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Linkage between Public Policy, Green Technology and Green Products on Environmental Awareness in the Urban Kuala Lumpur, Malaysia

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Abstract

The main purpose of this study is to investigate the factors that have an impact on public policy, green products and technology in Kuala Lumpur, given government initiatives to boost the environment awareness. The data used in this study was collected by distribution questionnaires randomly in six areas of Kuala Lumpur and 400 respondents were interviewed. Based on a literature review, three hypotheses were stated and tested using structural equation modeling (SEM). SEM is a statistical analysis method that involved two or more variables in analyzing structural relationships among the variables. The SEM model shows that green products and government policies have a direct influence on environmental awareness. However, green technology does not have a direct influence on environmental awareness. Since, knowledge on green technology does not have a significant impact on raising environmental awareness among the public, a much more pragmatic awareness campaign needs to be put in place to use green technology as a part of modern living. The study suggests that the urban population needs to be more aware of the environmental issue as cities tend to have better infrastructure to raise public awareness on green issues. Moreover, the government should increase the environmental awareness among younger generation through workshops, seminars, campaigns, and pamphlets.

Keywords: Public Policy, Green Technology, Green Products, Environmental Awareness, Malaysia.

JEL Classification Code: Q50, Q51, Q56.

1. Introduction

Good awareness of environmental issues is important for a healthy natural environment (Patchen, 2006). Many researchers have worked on the environmental issues and awareness. Their findings indicate that there is a strong

relationship between environmental policies, awareness and issues (Masud et al., 2016; Patchen, 2006; Kollmuss & Agyeman, 2002; Doss & Morris, 2001; Huq & Toulmin, 2006). According to Schultz and Oskamp (1996), people's attitude and knowledge on environment issues and awareness are very important to improve the natural environment. Individuals' views on natural environment and surrounding reflect their knowledge on environmental issues. A positive attitude and perception on environmental issues and awareness plays a significant role in conserving the environment (Bradley, Waliczek, & Zajicek, 1999). Environmental awareness is a precondition for understanding the environmental issues. Leiserowitz (2007) studied the environmental awareness, he argued that public perception significantly affects the future environmental policies and development. Likewise, Schmidt (2007) also found that concern for the environment is significant towards environmental preservation.

Malaysia has initiated green initiatives in recent years to minimize the degradation of the environment as well as achieve a sustainable growth. Efforts made by the

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government as well as the private sector in conserving energy and promoting renewable resources have been exemplary. Through the efforts on leveraging the green technology, it is expected that Malaysia will achieve sustainable development and will eventually triumph in accelerating towards a high income nation. However, Malaysia's effort in introducing green technology started back in 2009, where the Malaysian government established the basic foundation for green economy.

In terms of policy perspectives, environmental issues have been given due emphasis since the implementation of Sixth Malaysia Plan (EPU, 1990) in which environmental management was directly integrated into the national development planning as well as the national project. Under the Seventh Malaysia Plan (EPU, 1995) and Eight Malaysia Plan (EPU, 2000), the emphasis on environmental issues continued to be given due emphasis. From the Ninth Malaysia Plan (EPU, 2005) onwards, environmental issues were introduced as one of the main issues. The Seventh Malaysia Plan (EPU, 1995) asserted Malaysia's commitment towards enhancing environmental awareness among the population to promote an environmental friendly lifestyle. The plan stated that the relevant ministries will develop policies, strategies and programs on environmental education, awareness and training. The imparting of knowledge and instilling of awareness is expected to help Malaysians adopt a more environment friendly lifestyle. Environmental ethics and a sense of responsibility will be inculcated and the population will be encouraged to take an active role in the protection and maintenance of the environment.

The private sector, non-governmental organizations, and the media will be encouraged to play a bigger role to complement the Government's efforts in this endeavor. The Seventh Malaysia Plan also proposed the national policy on the environment which aims at promoting economic, social and cultural progress through environmentally sound and sustainable development. Subsequently, under the Tenth Malaysia Plan (EPU, 2010), the New Economic Model also focused on the environmental management in which the principle of sustainable development strategies was the main theme. The sustainability principles were discussed in line with the use of natural resources for a country which intended to enhance national income and achieve high income status by 2020.

This paper attempts to assess the environmental awareness of the general public related to public policy, green product and green technology. Moreover, the rest of this paper is organized as follows; Section 2 discusses the literature review on environmental awareness, green products, green technology and government policy. Section 3 presents the methodology and model specification of the

study. Section 4 analyses the results and Section 5 concludes the study.

2. Literature Review

Environmental awareness influences human behavior in several ways, such as reducing wasteful or harmful consumption patterns and raising preference for environmental friendly products, selective waste collection, or different forms of protest that may represent ecological sensibility. However, Friedman (2008) states that *"the convergence of global warming, global flattening, and global crowding is driving those five big problems – energy supply and demand, petro dictatorship, climate change, energy poverty, and biodiversity loss – well past their tipping points into new realms we've never seen before"*.

