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**MIND THE GAP: HOUSEHOLD'S KNOWLEDGE AND ACTION
IN ENERGY EFFICIENCY BEHAVIOUR**

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ABSTRACT

This objective of paper is to identify the relationship between environmental knowledge and action among Malaysian households. This body of work therefore aims to develop a perspective theoretically grounded in a more dialectical understanding of the relations between household's knowledge and action toward buying energy efficient products in Malaysian market. A cluster sampling method was employed. A total of 500 face to face interviewed questionnaires were distributed in the shopping area and electrical shops in two regions in Peninsular Malaysia. In total, 392 usable Malaysian consumer responses were collected and used for analysis. The reliability test on all these constructs produce satisfactory reliability coefficient. Results of structural equation model indicate that there are significant relationships among these constructs. The result shows perceived advantages of products, subjective norm and responsibility are significantly related through the mediating effect of attitude. It is hoped that the findings and discussion will contribute to the theory of consumer behaviour, as well as to offer insightful knowledge for practical consideration.

Keywords: Energy efficiency, household consumers, environmental concern, attitude, energy conservation.

1. Introduction

Environmental threats are alarming local governments and citizens. The environment is impacted in many ways, both directly and indirectly, from energy consumption and production. The consequences of climate change are uncertain, but potentially catastrophic. According to the Energy Information administration, energy production emits approximately 40 percent of American emissions of total carbon dioxide, a greenhouse gas (USEPA 2011). Air pollution leads to adverse health effects, especially in vulnerable populations. Energy is generated by burning coal and other fossil fuels. Household consumer sector has a potential to reduce the energy consumption by 25 to 30 percent a year (USEPA, 2003). Energy inefficiency occurs when energy is wasted in its dissemination or its use. Wasted energy means wasted fossil fuels, materials that are difficult to extract and produce. Most important to consumers,

wasted energy translates into wasted money. Thus promoting energy efficiency may be a successful strategy to increase financial stability. Consumers benefit from reduced spending on energy, but may be uninformed about these benefits, unable to take advantage of them, or unwilling to make the investment. Breaking these barriers to energy efficiency is a challenge for energy efficiency advocates and marketer. In a local context, Malaysia aspires to become high income nation with worldwide importance, its environmental quality lags far behind its western counterparts. Like many Asian countries, Malaysia suffers from dangerously high levels of air pollution, water quality and energy resources. Recently the government of Malaysia have started to realize the seriousness of the environmental threats and health problems which result to force green behaviour (ST, 2013). Emerging markets for environmental products and technologies in Malaysia mean promising opportunities for international green marketing. Therefore, there are concerned from government, business and non-profit organization with improving energy efficiency in Malaysia. However, people who most need these services often do not take advantages of them.

Study conducted by the United Nations Development Program (UNDP) found that major barrier to acceptance of energy efficient products in most countries are the lack of consumer knowledge on techniques or innovation as well as energy efficiency benefits from economic aspects (UNDP 2006). Shahnaei (2012) also support that low levels of acceptance of green innovation product were due to lack of knowledge and awareness on the innovation itself. This was seen as a primary reason for consumers in terms of green purchases especially in developing countries. Both studies agree with Roger (2003) which found knowledge as an important step of innovation acceptance. His study shows that the process of acceptance of innovation products occurs by involving several cognitive stages beginning with knowledge, persuasion or assessment, decision, implementation and confirmation. Then, knowledge usually depends on several factors such as socio-economics, personality, behaviour and communication. Knowledge level is the basic step and foundation that helps individual s in the decision making process to accept or reject innovation.

However, earlier behavioural study shows that knowledge alone cannot make one change to pro-environmental behaviour. Blake (1999) in his study found that there was a gap between the level of knowledge with the user's actual action or behaviour on environmental goods. Although users have good environmental awareness and knowledge, users are still not applying green action because of the inherent obstacle factors in the form of individual barriers (time, money, laziness and lack of interest), social barriers (less trust to new product) or institutions barriers (information and difficult of obtaining products). *The Natural Steps* (TNS) in 2008 found that 60 percent of respondents were asked and be aware of the deterioration of environmental quality in Malaysia, but they are still not ready to adopt environmental friendly lifestyle such as car-pooling and recycling in the reality of their daily lives (Wahid et al. 2011).

