Factors Contributing to the Purchase of Energy-Efficient Appliances in Malaysia

Teddy Lian Kok Fei

Department of International Business,Faculty of Accountancy and Management, Universiti Tunku Abdul Rahman, 43000, Kajang, Selangor, Malaysia

Abstract

There is a growing realisation of the adverse impacts of climate change as it continues to grow more serious. One promising area for greenhouse gas mitigation is using energy-efficient appliances. This study identified the factors that contribute to using energy-efficient appliances in Malaysia. It utilised variables from the theory of planned behaviour (TPB), attitude, subjective norms, and perceived behavioural control. This basic model is extended with the additional variables of habit, environmental concern, environmental knowledge, and energy efficiency policy to explain the purchase of energy-efficient appliances. Apart from direct effects, the study also tested indirect effects of habit. A final set of 147 responses was collected through purposive sampling and analysed using partial least squares. The findings show that habit is the most critical direct variable contributing to the purchase of energy-efficient appliances. Other influential variables are attitude, perceived behavioural control, and environmental concern. Together, these four variables explain 65.4 per cent of the variance in the purchase of energy-efficient appliances. Furthermore, habit also mediates the effects of perceived behavioural control, subjective norms, and environmental knowledge on the purchase of energy-efficient appliances. Overall, the study points to the importance of including both habitual and intentional variables when buying energy-efficient appliances. In addition, the study indicates the need for the government to use different types of intervention, such as labelling and setting standards, giving incentives, and providing information, to promote and diffuse the use of energy-efficient appliances. Such efforts cannot be done only in short periods of time but must be continuous to be effective.

Keywords: climate change, energy-efficient appliances, theory of planned behaviour, habit, energy-efficiency policy

1.0   Introduction

This research aimed to provide an integrated framework for the variables that influence Malaysians' purchase of energy-efficient appliances. While there had been many efforts done on energy-efficient appliances in the western context, only a few had been done in the Malaysian context. Moreover, an online search revealed a lack of research findings in Malaysian studies on the role of habit in energy efficiency. As such, this study intended to fill this gap. In addition, there is a pressing need to consider the role of the Malaysian government in energy efficiency, through energy labelling of energy-efficient appliances, given the unsuccessful attempts of the government to address global rising greenhouse gas emissions. Malaysia has to do much more in energy reduction because our greenhouse gas emissions continue to climb due to economic expansion and population growth. Therefore, this study sought to understand the factors impacting the purchase of energy-efficient appliances in the Malaysian context. This study is especially relevant given the slow progress among countries towards addressing climate change at the global level following the Paris Climate Agreement. Thus, a review of the role of government policy on energy efficiency is the most appropriate around the time when this study was conducted.

Malaysia responds to the dangers of climate change by putting forward its plan to reduce the greenhouse gas emissions intensity of Gross Domestic Product (GDP) by 45 per cent by 2030, relative to the emissions intensity of GDP in 2005. This reduction consists of 35 per cent unconditionally and another 10 per cent contingent on receiving climate finance, technology transfer, and capacity building from developed countries (Ministry of International Trade and Industry, 2017). There is, therefore, a strong commitment by the national government to improve environmental performance. National level agreements will eventually require organisational-level actions, resulting organisations to come under tremendous pressure to take environmentally sustainable measures (Jabbour and Santos, 2008).

Climate change has become a severe problem with the continuing increase in greenhouse gas emissions. The increase results in rising sea levels, warmer oceans, more intense droughts, and threaten the world's biodiversity. The Third National Communications and Second Biennial Update Report show that the energy sector is the major contributor to greenhouse gas emissions in Malaysia, at 253,000 gigatons of carbon dioxide. This contribution constitutes 80 per cent of

all greenhouse gas emissions (Ministry of Energy, Science, Technology, Environment, and Climate Change, 2017). As such, governments must take serious efforts to address the emissions from the energy sector that contribute to climate change.

One promising area for greenhouse gas reduction is the use of energy-saving appliances (Ministry of Natural Resources and Environment, 2014). Malaysia's energy intensity (energy/GDP) is rising. This rising intensity implies that Malaysia uses more energy to produce goods and services over time. Energy efficiency is an efficient way to address the energy supply security and energy-related environmental issues in the country. In the long run, energy efficiency may lead the country to a sustainable energy future. (Ministry of Energy, Green Technology and Water, 2015).

In Malaysia, the Energy Commission has made it a requirement for refrigerators, air conditioners, washing machines, and freezers to meet the Minimum Energy Performance Standards (MEPS) with effect from 2013. This requirement helps to reduce energy use in Malaysia (Salleh, Roslan, Isa, Nair, and Salleh, 2018) by as much as 3,645 GWh. The residential sector is ranked fourth in consumption after the industrial, transport, and non-energy sectors (Azlina, Abdullah, Kamaludin, and Radam, 2015). It is responsible for 15 per cent of the total energy consumption. Its importance is that emissions from this sector will increase due to increasing population and income. Moreover, there is a heavy reliance of the residential sector on electrical appliances like washing machines, air-conditioners, and refrigerators. Government intervention is therefore necessary. The Malaysian government has decided to promote energy efficiency, including the use of energy-efficient appliances.

However, consumers must buy and use energy-efficient appliances before the country can experience energy savings. This study drew on variables from the theory of planned behaviour (TPB), habit, environmental concern, environmental knowledge, and energy efficiency policy to explain Malaysians' purchase of energy-efficient appliances.