Afroz, Masud, Akhtar, and Duasa (2012) conducted a study in public environmental awareness and performance in Kuala Lumpur. The researchers found that 69 percent of the respondents were satisfied with the environmental quality of Kuala Lumpur. On the other hand, Mei, Wai, and Ahamad (2016) found that environmental awareness and behaviour towards the awareness is not positively related. The environmental awareness is not strong enough to positively reflect in the behaviour. Similarly, Liu (2009) found in Tianjin, China that the respondents have very poor understanding on environmental awareness but they showed a positive attitude towards environmental issues.

Fisman (2005) argued that children should be educated in school about the environmental awareness from a very young age. The author also found that there is a significant positive effect on learning about the local environment and knowledge of environmental perceptions. Moreover, environmental knowledge does not have any relation with socioeconomic status of primary school children but there is a significant improvement in the surrounding environment of high school students. Banna et al. (2016) found that not everyone is willing to pay for the environmental friendly technology. Moreover, the adoption and training of using the environmental friendly technology also has a price. Therefore, training to adopt green technology should be a part of corporate social responsibility (CSR) of companies.

Assuming the urban residents may have access to information on green products, this will encourage them to purchase and use green products. Studies have shown that a group of environmentally conscious consumers in more than 80 percent of Thai, Malaysian and Korean consumers from the emerging markets in the region, are willing to pay premium price to purchase green products (Dunlap & Scarce, 1991; Lung, 2010). D'Souza, Taghian, Lamb and Peretiatkos (2006) noted that all products offered should be

environmentally safe without a need to trade off quality and pay premium prices. It has also been stated that the consumers express environmental concerns based on product characteristics, accuracy of green product claims, information provided on the products and its benefits (Forkink, 2010; Luchs, Naylor, Irwin, & Raghunathan, 2010). Barr and Gilg (2006) found that committed individuals put forward a higher importance on environmental issues and develop a high level of environmental concern and express a personal responsibility to help the environment. By clearly stating the benefits of a product on packaging or in advertising, negative perceptions towards an environment friendly product's effectiveness, such as environmental concerns, can be surmounted (Luchs et al., 2010).

In purchase of green marketing products, consumers should have the awareness of the products marketed in green marketing. Companies try to influence each of these decisions by providing information that can assist in the product review. Therefore, it is important for consumers to develop environmental awareness of green products and technology. Previous studies have been conducted on the consumers' perception and attitude towards green products and technology (Cox, 2008; Haytko & Matulich, 2008, D'Souza & Taghian, 2005; D'Souza et al., 2006). Indeed, there has been a substantial research conducted on consumer characteristics (Banerjee, Gulas, & Iyer, 1995; Schlegelmilch, Diamantopoulos, & Bohlen, 1994), yet there is no agreement on the "true" profile of a green consumer (D'Souza et al., 2006). Lee (2008) stated that there are a few studies conducted on the green marketing issues in Asian countries, including Malaysia, as compared to developed countries.

Recent initiatives of promoting green technology and green economy include green manufacturing hub, green infrastructure, low carbon emission, efficient use of resources and a healthy and well educated population. Information technology (IT) can have a detrimental influence on the environmental footprint of organizations (Siegler & Gaughan, 2008). Some of the examples of green information communication technology (ICT) would be the energy saving, disposal of electronic waste, virtualization of server resources, regulatory compliance, telecommuting, end-user satisfaction and return of the investment on the product used (Kounatze, 2009). Green IT plays an important role in environmental sustainability which finally leads to the solution to improved sustainability.

Malaysia has made a strong commitment in implementing its green policy. As reflected in the policy statement, green technology shall be a driver to accelerate the national economy and promote sustainable development. Together with this objective, policies attempt to minimize growth of energy consumption while enhancing economic development.

At the macro level, the green technology and industry is expected to contribute to national economy. Similarly, green technology is expected to be promoted through education and public awareness in order to encourage its use. Under the New Economic Model (2010-2015), green policies were given due emphasis which includes new elements such as reducing carbon foot print, ability to better assess green investment, using non-collateral basic criteria and assessing viability of green technology projects. Moreover, there should be venture capital for green economy and green technology. Based on policy evolution timeframe, Malaysia's environmental planning started off with strong focus on nature conservation (1980-1990), followed by government reforms based on Agenda 21 as seen in the introduction of new instrument and supra structure reforms 1990-2005 and active green investment from 2006 until the present date (EPU, 1990; 1995; 2000; 2005).

3. Research Method

3.1. Site Selection

The target population was defined with respect to the sampling unit of the study. Sample was clustered based on the municipal council represented by Parliamentary zone which includes Ampang, Setapak, Pantai Dalam, Petaling Jaya Utara, Batu, and Putrajaya. The areas were divided into six clusters to capture the diverse groups in terms of race, employment and the overall-socio-economic status. The survey was conducted from January 2016 to April 2016. Randomness of the survey was based on alternating working days versus weekends to carry out the survey among potential respondents. In extension, randomness was also based on the willingness of the general public to respond to the survey. A total of 400 questionnaires were completed over the sampled period.

