals possess in certain cases. Still, people who possess this environmental awareness do not have the motivation to perform the behavior, even a person with such environmental awareness would tend to see that recycling behavior reduces rates of pollution formation and the wasteful use of landfills, and conserves natural resources [8].

Hypothesis 2 (H2). *Attitude is positively related to recycling behavior*.

2.4. Subjective Norm towards Recycling Behavior

Ajzen [24] states that subjective norms are directly proportional to normative belief; the likelihood that an individual will perform a behavior increases with the individual's motivation to perform that behavior. A subjective norm reflects an individual's feeling towards social pressure regarding whether or not to perform a behavior [24]. This means that an individual's decision and motivation to perform a behavior are affected by the group of people or community around them. Subjective norms derive from the individual's own assessment as to whether their significant others will approve or disapprove of their performing a particular behavior.

Subjective norms exist when a person knows that a certain social norm exists and prefers to comply with that norm [27]. Furthermore, a subjective norm will prompt a person to perform a behavior by satisfying normative and empirical expectations [27]. A person will be influenced by subjective norms if there are perceived behavioral rules in a certain group [28,29]. Miliute-Plepiene et al. [27] found that people who see that other people are recycling are more likely to perform the recycling behavior. In contrast, Ordoñez et al. [30] found that neighbors who do not segregate their waste tend to influence other neighbors not to perform waste segregation behavior.

Jiang et al. [31] conducted a study analyzing the intention to recycle agricultural waste among Chinese farmers, and it was found that subjective norms influence the farmers' intentions. Another study conducted by Khan et al. [32] to analyze the behavioral intention among consumers to recycle waste plastics, and the subjective norm was found to be one of the strong predictors. Similarly, Ramayah et al. [8] have also found that the subjective norm is one of the predictors in motivating recycling behavior in poor waste management. As well as influences from community circles, government initiatives, policymakers' efforts, and social media also play a role in influencing a person's intention to perform certain behavior [20].

Hypothesis 3 (H3). *Subjective norms are positively related to recycling behavior*.

2.5. Moral Norm towards Recycling Behavior

Ajzen [24] states that an individual is bound to decide to perform or not to perform a behavior based on their moral obligation or responsibility to perform or not to perform that behavior. Ajzen also states that moral norms could influence the intention to perform a behavior in a similar manner to attitude, subjective norms, and perceived behavior control.

Moral norms guide individuals in differentiating good from bad, which leads them to evaluate a behavior positively or negatively. Moral norms motivate people to perform certain behaviors largely based on intrinsic emotional responses; in other words, moral norms are followed and prompted by emotional reactions [27].

Saphores et al. [33] stated that moral norms are an important predictor in cultivating recycling behavior. Onwezen et al. [34] stated that moral norms could create pride and guilt within an individual; in addition, De Young [35] noted that recycling behavior positively impacts the environment; thus, it would influence the individual by making them feel good after performing the behavior. Few studies stated that moral norms need to be included in the theory of planned behavior model to analyze pro-environmental behaviors [15,36,37]. Thus, in this study, the hypothesis proposed is as follows.

Hypothesis 4 (H4). *Moral norm is positively related to recycling behavior.*

2.6. Perceived Behavior Control towards Recycling Behavior

Ajzen [24] states that the intention to perform a behavior depends on experience and second-hand information from the experiences of friends or acquaintances. Ajzen [24] explains that perceived behavioral control entails the ease of carrying out behavior and reflects previous experiences and expected barriers. Building on that statement, it can be said that more resources or information possessed by an individual would create a greater perceived behavior control. These resources and information would generate confidence in an individual to perform a behavior.

Russell et al. [38] studied the development of pro-environmental behavior and found that perceived behavior control affects behavior adaptation. Niaura [39] states that perceived behavioral control is a strong predictor in analyzing consumers' intention to perform a behavior that positively impacts the environment. Adapting Niaura's argument [39], perceived behavior control will be used to determine the recycling behavior among residents in Sabah, Malaysia.

However, a few other studies have shown that perceived behavior control does not significantly influence recycling behavior [16,40]; with that in mind, Ramayah et al. [8] created an alternative means of measuring recycling behavior. The authors added two new variables under perceived behavior control—the convenience of availability of recycling infrastructure and cost of recycling.