2.0 Literature Review

2.1 Theory of Planned Behavior

This study extended the basic theory of planned behaviour (TPB) by adding several other independent variables that were not

found in the original model developed by Ajzen (1991). The TPB states that individuals make rational choices and that behaviour comes from their intentions. Their intention depends on three variables: attitude towards the behaviour, subjective norms connected to the behaviour, and perceived behavioural control.

The attitude of an individual influences his ultimate choice. For example, a person having a favourable attitude towards energy-efficiency appliances will buy such appliances. Subjective norms (SN) refer to the influence that an individual receives from other important people and how it impacts the individual's decisions. For example, an individual may have friends and relatives who like to use energy-efficient appliances. The SN of these friends and relatives concerning energy-efficient appliances will influence the individual to buy or not to buy such appliances.

Energy-efficient appliances in this study refer to appliances such as air-conditioners, refrigerators, televisions, and chillers. Their energy consumption is measured through the government's Minimum Energy Performance Standards (MEPS). The standard rates and labels of these appliances ranged from one-star to five-star, with one-star the lowest and five-star the highest. Through the various Sustainability Achieved via Energy Efficiency (SAVE) programmes, the government offers rebates to consumers who buy such energy-efficient appliances.

Finally, perceived behavioural control (PBC) refers to the ability of an individual to perform a specific course of action. For example, suppose a person can control the use of energy-efficient appliances. In that case, he is more likely to buy such appliances. Thus, this study hypothesised that the three variables led to the purchase of energy-efficient appliances.

The successful application of the basic model of TPB to the field of environment was well-documented. For example, previous work by Wang, Zhang, and Li (2015) and Wang, Wang, and Guo (2017) on energy consumption behaviour and energy-efficient appliances applied the TPB. Bamber and Schmidt (2003) also used this theory to explain transportation modes. Harland, Staats, and Wilke (1999) found that TPB variables explained other types of environmental behaviour. In addition, in a Malaysian study, Tan, Ooi, and Goh (2017) found that consumers' favourable attitudes towards energy-efficient appliances and PBC influenced their purchase intentions for such products.

Ali, Ullah, Akbar, Akhtar, and Zahid (2019) found that attitude and PBC were significant determinants of intention to purchase energy-

saving household products. Hua and Wang (2019) found that subjective norms, PBC, and attitude significantly affected the consumers' purchasing preferences of energy-efficient appliances. Ofstad, Tobolova, Nayum, and Klockner (2016) also found that PBC and social norms, among others, were essential determinants for recycling behaviour. On the other hand, Li, Li, Jin, and Wang (2019) found that attitude and PBC were critical determinants in purchasing energy-efficient appliances in Shanxi, China.

Based on the above research findings from the TPB, it was therefore hypothesised that:

Hypothesis 1: Attitude has a significant positive impact on purchasing energy-efficient appliances

Hypothesis 2: SN has a significant positive effect on purchasing energy-efficient appliances

Hypothesis 3: PBC has a significant positive impact on purchasing energy-efficient appliances.

In addition, other variables were included in the TPB to provide additional explanatory power.

2.2   Other Variables Used in Study

The fourth exogenous variable included in this study is government policy related to energy efficiency or energy-efficiency policy (EEP). Many studies find that government policies can induce or encourage people to switch to energy-efficient behaviours.

The introduction of energy efficiency policies speeds up the adoption of energy-efficient technologies of various types (Hesselink and Chappin, 2019). Many of these policies are targeted at individuals to adopt energy-efficient measures. These policies can fall into three types. The first type is economical, financial, and market-based such as taxes, loans, rebates, or discounts. The second type is the regulatory approach, which may be in performance standards, prohibitions, or energy efficiency obligations. The third type is the informative and voluntary approach, including awareness-raising, campaigns, energy audit management, environmental awards, and promotions.

Zabaloy, Recalde, and Guzowski (2019) emphasise that energy efficiency policy implementation is highly dependent on a country's context. An enabling framework should include variables such as solid commitment, awareness-raising, price policies, financing access, and favourable macroeconomic conditions. Harmelink, Nillson, and Harmsen (2008) highlight that energy efficiency instruments can be successful only when four factors are in place. First, there must be clear goals and mandates for the implementing organisation. There must also be an ability to balance and combine flexibility and continuity. Furthermore, there must be participation from relevant stakeholders impacted by the policy. Finally, there must be an ability to adapt to and integrate policies or develop consistent policy packages.

Zhang, Wang, Hao, Fan, and Wei (2013) found that the Chinese government's subsidy to consumers to buy hybrid or all-electric, or better-electric vehicles moderated the consumers' willingness to purchase such cars and made their higher prices acceptable. However, the coefficients of the government policies were relatively small (0.084 and 0.161, respectively).

The Malaysian government introduced the National Energy-Efficiency Action Plan, which presents a well-coordinated and cost-effective implementation of energy efficiency measures in the industrial, commercial, and residential sectors to reduce energy consumption and generate economic savings for the consumers and nation.

Under this plan, the Malaysian government utilises standards and labelling to improve energy efficiency in the country. The energy performance of these appliances is measured through the Minimum Energy Performance Standards (MEPS) that rates and labels these appliances from one to five stars, with one star being the lowest and five stars being the highest rating.