Several models have been used over the past decades to gain a better understanding of the factors of engaging in green buying behaviour. The theory of planned behaviour (TPB) (Ajzen, 1985; Ajzen 1991) is one of the major predictor theory used in research on green behaviour. The TPB suggests that the important determinant of behaviour is individual intention to engage in behaviour, with intentions being determined by three variables which are attitudes, subjective norms and perceived behavioural control. Attitudes refer to the overall evaluations, either positive or negative, toward performing the behaviour. Subjective norms are the perceived social pressure such as friends, peer and family to perform or not to perform the behaviour. Perceived behaviour control refers to the amount of individual's control on ability to perform the behaviour. It also appears in earlier environmental studies based on behavioural theories such as theory of reasoned action (TRA) and technology acceptant model (TAM) that found significant behavioural characteristic on individual behaviour. TAM developed by Davis (1993) states that individual's innovation usage is determined by behavioural intention. Behavioural intention then is

determined by his attitude toward the behaviour, and this in turn is determined by two beliefs which are perceived usefulness and perceived ease of use. In this study, consumers' perception on product advantages was based on perceived usefulness in TAM model which defined in this study as the extent to which a person believes that using an energy efficient products would give an advantages to individual, societies and environment. The last factor of responsibility was added to the proposed model to test how a person feels responsible for buying energy efficient products. In regard to energy efficient products, Ha and Swinder (2012) found the important of attitude on consumer decision toward energy efficient products. With the used of theory of reasoned action, this study suggest that the important of attitude compared to subjective norm in motivate consumer buying behaviour. Findings of this study also include the factor of consumer's perception about the product advantages, which found positively related to the level of buying decision.

Thus, this paper was designed to have better understanding on what motives consumers to make buy energy efficient products and what discourages them from doing so as the first step in promoting green buying. Therefore study aim to have a better understanding on consumer acceptance on energy efficient products which specifically stated as follows:

To identify the level of consumer's knowledge on energy efficient products.

To explore behavioural factors that may influence consumer's intention to buy energy efficient products.

To determine the relationship between consumer's knowledge and intention to buy energy efficient products.

2.0 Methodology

2.1. Subjects and Procedures

A total of 416 structured questionnaires were collected from users and non-users of energy efficient products. Survey was conducted in the six urban areas in Malaysia, Kuala Lumpur, Putrajaya, Shah Alam, Kuantan, Kuala Terengganu dan Kota Baharu. These urban areas were chosen because their residents have more exposure for energy efficient products than those residents in the rural parts of Malaysia. After excluding some of questionnaires that were not completed, 392 usable data sets were entered for data analysis which 49 percent were male and 51 percent were female. The mean age of respondents was 41.3 years and most (69.6 percent) had married. In total 29 percent of respondents indicated their gross income was between RM1,501 and RM3,000. The distribution of highest educational level attained showed 35.5 percent had completed secondary school, 53 percent had completed a college or university degree, and 8 percent had attained a master or more higher education level.

2.2. Measures

For all measures, a 6-point Likert scale was used with the anchors ranging from strongly disagree (1) to strongly agree (6). To fulfil the goal of obtaining the behavioural characteristics in explaining buying decision of consumers, the expert elicitation literature was reviewed. Table 1 shows the set of instrument used in this research. As mentioned in the above section, the study aims in exploring factors which contributes to buying energy efficient products by the Malaysian household. Therefore, the regression model was used to provide empirical evidence on the second objective of this study. The dependent variable is the consumer's buying intention (BI) and the independent variables of interest include perception on product advantages, attitude, subjective norm, perceived behaviour control negative, responsibility and personal norm. Equation (1) below is the full regression model utilized in this study.

$$INT_{it} = \beta_0 + \beta_1 PADV_{it} + \beta_2 SNORM_{it} + \beta_3 PBCN_{it} + \beta_4 RESP_{it} + \beta_5 ATT_{it} + \varepsilon_{it} \quad (1)$$

Where:

INT_{it}	=	Consumer intention to buy energy efficient product i at time t
$PADV_{it}$	=	Perceived product advantages
$SNORM_{it}$	=	Subjective norm
$PBCN_{it}$	=	Perceived behavioural control negative
$RESP_{it}$	=	responsibility
ATT_{it}	=	Attitude
ε_{it}	=	is error term for this regression model

3.0 Findings and discussion

Analysis of consumer knowledge on energy-efficient products in the market found 63.3 percent knowing about products (Table 1). While the rest say never heard about energy-efficient products. For respondents who know about energy-efficient products, some have been given a picture of their understanding of the product as classified to the following themes:

..energy efficient products as saving their electricity.