The convenience of the availability of recycling infrastructure refers to the availability of recycling facilities. It was found that consumers tended not to be motivated to perform recycling due to a lack of facilities, a lack of time, and long-distance travel [41]. The cost of recycling includes time, space, and ease of carrying out the recycling task. Diekmann and Preisendörfer [42] have stated that consumers tend to prefer to perform low-cost behavior.

Hypothesis 5 (H5). *The convenience of available recycling facilities is positively related to recycling behavior.*

Hypothesis 6 (H6). *The cost of recycling is positively related to recycling behavior.*

3. Methods

This study employed a quantitative research design, using a structured questionnaire. The question statements were adapted from multiple sources (refer to Table A1). The questionnaire was segregated into a few sections to assess all the variables and was measured with a 5-points Likert scale in which 1 = strongly disagree, and 5 = strongly agree.

A self-administered online questionnaire was employed for collecting data in this research via purposive sampling. Before answering the questionnaire, the respondent will be screened to ensure that they are actively involved in recycling activities and know what they are doing before being given access to the online survey. This is necessary to contact individuals who are practicing or involved with recycling activities; since there are no readily accessible sampling databases, records or lists used to randomly choose subjects. This led to the purposive sampling that matches this study's objective, which focuses principally on those who have knowledge pertaining to recycling and who practice recycling, rather than merely selecting those who are only aware of this activity.

A total of 170 questionnaires were collected from individuals who practice recycling in Sabah, the second-most populous state in Malaysia. This was required to establish the determinants of actual recycling behavior, rather than merely the awareness of recycling practice or the intention to practice recycling. This follows the recommendation of Chekima et al. [43] not to combine responses to cases of observed behavior and intention in actual behavior studies as their patterns are very different. To decide on the sample size for this study, G*Power software was used to calculate the minimum sample size required based on statistical power (Faul et al. [44]). Since the model has five predictors, the effect size was set as medium (0.15) and power needed as 0.95. The sample size required was 138.

Typically, the minimum power required for social science and behavioral studies is 0.8 (Hair et al. [45]). Therefore, we can safely conclude that a sample of 170 is adequate for this study and has enough statistical power. The respondents' participation in the survey was voluntary, and a consolation prize was given to every participant as an inducement.

The research model was analyzed using the partial least squares structural equation modeling technique (PLS-SEM) using SmartPLS 3 software. The use of PLS-SEM is relevant and preferred in this research as it is intended to predict the determinants of recycling behavior as suggested by Hair et al. [45]. Anderson and Gerbing [46] recommend two-stage analytical procedures, firstly assessing the measurement model and then assessing the structural model (testing the hypothesized relationship).

4. Results

4.1. Profile of Respondents

About 68% of the respondents are female, and 32% are male, and most of the respondents are aged between 20 and 39. Regarding educational attainment, the majority of the respondents hold a bachelor's degree (51%), while 22% hold a diploma/certificate and 18% hold a master's degree.

4.2. Internal Consistency Reliability, Indicator Reliability, and Convergent Validity

Cronbach's alpha and composite reliability index were used to evaluate the consistency and reliability of the measurement model. Based on Table 1, the Cronbach's alpha ranges between 0.792 and 0.883, based on the threshold recommended by Hair et al. [47]; the Cronbach's alpha of this measurement model meets the criteria by more than 0.7. The CR for this measurement model ranges between 0.850 and 0.927, which is above the recommended threshold.

Table 1. Indicator Reliability, Internal Consistency Reliability, and Convergent Validity.

Item	Indicator Reliability	Internal Consistency Reliability		Convergent Validity
	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
	>0.60	>0.70	>0.70	>0.50
ATT1	0.722	0.788	0.863	0.613
ATT3	0.814			
ATT5	0.825			
ATT6	0.766			
CON1	0.917	0.845	0.927	0.865
CON2	0.943			
COST1	0.844	0.838	0.903	0.755
COST2	0.894			
COST3	0.869			
EA1	0.820	0.883	0.914	0.681
EA2	0.842			
EA3	0.847			
EA4	0.774			
EA5	0.843			
SN1	0.854	0.860	0.915	0.782
SN2	0.880			
SN3	0.918			
MN2	0.767	0.794	0.875	0.700
MN3	0.846			
MN4	0.892			
RB1	0.827	0.879	0.917	0.733
RB2	0.862			
RB3	0.873			
RB4	0.863			

With the confirmation of the internal reliability, the data analysis proceeded further to analyze the indicator reliability. Several items were removed due to low outer loadings,

where these loadings were below 0.708, following the recommendation of Hair et al. [48]. Average Variance Extracted (AVE) was measured to analyze the convergent validity. When AVE is higher than 0.5, it means a variance of 50% for each indicator [49]. Table 1 shows that all the construct's AVE values were above the threshold of 0.5. Therefore, the measurement model's convergent validity is acceptable.