On July 7th, 2011, the government introduced the Sustainability Achieved via Energy Efficiency (SAVE) programme. This programme had two objectives. First, it increased the number of energy-efficient appliances in the market. Second, it raised public awareness to purchase such energy-saving appliances to reduce electricity consumption. Through this programme, purchases of refrigerators, air-conditioning, and energy-efficient chillers received a rebate of RM100 to RM200. SAVE was followed by SAVE 2, launched in 2021. SAVE 2 offered rebates of RM200 to consumers of refrigerators and air-conditioners with a four- and five-star rating. Finally, SAVE 3 was

launched in January 2022. It covers more energy-efficient appliances categories: category 1 (air-conditioners and refrigerators) and category 2 (television, washing machine, microwave oven, and rice cooker). Consumers are eligible for a maximum rebate of RM400 on these categories of energy-efficient appliances, with either a four- or five-star rating (Sustainable Energy Development Authority).

Thus, policies encourage people to purchase energy-efficient appliances. Therefore, the hypothesis is that:

Hypothesis 4: EEP positively impacts consumers' purchase of energy-efficient appliances.

The fifth exogenous variable included in this study is the concern for the environment (EC). Environmental concern refers to a specific attitude that directly determines behaviour and, more broadly, to a general attitude or value orientation (Aprille and Fiorill, 2017). The attitude relevant to climate change is altruism, which is a threat to the well-being of people (Shultz, 2000). Therefore, people with altruistic environmental concerns have a higher pro-environmental behaviour (Stern, Dietz, and Kalof, 1993). In their study, Aprile and Florillo (2017) found that altruistic concern regarding climate change led people to the pro-environmental behaviour of saving water.

Tam and Chan (2017) caution that environmental concern does not always translate into pro-environmental behaviour. They point out a concern-behaviour gap due to psychological barriers linked to culture. They discovered in their study that the link between concern and behaviour were weaker in societies characterised by higher levels of distrust, belief in external control, and present orientation. On the other hand, the concern-belief relationship was more robust in societies with higher levels of individualism and looseness. This stronger relationship means that efforts to counter distrust, belief in external control, present orientation, as well as strengthen belief in internal control can raise environmental concern and pro-environmental behaviour.

Jekria and Daud (2016) find that environmental concern acted on attitude to encourage recycling behaviour. However, Ohler and Billger (2014) find that self-interest has a more significant impact on an individual's attitude towards energy consumption than social interest. Thus, if an individual needs to use air-conditioners to be comfortable, this need overrides the social interest to reduce greenhouse gas

emissions. Environmental concern and perceived behavioural impacts do not change this relationship.

Fujii (2006) studied three determinants of pro-environmental behaviour: environmental concern, attitude towards frugality, and ease of behaviour. He found that ease of behaviour had effects on four types of pro-environmental behaviour: reductions in electricity use, reductions in gas use, garbage reduction, and automobile use. In addition, environmental concern had a positive effect only on garbage reduction. In contrast, attitudes towards frugality had an effect on gas and electricity reduction.

Nilsson and Kuller (2000) find that environmental attitudes are more important than factual knowledge in promoting pro-environmental travel behaviour. The two most essential attitude factors are the concern for the environment and car affection (preference for using a car as a travel mode). Kim and Hall (2020) discover that environmental concern significantly moderate the relationships between hedonic and utilisation values and diner behaviour, which means that customers with greater concern for the environment have more enjoyment dining in restaurants with sustainable practices.

Enzler and Diekmann (2019) analysed environmental concern, income, and greenhouse gas emissions in a study in Switzerland. They find that total greenhouse gas emissions are related to higher income and lower environmental concerns. In contrast, emissions by housing are related to income. In contrast, food emissions are related to concern for the environment. Therefore, lower concern for the environment and higher income are both related to less environmentally friendly behaviour.

Environmental concern, environmental knowledge, and perceived behavioural control correlate positively with the willingness to purchase energy-efficient appliances (Li et al., 2019). Overall, it is highly likely that environmental concern contributes to a positive relationship with the purchase of energy-efficient appliances. Thus, the hypothesis is that:

Hypothesis 5: EC positively impacts the purchase of energy-efficient appliances.

The study included a sixth exogenous variable, environmental knowledge (EK). The reporting of mixed findings regarding the relationship between this variable and the purchase of energy-efficient

appliances needs highlighting. For example, Tan, Ooi, and Goh (2017) do not find a significant relationship between environmental knowledge and purchase intention for energy-efficient appliances in Malaysia. Similarly, Gkargkavouzi, Halkos, and Matsiori (2019) do not find any association between environmental knowledge and intentions to perform environmental behaviour. Paco and Lavrador (2012) find that environmental knowledge does not necessarily lead to pro-environmental behaviour.

However, Nguyen, Lobo, and Greenland (2016) find that environmental knowledge has a positive relationship with environmental protection and environmental protection, in turn, affecting the purchase of energy-efficient appliances. Furthermore, Li et al. (2019) find that environmental knowledge positively impacts attitude, which affects willingness to purchase energy-efficient appliances in China. Pothitou, Hanna, and Chalvatzis (2016) find that knowledge of GHG emissions contributes to pro-environmental behaviour. Frick, Kaiser, and Wilson (2004) also find a positive relationship between environmental knowledge and conservation behaviour. However, they mention that the direct effect is negligible. Finally, Liu, Teng, and Han (EK5) uncovered that environmental knowledge contributed to pro-environmental behaviour but only in an indirect way. Thus, the hypothesis is that:

Hypothesis 6: EK significantly and positively impacts the purchase of energy-efficient appliances.