..energy efficient products can reduce the energy used by individual.

Consumer knowledge about energy-efficient labels in the market is important in an effort to increase consumer awareness of the availability of energy-efficient products in the market as well as product advantages to consumers. The survey found that 53.1 percent of consumers had seen the ENERGY STAR label and only 42.9 percent of consumers knew about energy efficiency labels issued by the Energy Commission of Malaysia (EE ST).

Table 1: Knowledge on energy efficient products

<i>Do you know about energy-efficient products?</i>	<i>Frequency</i>	<i>Percent</i>
Yes	248	63.3
No	144	36.7
Total	392	100

<i>Do you know about energy-efficiency (ENERGY STAR) label?</i>	<i>Frequency</i>	<i>Percent</i>
Yes	208	53.1
No	184	46.9
Total	392	100

<i>Do you know about energy-efficient (ENERGY EFFICIENT- MALAYSIAN) label?</i>	<i>Frequency</i>	<i>Percent</i>
Yes	168	42.9
No	224	57.1
Total	392	100

AMOS 20 was used for test measurement quality. Based on the previous study in structural model (Iravani et al., 2012) in testing construct validity, construct reliability and discriminant validity, study suggest that for a good model fit, there are some indicators have to achieved certain values such as the value of chi-square normalized by degrees of freedom (χ^2/df) should not exceed 3, comparative fit index (CFI), goodness of fit index (GFI), non-normed fit index (NNFI) all should exceed 0.9 and root mean squared error (RMSEA) should not exceed 0.08. Analysis from confirmatory factor analysis (CFA) shows

result of the measurement model indicated a good fit to the data. The CFI estimate was 0.949, RMSEA estimate was 0.055, indicating that the fit is good because the RMSEA is the least affected by sample size (Hair et al., 2006). Similarly, the NFI estimate was 0.911 and p-value were 0.001 which further supports the adequacy of the measurement model.

Table 2: Details of the measures and results of CFA for measurement model

Measure	Mean	SD	Factor Loading	CR	AVE
<i>Perception on Product Advantages (PADV) ($\alpha = 0.64$)</i>				0.81	0.59
Buying energy efficient products is trendy.	5.09	0.94	-a		
Energy efficient products is good for the environment	5.01	0.99	0.69		
Energy efficient products help to save resources	4.93	0.98	0.84		
Energy efficient products have a better quality.	4.68	1.08	0.77		
<i>Subjective Norm (SNORM) ($\alpha = 0.79$)</i>				0.86	0.56
My family encourage me to buy ENERGY STAR products	4.12	1.50	-a		
My friends suggest me to buy ENERGY STAR products	3.96	1.56	0.74		
The government suggests me to buy ENERGY STAR products	3.77	1.51	-a		
Mass media recommends me to buy ENERGY STAR products	4.03	1.42	0.62		
Green society suggests me to buy ENERGY STAR products	3.68	1.41	0.91		
I like to share information regarding environmental products with my friend	4.02	1.45	0.72		
I like to share information regarding environmental products with my family members.	4.18	1.44	0.73		
<i>Perceived behaviour Control Negative (PBCN) ($\alpha = 0.74$)</i>				0.88	0.72
I believe the green concept is a trend that will wear away with time	3.13	1.58	0.84		
Energy efficiency products have fewer choices.	3.06	1.66	0.87		
Buying energy efficiency products can be easily cheated by the manufacturers.	3.11	1.68	0.83		
<i>Responsibility (RESP) ($\alpha = 0.71$)</i>				0.79	0.56
It is very important to raise environmental awareness among Malaysian.	5.24	1.07	-a		
We need more government regulations to force people to protect the environment	5.23	1.02	0.72		
Malaysia's environmental problems are worsening.	5.27	0.98	-a		
I strongly agree that more environmental protection works are needed in Malaysia.	5.15	1.04	0.78		

(continued)