4.3. Discriminant Validity

Discriminant validity confirms that constructs are not related to each other. To ensure the discriminant validity, we used the criterion of Fornell and Larcker [50]. Fornell and Larcker's criterion confirms a construct's discriminant validity if the square root of each construct's AVE is higher than its correlation with another construct. Table 2 shows the matrix of discriminant validity of the constructs, whereby all the correlation values (non-bolded) are lower than the square root of the construct's AVE value (bolded).

Table 2. Fornell and Larcker's Criterion.

	ATT	CON	COST	EA	RB	SN	MN
ATT	**0.783**						
CON	0.185	**0.930**					
COST	0.300	0.615	**0.869**				
EA	0.488	0.133	0.130	**0.825**			
RB	0.296	0.597	0.713	0.043	**0.856**		
SN	0.313	0.495	0.663	0.121	0.624	**0.884**	
MN	0.505	0.315	0.536	0.372	0.499	0.461	**0.837**

In addition, discriminant validity can also be confirmed using the heterotrait-monotrait ratio of correlations (HTMT). HTMT is the ratio between trait correlations [49]. If the HTMT value is greater than $HTMT_{0.85}$, it does not confirm discriminant validity, which means that there is a relationship between constructs. Table 3 shows the HTMT matrix in which none of the constructs achieves higher than 0.85. Thus, the constructs have established discriminant validity.

Table 3. HTMT Matrix.

	ATT	CON	COST	EA	RB	SN	MN
ATT							
CON	0.224						
COST	0.372	0.725					
EA	0.572	0.156	0.176				
RB	0.352	0.684	0.829	0.095			
SN	0.376	0.575	0.779	0.150	0.716		
MN	0.684	0.359	0.639	0.466	0.559	0.534	

4.4. Structural Model Assessment

In the second stage of analysis, the structural models for recycling behavior were assessed. To assess the structural model, Hair et al. [45] recommended looking at the beta, R^2, and the corresponding t-values through bootstrapping with a resample of 5000, effect sizes (f^2) and predictive relevance (Q^2).

Table 4 summarizes the results of the structural model analysis. The first relationship between environmental awareness and attitude found to be significantly positive (β = 0.262, $p < 0.01$), which explains the 23.8% of variance in attitude. As for the determinants of recycling behavior, subjective norm (β = 0.421, $p < 0.01$), moral norm (β = 0.262, $p < 0.01$) convenience (β = 0.290, $p < 0.01$), and cost (β = 0.290, $p < 0.01$) were positively related to recycling behavior, while attitude (β = 0.077, $p > 0.01$) was found to not significantly influence recycling behavior. Thus, H1, H3, H4, H5, and H6 were supported, while H2

was rejected. All together, these factors explain 59.2% (R^2 = 0.592) of the variance in recycling behavior.

Table 4. Summary of Structural Model.

	Relationship	Std Beta	Std Error	T-Value	Decision	R^2	F^2	Q^2
H1	EA ≥ ATT	0.488	0.071	6.862 **	Supported	0.238	0.312	0.13
H2	ATT ≥ RB	0.014	0.056	0.243	Not Supported	0.592	0.000	0.42
H3	SN ≥ RB	0.206	0.082	2.517 **	Supported		0.055	
H4	MN ≥ RB	0.130	0.078	1.680 *	Supported		0.024	
H5	CON ≥ RB	0.228	0.086	2.640 **	Supported		0.078	
H6	COST ≥ RB	0.363	0.097	3.750 **	Supported		0.129	

Note: ** $p < 0.01$; * $p < 0.05$.