Another significant variable that is not considered adequately in the Malaysian context is habits. A habit develops when an action that is repeated in similar situations by an individual is rewarded by attaining specific goals. For example, if an individual has the habit of going to work by car every day and can reach his office on time comfortably, he will develop the habit of using his car. He will not change this preference of using his car to use a train or bus to his office. Habits free up our limited cognitive resources to actively plan more critical things that require abundant mental resources.

Our habits can significantly impact our environment. For example, suppose we have the habit of not switching off our tap or our air-conditioning. In that case, we consume more water or energy than is necessary and create additional greenhouse gas emissions. Habits are potent forces that automatically govern human behaviours. We do

not think about the adverse environmental consequences due to our habits. Thus, the variables in the TPB represent intended behaviours, whereas habits represent habitual behaviour.

Previous research has documented the impact of habits on the environmental domain. For example, Bamberg and Schmidt (2003) demonstrated that the use of car habits significantly improved the predictive power of the variables in the TPB. Gregory and Leo (2003) found that personal involvement and habits, rather than attitudes, were significant predictors of water usage. In other words, the addition of habits increased the predictive power of the TPB.

Aarts, Verplanken, and Knippenberg (1998) state that frequently performed behaviours are often a matter of habit, limiting the boundaries for the operation of attitude-behaviour models like the TPB. Kurz et (2015) emphasise this point by stating that environmental behaviours are like habits because they are frequent, stable, and persistent. Thus, it would be more beneficial to examine why certain environmental behaviours lead to specific outcomes and to institute measures to change those environmental behaviours. Marechal (2010) reinforce this view by emphasising that people use simple heuristics, like habits, to make energy usage decisions. Secondly, people do not use a lot of cognitive effort as there is little complexity involved. Thirdly, constraints of time and information overload cause people to rely on habits rather than deeply think about energy usage.

Many studies have indicated the additional predictive power of habits above and beyond variables from TPB. For example, Bagozzi (1981) find that the introduction of habit reduces the attitude-behaviour relationship. Budd, North, and Spencer (1984) find that including a self-report measure of past behaviour or habit significantly improves the prediction of one's behavioural intention. Fredricks and Dossett (1983) find that prior behaviour directly influences one's subsequent behaviour and behavioural intentions. There is, therefore, a need to include habits when studying the attitude-behaviour relationship. Thus, the hypothesis is that:

Hypothesis 7: Habits have a significant positive impact on purchasing energy-efficient appliances.

2.3   Habits as a Mediating Variable

Some research exists to support a mediating role of habits in human behaviour. Chung (2015) found that habit strength mediated

attitude, subjective norms, perceived behavioural control, and speeding intention. Tak, Te Velde, Oenema, Van der Horst, Timperio, Crawford, and Brug (2011) found that habit strength mediated the relationship between home environmental conditions and soft drinks consumption. Gregory and Di Leo (2003) found that habitual behaviour mediated the awareness-behaviour relationships in water consumption. Chuang, Chen, and Chen (2018) found that habits mediated the relationship between sustainability values and pro-environmental behaviour. Zhang, Chen, and Li (2020) found that habits partially mediated the effect of environmental concerns on public transportation travel. Meanwhile, Donald, Cooper, and Conchie (2014) discovered that attitude, SN, and PBC indirectly influenced the use of transportation modes through their effects on habits and intention. Therefore, the hypotheses are:

Hypothesis 1A: Attitude significantly affects purchasing energy-efficient appliances mediated by habit

Hypothesis 2A: SN significantly affects purchasing energy-efficient appliances mediated by habit

Hypothesis 3A: PBC significantly affects purchasing energy-efficient appliances mediated by habit

Hypothesis 4A: EEP significantly affects the purchase of energy-efficient appliances mediated by habit

Hypothesis 5A: EC significantly affects the purchase of energy-efficient appliances mediated by habit

Hypothesis 6A: EK significantly affects the purchase of energy-efficient appliances mediated by habits.

2.4 Dependent Variable

The dependent variable in this study is the purchase of energy-efficient appliances.

2.5 Conceptual Framework

Figure 1 shows the conceptual framework of this study.

3.0   Methodology

The researcher sent a structured survey, consisting of two sections, to 200 employees in Kuala Lumpur and Selangor. The first section of the survey form consisted of demographic variables like age, gender, level of education, monthly household income, and household size. The second section contained five-point Likert scale items on the exogenous, mediating, and endogenous variables.

The sampling used was the purposive sample. The survey's electronic link stated that only people with experience purchasing electrical appliances should fill in the survey. The researcher received 153 forms but removed six of them because they were from people who had no experience purchasing household appliances. After their removal, the final number of respondents included in the analysis was 147. This figure of 147 is close enough to the recommended sample size of 153 computed using G Power software for the seven independent variables used in this study (Memon, Ting, Cheah, Ramayah, Chuah, and Cham, 2020).

The researcher took measures from published sources. Higher scores on the Likert scale indicate a higher level of the measured items. The four items on attitude were modified from Li et al. (2019a). The five subjective norms (SN) items were from Hua and Wang (2019) with slight amendments. The three items on perceived behavioural control (PBC) were from Hua and Wang (2019) but were slightly changed. The researcher selected the eight items on habits out of twelve items of the Self-Report Habit Index developed by Verplanken and Orbell (2003). These items measured individuals' habits of purchasing energy-efficient appliances. The three items on environmental concern were adopted from Li et al. (2019) but were slightly adjusted. The items on energy-efficiency policy (EEP) were drafted by modifying Zhang et al. (2013). The items on purchase of energy-efficient appliances were from Nguyen et al. (2016). Appendix A shows the items used to measure the variables in the current study.