Global climate change will have a noticeably negative impact on the environment in which my family and I live.	4.70	1.18	0.74		
Environmental protection start with me	5.16	1.23	-a		
I am always look for the eco-label before buying a product	4.41	1.31	0.74		
I do not care about the risks on environmental problems.	3.99	1.91	-a		
I think if I carry out some pro-environmental behaviors in may everyday life, I would contribute a lot to our environment.	5.09	1.04	0.73		
I am trying to improve the environmental quality in Malaysia	4.49	1.22	0.72		
I would switch off electronic appliances when not in use.	4.89	1.13	0.69		
<i>Intention to buy (INT) ($\alpha = 0.65$)</i>				0.68	0.42
I used to buy energy efficiency products, but do not buy them recently.	4.07	1.50	0.62		
I will purchase energy efficiency products when the prices are comparable with the conventional products.	4.56	1.26	0.64		
I will buy products that are environmentally-friendly.	4.94	1.00	0.68		

Note: Composite Reliability (CR) = (square of the summation of the factor loading) / {(square of the summation of the factor loadings) + (summation of error variances)}. Average Variance extracted (AVE) = (summation of the square of the factor loading) / {(summation of the square of the factor loadings) + (summation of error variances)}.

As shown in Table 2, the reliability was assessed using the composite reliability (CR) value. All the CR values were above 0.68 indicating sufficient reliability of the measurement used. As suggested by previous literature (Iravani et al., 2012; Zainudin, 2012) if all factor loading exceed 0.6 and the average variance extracted (AVE) for each construct exceeds 0.5 then we can conclude that convergent validity has been established. The internal reliabilities of the measures in this study were assessed using Cronbach's alpha coefficients. The result in Table 2 shows that the alpha values ranged from 0.64 to 0.79, which above the acceptable threshold. Analysis on data validity suggested that satisfactory discriminant validity when the AVE of a particular construct is greater than the correlation shared by that particular construct with other construct in the model. Hair et al. (2006) asserted that convergent discriminant is established when a diagonal elements (square root of the variance extracted) are greater than the off-diagonal elements (correlations among constructs). Refer to Table 2, we can conclude that the construct validity of the scale is high. Analysis on data validity suggested that satisfactory discriminant validity when the AVE of a particular construct is greater than the correlation shared by that particular construct with other construct in the model. Convergent discriminant is established when a diagonal elements (square root of the variance extracted) are greater than the off-diagonal elements (correlations among constructs). Refer to Table 3, we can conclude that the construct validity of the scale is high.

Table 3: Discriminant validity

Construct	1	2	3	4	5	6
1. INT	0.68					
2. PADV	0.59	0.81				
3. SNORM	0.45	0.36	0.86			
4. PBCN	-0.05	-0.04	-0.25	0.88		
5. RESP	0.32	0.25	0.18	0.01	0.79	
6. ATT	0.50	0.33	0.33	-0.02	0.65	0.81

Note: diagonal element (in bold) are the square root of the average variance extracted (AVE). Off-diagonal elements are the correlation among the constructs.

A hierarchical multiple regression analysis was conducted by entering four variables (PADV, SNORM, PBCN and RESP) in Model 1 and the five predictors in Model 2. Results presented in Table 4 shows that in first step of analysis (M1) three variables which is perception on product advantages (PADV: $b=0.57$, $p<0.001$), subjective norm (SN: $b=0.30$, $p<0.001$) and responsibility (RESP: $b=0.13$, $p<0.001$) were found significantly related to the intention to buy, whereas perceived behavior control negative (PBCN) shows not significant to buying decision. This multiple regression analysis shows that all the behavior characteristics variables accounted for about 67 percent of the variance in buying behavior (INT).

In Model 2, it was found that PADV, SN, RESP and ATT are also significant related to consumer buying behaviour (ATT: $b=0.48$, $p<0.001$) which increase variance to 76 percent. The predictability of the five predictors on intention to buy energy efficient products behaviour was in the following descending order: perception on product advantages, attitude, subjective norm, responsibility and personal norm.

Table 4: Hierarchical multiple regression of five environmental predictors on energy efficient purchasing behaviour

Variables	Intention to buy	
	Model 1	Model 2
	B	
Perception on Product Advantages (PADV)	0.57***	0.50***
Subjective Norm (SNORM)	0.30***	0.24***
Perceived behaviour Control Negative (PBCN)	-0.08	-0.07
Responsibility (RESP)	0.13*	-0.22*
Attitude (ATT)	-	0.48***
R^2	0.67	0.76