Cohen's (1988) guidelines 0.02, 0.15, and 0.35, representing small, medium, and large effects, were referred to in order to evaluate effect size. From Table 4, it can be observed that all the relationships recorded a small effect with one medium effect (EA). In addition, the predictive relevance of the model was also assessed by using the blindfolding procedure. If the Q^2 value is larger than 0, the model has predictive relevance for a certain endogenous construct, and it does not if the value is less than 0 (Hair et al., 2014). Hair et al., (2014) also stated that as a relative measure of predictive relevance, values of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, or large predictive relevance for a certain endogenous construct. Referring to Table 4, the Q^2 value is 0.43, suggesting that the model has large predictive relevance.

5. Discussion

This study has enhanced the understanding of what characterizes individuals' recycling behavior in a developing country. It is among the earliest studies proposing and examining a conceptual model to understand the impact of attitude, subjective norms, moral norms, perceived facilities availability, and cost of recycling on individuals' actual recycling practice (instead of intention which is a less than ideal proxy for actual behavior); in addition, the study explored the relative importance of these variables. The study is important to the government, municipality, and policymakers in its attempt to foster and instil sustainable consumption and disposal of waste among its citizens.

The findings of this study confirm that subjective norms, moral norms, availability of the facility, and cost of recycling are salient factors influencing recycling behavior, while attitude is found not to play a role. This corroborates Chekima et al. [43] and Thogersen's [51] claims that general attitudes (e.g., attitude towards a subject) do not necessarily spill over into most behaviors or specifically environmentally friendly behaviors. Likewise, Ajzen and Fishbein [52] stress that there is a possibility that attitude would have little prediction power on overt behavior; it was also argued that attitude towards an object would influence the pattern of an individual's response towards the object, but that it need not predict any given action. In this study, cognitive dissonance might have played a role in influencing the attitude and recycling behavior relationship. Festinger [53] has explained that cognitive dissonance occurs when individuals feel uncomfortable due to their beliefs that contradict one another.

Juvan and Dolnicar's [54] study, which relates cognitive dissonance to environmental behavior, showed that younger generations with high environmental attitudes were found to litter more than older generations with high environmental attitudes due to the presence of cognitive dissonance. It can be seen that cognitive dissonance creates an internal conflict within an individual, thus creating mental discomfort and altering the individual in terms of attitude, beliefs, or behavior. Although they possessed a high environmental attitude, participants in this study were found not to translate their attitude into recycling behavior. This can be attributed to the ample knowledge being held by them. The respondents who joined in this study might have been affected by cognitive dissonance, which is tallied with Juvan and Dolnicar [54], who found that younger generations have higher cognitive dissonance than older generations.

To improve this situation, local authorities and NGOs can work together to inculcate or foster recycling habits by educating the public. Awareness and education efforts can be implemented by posting content on social media that focuses on the benefits of recycling to the community and the world in general and the importance of the role of individuals in the success of this effort. Social media is a platform to convey information to more people that has proven to be effective and provides a space for people to interact and give insights into a shared proposal or plan related to recycling. Ultimately, citizens will develop a favourable attitude towards recycling that can lead them into practicing it on a daily basis.

Regarding perceived behavioral control, both the dimensions of cost of recycling and availability of recycling facilities were found to have the highest direct effect on recycling behavior. This finding, however, contradicts the findings of Ramayah et al. [8]. This shows that residents are aware of the recycling facilities around their area, and they can differentiate the items that can be recycled. These findings can be related to the aftermath of the pandemic. The pandemic was found to have triggered increased concern towards climate change and to have motivated increased recycling and the reduction of consumption [55]. It was found that 40% of low-intensity recyclers and 20% of the high-intensity recyclers intend to increase their recycling activity after the pandemic outbreak [55]. Accordingly, local governments, together with NGOs and profitable companies, can expand the availability of recycling collection points or stations to call and facilitate surrounding residents to fulfil their obligations to the environment's well-being by segregating and collecting recycled waste conveniently. This also reduces one obstacle to the residents' intention to adopt a recycling lifestyle—the lack of recycling stations or points around residential areas and commercial places.