3.1   Profile of Respondents

There were 78 females (53.1 %) and 69 (46.9 %) males in the sample. The mean age of the respondents was 40.86 years. The levels of education were as follows: 39 (26.5 %) possessed a diploma, 26 (17.7 %) had a first degree, 59 (40.1 per cent) had a master's degree, and 23 (15.6 %) had a PhD. The average household size was four, and

the monthly household incomes were as follows: Fifty (34 %) were in the less than RM5,000 category; 49 (33.3 %) were in the RM5,001 to RM8,000 category; 29 (19.7 %) were in the RM8,001 to RM11,000 category, and 19 (12.9 %) were in the more than RM11.001 category. Approximately 59 per cent of the respondents were the heads of their households. All respondents had purchased household electrical appliances before.
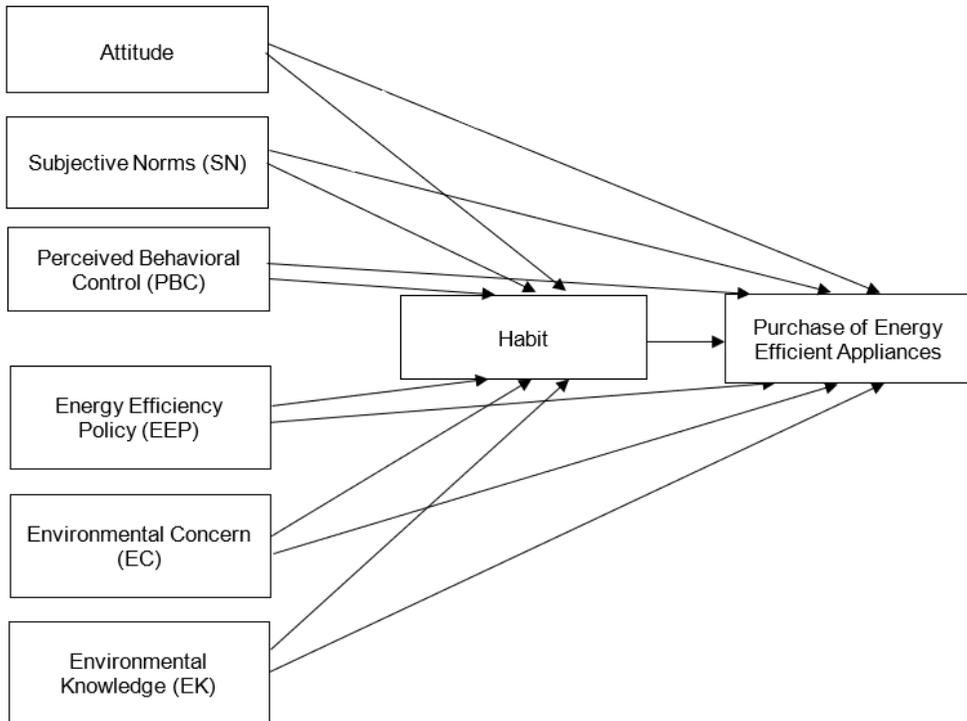

Figure 1 : Conceptual Framework

3.2 Measurement Model

Data analysis was done with SMART-PLS in two stages: first with the measurement model and then the structural model. The main objective of the measurement model was to establish the reliability and validity of the data used in the study. There were three primary assessment criteria in the measurement model for reflective indicators: internal consistency reliability, convergent validity, and discriminant validity. Convergent validity means that indicators of a reflective construct should come together. It comprises factor loadings and average variance extracted (AVE).

The factor or outer loadings, which show the consistency of variables measured, are shown in Table 1, and researchers recommend values above 0.708 (Hair, Hult, Ringle, and Sarstedt, 2017). Table 1shows the removal of PBC2, H8, EEP2, and EC1 because their factor loadings were 0.449, 0.493, 0.437, and 0.592, respectively. However, indicator PBC 1, with a factor loading of 0.686, was retained as it was close to 0.708. PBC 3 and PBC 4 had factor loadings well above 0.708. The second component of the convergent analysis was the computation of the AVE.

Table 1 : Results of The Measurement Model

Factor	Item	Factor loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
		$(>0.708)^b$	$(>0.50)^b$	$(>0.70)^b$
A	A1	0.848	0.737	0.918
	A2	0.867		
	A3	0.891		
	A4	0.827		
P	P1	0.918	0.841	0.941
	P2	0.912		
	P3	0.921		
EC	EC2	0.757	0.607	0.818
	EC3	0.951		
EEP	EEP1	0.761	0.596	0.875
	EEP3	0.909		
	EEP4	0.910		
	EEP5	0.822		
EK	EK1	0.891	0.851	0.958
	EK2	0.937		
	EK3	0.931		
	EK4	0.930		
H	H1	0.871	0.683	0.944
	H2	0.881		
	H3	0.900		
	H4	0.752		
	H5	0.846		
	H6	0.897		
	H7	0.900		
PBC	PBC1	0.686	0.796	0.765
	PBC3	0.788		

Factor	Item	Factor loading	Average Variance Extracted (AVE)	Composite Reliability (CR)
	PBC4	0.779		
SN	SN1	0.708	0.558	0.863
	SN2	0.766		
	SN3	0.761		
	SN4	0.707		
	SN5	0.791		

Note: A = Attitude; P = Purchase of energy-efficient appliances; EC = Environmental concern; EEP = energy-efficiency policy; EK = Environmental knowledge; H = Habit; PBC = Perceive behavioral control; SN = subjective norms.
[b] Recommended threshold values.