Based on descriptive analysis of consumer acceptance of energy-efficient products, analysis found that from a total of 392 users 50.5% had purchased energy-efficient products (Figure 1). Of these, 79.3 per cent stated 'YES' to continue to use energy-efficient products in the future. Only a small number of those who did not continue were 12.1 percent. This number shows a very good percentage of confirmation to buy energy efficient products in the future for users who have used energy-efficient products. This value shows that the individual experience on product is important in promoting the use of energy-efficient products. An individual's good experience with the product will further encourage individuals to buy and use the product in the future. For users who refuse, analysis shows that 70.1 percent is postponed (received later). This means that even though they did not buy energy efficient products at the moment but they intend to buy in the future. The 70 percent estimate is regarded as a "long-awaited" that requires continued persuasion and evaluation of consumers to buy and use energy-efficient products in the future. Here is the need for four elements outlined by Rogers (2003), namely innovation, communication channels, time and social systems. The energy-efficient product innovation itself needs to be created with real functions and roles in energy saving and thereby enhancing product-friendly features to the environment and consumers.

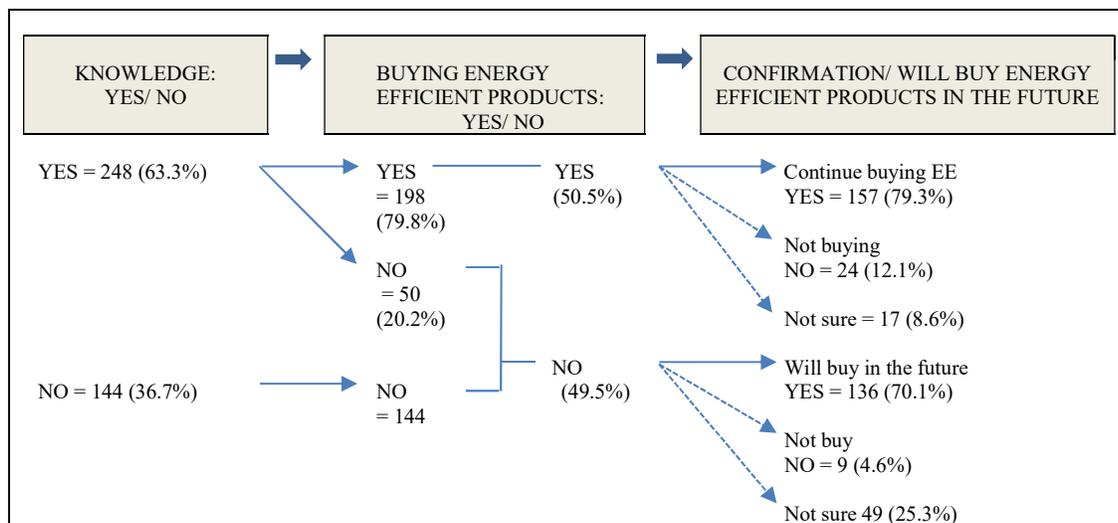


Figure 1 Consumer intention to buy energy efficient products

4.0 Conclusion

Among the six predictors, perceived product advantages was the most important predictor of households' green purchasing behaviour. This finding has demonstrated the significant of influence of an individual perception on energy efficient products buying behaviour, propensity to search for product information. Subjective norm was found to be the third factors of this behavioural context. This means in the pressure to follow the behaviour of social circle might be particular strong in collective Malaysian culture. The finding suggests that Malaysian green purchasing behaviour is more easily active by emotional involvement (perception on product advantages) than by rational assessment (attitude) even the different was not much different. This study has demonstrate the significant of household perception about the products, therefore producers and marketers who wish to promote energy efficient need to look in this factor to develop a good perception on a products itself. A social support such as family, peers and friends also plays an important role in developing individual behaviour on buying green products. Thus, the result of this study has some important implication for the knowledge and management practices.

The 70 per cent figure has shown that many of the users out there are still in the process of persuading and evaluating the benefits and efficacy of this energy-efficient product. It is therefore not surprising to find out the findings that prove the perceptions of product advantages as the most important factor in influencing purchase intention. Markets are seen as critical in gaining consumer confidence in energy efficient products sold in the market today. Furthermore, the factor of barriers to perception should also be taken into account by producers or policy makers in raising the individual's positive judgment on the effort, convenience or difficulty in obtaining energy-efficient products in the market. Producers need to prove to consumers that the features of the product being described as saving energy and providing long-term returns to consumers are really as stated to provide a surge in consumer acceptance in the future. The neglect of this factor may cause less consumer confidence in purchasing energy-efficient products in the future.

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