The results also confirmed that their social circles positively influence Malaysian citizens due to their collectivist characteristics. This proves that the sample would highly affect the perceived behavior accepted by the people in their social circles, such as friends and family. Social norm influence can also come from government initiatives or social media awareness, which shows that these mediums can play a role in influencing the decision-making process of individuals in performing recycling behavior. Accordingly, social media content must touch on the social and moral norms that are found to be positive in this study to apply the habit of recycling to the public and further strengthen it among those who have been recycling for a period. This coincides with research performed by Nolan et al. [56], which showed that when consumers were given a door hanger with the enticing statement "join your neighbours in conserving energy" to decrease energy use, they tended to save the most energy. Likewise, Gockeritz et al. [57] assert that the link between subjective norms and environmentally friendly conduct increased with the belief that others approved of participating in such behaviors. In short, when people see that the "significant other" among their family, colleagues, or leaders supports environment-friendly behavior, they are more likely to engage in or perform it, and it is expected to be identical or similar in the case of recycling. This is realistic considering that Malaysians have a collectivist living culture and prefer to follow the norms of others around them.

Moral norms were also found to have a positive influence on recycling behavior. This finding aligns with Razali et al. [15] and Pakpour et al. [58]. Both these studies found moral norms to significantly affect waste separation behavior in Malaysia and Iran, respectively. The indicators used for moral norms were questions about feeling ashamed and guilty if they did not perform recycling; participants were further asked if they would like to be deemed a person who conducts recycling and is principled about recycling. Similarly, in this study, residents were found to feel guilty if they did not perform recycling behavior. It was also found that not recycling would go against their principles.

Finally, environmental awareness was found to have a high direct effect on attitude. A possible and sound explanation for this is that the educational system plays a role in cultivating attitudes towards recycling behavior like that which is practiced in Malaysia by the government and NGOs. Knowledge or awareness can be obtained through the education system; alternatively, individuals can be informed through word of mouth or

social media. The residents were able to connect their knowledge on recycling to pollution reduction, landfill usage reductions, and conserving natural resources.

6. Conclusions

This study provides an overview of recycling behavior among Malaysians by deciphering the factors that affect the decision to perform recycling behavior: attitude, social norms, moral norms, and perceived behavioral controls.

Despite the contributions of this study, a few limitations are worth focusing on to propel our insights on the determinants of recycling behavior forward. This study was conducted in Malaysia; thus, it could be valuable for future research to replicate this study focusing on samples from different countries or conducting a cross-cultural comparison to substantiate different stakeholders' recycling behavior and related practices. McEachern and Willock [59] recommend looking at different samples to see if the theory holds for all consumer groups and to confirm the generalizability of the previous and current study.

In addition, it could be worth considering incorporating temporal orientation, which makes a prevalent and influential, yet unrecognized, impact on a lot of human behavior. This construct was found to strengthen the relationship between the predictors and environmentally friendly behavior, confirming that it has a pervasive effect on people's behavior, especially in organic food consumption [13]. This corroborates the view that monetary and non-monetary benefits related to environmentally friendly consumption normally become salient over the long term. As Chekima et al. [43] suggest, through understanding and incorporating a sense of temporal orientation, interested parties could design and communicate their messages much more effectively to alter or influence individuals' attitudes and behaviors towards ecologically friendly behaviors.

Appendix A

Table A1. Measurement Items.

Variable	Measurement Items	Source
Recycling behavior	I usually separate and dispose all recyclable materials. I have high involvement in recycling activities. I have high adherence level to separation and disposal of recyclable materials. I have practice waste recycling for some time. I believe that my recycling behavior will help reduce wasteful use of landfills.	Ramayah et al., 2012
Attitude	I feel good about myself when I recycle. I feel responsible when I recycle I am interested in recycling my household waste.	Wan et al., 2021
Subjective Norm	My family expects me to engage in recycling behavior. Most people who are important to me think I should engage in recycling behavior. Most people who are important to me would approve me engaging in recycling behavior.	Ramayah et al., 2012

Table A1. *Cont.*

Variable	Measurement Items	Source
Moral Norm	It would be wrong of me not to recycle my recyclable materials. I would feel guilty if I did not recycle my recyclable materials. Not recycling goes against my principles.	Wan et al., 2021
Available Recycling Infrastructure	I am familiar with the recycling facilities in my area. I am familiar with the materials accepted for recycling in the recycling facilities in my area. Household recycling is an easy task for me.	Ramayah et al., 2012
Cost of Recycling	I have enough space to store the materials for recycling. I have enough time to sort the materials for recycling. Recycling is a major way to reduce pollution.	Ramayah et al., 2012
Environmental Awareness	Recycling is a major way to reduce wasteful use of landfills. Recycling is a major way to conserve natural resources. Recycling saves energy. Doing recycling practices can provide a better environment for next generation.	Ramayah et al., 2012

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