As shown in Table 1 above, the AVE values for this study were more than the recommended which was 0.5 (Hair et al., 2017). Thus, the study has convergent validity. The internal consistency of the variables was measured using composite reliability (CR). Table 1 shows that all values in the current research exceeded the threshold value of 0.7.

Finally, discriminant validity, which is the degree to which variables are unique and do not capture what other variables measure, is measured. The Heterotrait-Monotrait (HTMT) Ratio is the most valid and reliable method to measure discriminant validity. Kline (2011) recommends that values should not exceed 0.85. As can be seen in Table 2, the HTMT results were all below 0.85. Hence, the study had discriminant validity.

Table 2 : Discriminant validity based on HTMT result

	A	EC	EEP	EK	Habit	P	PBC
A							
EC	0.715						
EEP	0.413	0.428					
EK	0.243	0.210	0.155				
Habit	0.348	0.263	0.363	0.482			
P	0.420	0.223	0.410	0.407	0.807		
PBC	0.388	0.494	0.438	0.441	0.541	0.660	
SN	0.605	0.499	0.639	0.157	0.446	0.398	0.473

Having met the requirements relating to reliability and validity, the next step is to conduct a structural model to test the hypotheses of the study.

3.3 Results of the Study

3.3.1 Direct Effects

A structural model showing the relationships among the exogenous, mediating, and endogenous variables was estimated using SMART-PLS. Table 3 shows the results. This step tested hypotheses 1 to 7, which were the direct effects.

Table 3 : Results of Hypotheses Tests (Direct Effects)

Hypotheses	Path	Path Coefficient	Results
Hypothesis 1	A ➡ P	0.187*	Supported
Hypothesis 2	SN ➡ P	-0.086	Not Supported
Hypothesis 3	PBC ➡ P	0.218**	Supported
Hypothesis 4	EEP ➡ P	0.107^c	Not supported
Hypothesis 5	EC ➡ P	-0.139*	Supported but sign reversed
Hypothesis 6	EK ➡ P	-0.008	Not Supported
Hypothesis 7	H ➡ P	0.647***	Supported

Note: *** <0.001 ** <0.01 *<0.05. ^{c}p-value of 0.057. P – purchase of energy-efficient appliances.

Table 3 shows that attitudes (A), perceived behavioural control (PBC), environmental concern (EC), and habits are significant direct predictors of the purchase of energy-efficient products (P), explaining 65.4 per cent of the variance in P. There was support for hypotheses H1, H3, H5, and H7. In terms of direct effects, habits were the most influential predictor of the purchase of energy-efficient appliances. Thus, people who have positive habits relating to the environment are more likely to buy energy-efficient appliances. Apart from habit, attitudes, environmental concern, and perceived behavioural control also significantly affect the purchase of energy-efficient appliances. As found in many previous studies, the research findings for attitudes and perceived behavioural control, in the current study, were not surprising. The study points out the importance of including both habitual and intentional elements in understanding the purchase of energy-efficient appliances.

However, the relationship between environmental concern and the purchase of energy-efficient appliances is negative, which is unexpected and deserves closer scrutiny. Studies including those by Gaspar and Antunes (2011) in Europe and by Nor, Lokhman, Syed, and Abdullah (2015) in Malaysia demonstrated the positive

relationships between environmental concern and preference for environmentally friendly products. On the other hand, in a Malaysian study, Tan et al. (2017) do not find any significant relationship between environmental concern and energy-efficient appliances. Therefore, people who have environmental concerns may not translate them into purchasing decisions.

Ohler and Billger (2014) support this view as they find that environmental concern does not lead to pro-environmental behaviour. Instead, people's self-interest influences them to have pro-environmental behaviour. People may be concerned about environmental issues. However, their concern may go against their self-interest; for example, they have to pay more to purchase energy-efficient appliances, but they may not do so. Indeed, in a Malaysian study, Teo and Wan (2014) found that higher prices deterred people from buying green products. Furthermore, Zainudin, Siwar, Ah Choy, and Chamhuri's research (2016) found that Malaysians with higher income were unwilling to pay more for energy-efficient air conditioners.

Hashim and Woon (2014) showed a positive relationship between environmental concern and people's self-interest in the form of savings from energy usage due to pro-environmental behaviour. In other words, environmental concern alone may not be sufficient to lead to environmental action as self-interest must also be present.

Another significant finding from this study was that energy-efficiency policy reached a significant direct effect, with a p-value of 0.057. Research has shown that the energy-efficiency policy plays an essential role in environmental behaviour in countries like China (Zhang et al., 2013; Hua and Wang, 2019; and Wang, Sun, Wang, and Zhang, 2019). Malaysia must make more efforts to design effective energy-efficiency policies. There is a need to encourage pro-environmental behaviours through continuous public policy actions in various ways, such as offering subsidies, setting standards, and providing information. Such efforts cannot be done only for short periods but must be continuous to be effective; thus, hypotheses H1, H3, H5, and H7. However, hypotheses H2 and H6 were not supported.

3.3.2 Indirect Effects

The mediated or indirect effects are shown in Table 4. The table demonstrates that habits positively mediate subjective norms (SN), perceived behavioural control (PBC), and environmental knowledge

(EK) to purchase energy-efficient appliances. Therefore, hypotheses H2A, 3A, and 6A were supported.

Table 4 : Results of Hypotheses Tests (Indirect Effects)

Hypotheses	Path	Path Coefficient	Results	C.I
Hypothesis 1A	A ➡ H ➡ P	0.039	Not Supported	(-0.086, 0.143)
Hypothesis 2A	SN ➡ H ➡ P	0.151*	Supported	(0.036, 0.284)
Hypothesis 3A	PBC ➡ H ➡ P	0.118*	Supported	(0.013, 0.223)
Hypothesis 4A	EEP ➡ H ➡ P	0.061	Not supported	(-0.039,0.167)
Hypothesis 5A	EC ➡ H ➡ P	-0.031	Not Supported	(-0.119, 0.057)
Hypothesis 6A	EK ➡ H ➡ P	0.221***	Supported	(0.119, 0.331)

Note: *** <0.001 ** <0.01 *<0.05.   ᶜp-value of 0.057. P – purchase of energy-efficient appliances.
Mediating variable – habit. C.I. – confidence interval.

The mediated or indirect effects results show that subjective norms and environmental knowledge, which did not demonstrate significant direct impacts on purchasing energy-efficient appliances in paragraph 3.3.1, are now significant. Therefore, hypotheses H2A and 3A are supported.

This finding indicates that only people with the habit of buying and using energy-efficient appliances will be influenced by others who use such appliances to buy them. Secondly, only people who have environmental knowledge and the habit of buying energy-efficient appliances will be influenced by policy to buy energy-efficient appliances. The preceding two findings point to the need for increased environmental knowledge among Malaysian consumers on the urgency of energy-saving and conservation. They will be discussed further in section 5.

Finally, habits mediate perceived behavioural control (PBC) and the purchase of energy-efficient appliances. But the current study found that the coefficient reduced from 0.218 in the direct effect to 0.118. This reduction is because perceived behavioural control (PBC) is a planned behaviour, which is different from habits, which is an automatic behaviour. So, PBC's effect is diluted through interaction with habits.

Hypothesis 1A was not supported. While the direct effects of attitudes (A) on the purchase of energy-efficient appliances were

significant, the introduction of habits as the mediator weakens the relationship so the relationship is no longer significant.

Hypothesis 4A was also not supported. The energy-efficiency policy has not successfully impacted habits, which is not surprising because habits are difficult to change and require more work. It also means that changes to the policy must be made. Finally, hypothesis 5A was not supported because the interaction between environmental concern and habits is not significant.

4.0   Discussion and Conclusion

This research's most important theoretical contribution demonstrates that habits, attitudes, perceived behavioural control, and environmental concern directly impact the purchase of energy-efficient appliances. Habits are the most critical direct independent variable, with a beta coefficient of 0.631 and significant at the p-value of <0.001, followed by perceived behavioural control, attitudes, and environmental concern.

Furthermore, habits are also a mediator that mediates the relationship between subjective norms and purchasing of energy-efficient appliances, as well as environmental knowledge and the purchase of energy-efficient applianceshabits is crucial because only a few studies in Malaysia gives attention to habits in explaining the purchase of energy-efficient appliances.

Overall, the direct and mediated impacts of habits, attitudes, perceived behavioural control, and environmental concern explain 65.4 per cent of the variance in purchasing energy-efficient appliances. While habit and non-habitual variables explain the purchase of energy-efficient appliances in Malaysia, habits are more important.

However, identifying the essential factors in energy-saving is only the first step. More important are the policy changes that the government must put into place to ensure that energy efficiency can become a reality in Malaysia. The finding in this study indicates that the energy-efficiency policy is almost significant, with a p-value of 0.058.

This finding means that while the government has taken action, it must do more to refine and improve the policy to help accelerate the penetration of energy-efficient appliances in Malaysia. Moreover, such action must be continuous and done over a long time to break habits that do not support the purchase of energy-efficiency appliances (Verplanken and Aarts, 1999). There are three principal policy instruments that the Malaysian government should rely on to promote

and diffuse energy-efficient appliances. They are standards and labelling, incentives and subsidies, and information-sharing and training.

The Malaysian government implemented standards and labelling in 2011 when it introduced the National Energy-Efficiency Action Plan. Moreover, it also introduces incentives in the form of rebates to consumers who buy energy-efficient appliances and consumers receive information on the benefits of energy-efficient appliances. However, implementing these policy instruments requires deeper scrutiny to ensure effectiveness.

As far as consumers are concerned, there should be a deeper understanding of energy efficiency in ensuring the country's future. Providing information on energy labels and standards alone is not enough. Consumers should know how to calculate their savings to buy and use energy-efficient appliances. At present, consumers hesitate to purchase energy-efficient appliances as they cannot calculate the savings that will accrue to them in the future because of their purchase. Moreover, the high prices of energy-efficient appliances block their vision, so they pay more in the long run.

The provision of different types of information to different sub-groups is also another point that needs to be considered when government agencies do awareness-raising sessions. Different types of groups require different types of information. For example, those groups attending the briefing for the first time may require basic information on the design and workings of the standards, labels and rebates. But those that have participated in earlier sessions might be more interested in calculating their savings over the life of the appliance.

The government could also consider a more proactive intervention than is being practised now. For example, after discussions with housing developers and buyers, the government may want to make it compulsory to fit all new housing projects with energy-efficient appliances. The government too should simplify the process of granting rebates to consumers as it involves making claims. Instead, the rebate should be deducted at the point of sale.

Furthermore, any successful effort to teach pro-environmental behaviours must start when people are still young. Therefore, educational systems have a critical role in preparing citizens to become stewards of the environment. Every Malaysian must be fully conscious of the crucial role of environmental sustainability in the country's future.

However, Malaysians focus more on bread-and-butter issues than those on environmental sustainability. As a result, progress on energy efficiency will be slow without adjustment to the new paradigm that sees the economy as a part of the environment. Thus, teaching Malaysians to be more pro-environmental in their lifestyles through techniques such as implementation intentions which include a concrete plan on when and where to perform the intended behaviours ("Next time I want to change my refrigerator, I will buy an energy-energy refrigerator") (Gollweitzer, 1996).

Retailers and manufacturers of energy-efficient appliances must also be involved in any exercise relating to energy efficiency. This partnership approach ensures that all parties that have a role in promoting energy-efficiency can give their constructive inputs and remove any barriers to implementation. For example, the government could conduct special briefing sessions for retailers on energy efficiency and supply them with brochures that can assist them in marketing energy-efficient appliances to consumers.

The government must also ensure that manufacturers of energy-efficient appliances produce more high-quality energy-efficient products. The government should also ensure that manufacturers price their appliances appropriately so that consumers would find that buying such products is attractive compared to less energy-efficient appliances. Discussions could also focus on phasing out less energy-efficient appliances, including the use of taxes.

Another important role by the government is by providing research grants and low-interest loans for energy research to accelerate the development of energy-efficient technologies. The government could collaborate with universities, research centres, energy consultants, and manufacturers to provide such grants.

Government agencies involved in energy efficiency should also monitor and evaluate their programmes to know their strengths and weaknesses. Therefore, budgets should be made available for such monitoring and evaluation programmes to improve the quality of the delivery of government services in Malaysia.

There are some limitations to this study. First, the researcher surveyed only respondents in Kuala Lumpur and Selangor. Their purchasing of energy-efficient appliances may be different from those in other states. Further studies may therefore consider covering the whole country.

It would also be beneficial to conduct a longitudinal study to produce more robust results. Furthermore, research on energy-efficient appliances should attract more interest because Malaysia needs to address its increasing greenhouse gas emissions. Therefore, energy efficiency in energy usage has an important role. Comparing the results of energy efficiency for Malaysia with other countries would also help provide guidance in improving energy usage.

Finally, future researchers can include other variables not included in this study. For example, future studies can include the role of technology, culture, perceived usefulness, and ease of use to increase the explanatory power of the models relating to this study.

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Appendix A

The measurement of variables is based on the use of 5-point Likert scale items shown below, with 1 the lowest and 5 the highest.

<u>Purchase of energy-efficient appliances</u>

(i)   I have bought energy-efficient appliances.
(ii) I have switched to energy-efficient appliances.
(iii) I have used energy-efficient appliances.

<u>Attitudes</u>

(i)   Reducing the use of energy is important.
(ii) Reducing the use of energy is beneficial.
(iii) Reducing the use of energy is useful.
(iv) Reducing the use of energy is urgent.

<u>Perceived behavioural control</u>

(i)   I have a good understanding of new functions of energy-efficient appliances.
(ii) I can afford to buy energy-efficient appliances.
(iii) I can overcome problems in using energy-efficient appliances.
(iv) It is pleasant to use energy-efficient appliances.

<u>Subjective Norms</u>

(i)   If important people use energy-efficient appliances, I would use them more often.
(ii) If my family and friends use energy-efficient appliances, I would use them more often.
(iii) If people around me use energy-efficient appliances, I would use them more frequently.
(iv) Using energy-efficient appliances is socially acceptable.

Environmental concern

(i)   When nature is disturbed by human beings, there will be negative consequences.
(ii) Human beings must live in harmony with nature in order to survive.
(iii) The natural balance of the environment is fragile and vulnerable to damage.

Environmental knowledge

(i)   I know methods to reduce the lighting load in my office and house.
(ii) I know methods to reduce the plug load in my office and house.
(iii) I know methods to reduce the cooling load in my office and house.
(iv) I know methods to reduce the heating load in my office and house.

Habit

(i)   I use energy-efficient appliances frequently.
(ii)   I use energy-efficient appliances automatically.
(iii) I use energy-efficient appliances without having to consciously remember.
(iv)   I feel weird if I do not use energy-efficient appliances.
(v)   I use energy-efficient appliances without thinking.
(vi)   I have used energy-efficient appliances for a long time.
(vii) Using energy-efficient appliances belongs to my usual routine.
(viii) I have no need to think about using energy-efficient appliances.

Energy-efficiency policy

(i)   I am aware of the policies on energy-efficient appliances.
(ii) I became aware of the energy-efficiency policies through various channels, including the mass media.
(iii) The energy-efficiency policies are generous.
(iv) The energy-efficiency policies strongly promote energy-efficient appliances.
(v)   The energy-efficiency policies are efficient in promoting the use of energy-efficient appliances.
(vi) The energy-efficient policies are necessary to encourage sales of energy-efficient appliances.