3.2. Sampling Technique and Sample Size

This study used multi-stage of sampling technique to collect the data and obtain study objective. Using cluster sampling technique, Kuala Lumpur was clustered into six clusters based on geographic location. A total of 400 questionnaires were distributed among young generation through face-to-face interviews. Out of 400 questionnaires, 28 questionnaires were incomplete, resulting in 372 usable questionnaires to obtain study aims. This study used a questionnaire as the primary instrument to collect data. The questionnaires were divided into two sections (A and B). Section A consisted of the demographic information of the

respondents, which included their gender, age and education. Section B contained 29 items to assess the environmental awareness based on a 5-point Likert scale with 1 being “strongly disagree” and 5 being “strongly agree”.

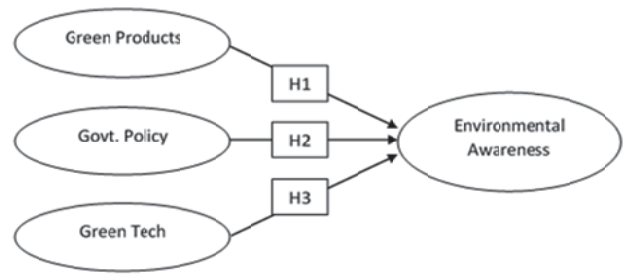
3.3. Data Analysis Technique

This study adopted Structural Equation Modeling (SEM) to analyse the effect of public policy, green products and green technology on environmental awareness. The advantage of using SEM is that it can be applied to different shapes of data. For example, SEM is appropriate for non-normality data set (Hair, Sarstedt, Ringle, & Mena, 2012; Ringle, Götz, Wetzels, & Wilson, 2009). Moreover, according to Chin and Newsted (1999) SEM is able to reach robust result. Other advantages of using SEM are that it is applicable for formative mode and to identify the key driving constructs (Hair et al., 2012; Ringle et al., 2009). A SEM model has two parts; measurement part and structural part. The Measurement part demonstrates the relationship between latent variables and their indicator. And the structural part shows the relationship between latent variables (Vinzi, Chin, Henseler, & Wang, 2010).

The sample size adequacy remains a prime concern in the application of SEM. Referring to Hoe (2008), a sample size of 200 offers enough statistical strength for data analysis. According to Hair, Black, Babin and Anderson. (2010), sample size plays a vital role in gaining steady, significant approximations and explanations of outcomes. While no precise guidelines regarding sample size have been required, one rule of thumb recommended by Hair et al. (2010) is that a minimum suggested ratio is less than five observations for each parameter. If the observation or parameter proportion is less than 5:1, the statistical strength of the outcome might be in doubt (Baumgartner & Homburg, 1996). This postulation suggests that models with a larger number of parameters necessitate a greater sample size (Kline, 2010). However, if the sample size is too large (e.g., beyond 400), the SEM statistical analysis might be too sensitive, and constructing a goodness-of-fit measure would indicate poor fit (Hair et al., 2010). Therefore, a sample size of about 372 is considered adequate. In line with the above recommended guidelines, it was decided to use the target sample size for this study as 372.

3.4. Hypothesis

In order to have a clear understanding and to develop a clear representation of this study; particularly to find the relationship between green products, green technology and government policy on environmental awareness, following hypotheses have been taken into account (Figure 1).



<Figure 1> Proposed research model

- <H₁> Green products are positively related to environmental awareness.
- <H₂> Government policies are positively related to environmental awareness.
- <H₃> Green technologies (Green Tech) are positively related to environmental awareness.

4. Results and Discussion

4.1. Demographic Characteristics

A total of 400 questionnaires were successfully distributed and collected through face-to-face interviews. Out of a total of 400 questionnaires, 28 questionnaires had missing data. This indicates a response rate of 93% (n=372) (see Table 1).

<Table 1> Socioeconomic and demographic profiles of the respondents (n = 372)

	Frequency	Percentage(%)
Gender		
Male	163	43.82
Female	209	56.18
Age		
20 & below	130	34.95
21-30	205	55.11
31-40	20	5.38
41-50	14	3.76
51 & above	3	0.81
Education		
No formal education	2	0.54
Primary education	3	0.81
Lower Secondary education	65	17.47
Higher Secondary education	23	6.18
High school	23	6.18
Diploma	50	13.44
Bachelor Degree	188	50.54
Master Degree	8	2.15
PhD	2	0.54
Others	8	2.15

Source: Field survey, 2016

Table 1 show that males comprised 43.82% of the respondents, while females constituted 56.18%. Table 1 also shows the age distribution of respondents in the study area. The age group 21-30 had the highest number of respondents (55.11%), followed by age group of 20 & below (34.95%). Most of the respondents were young generation. The age group of 51 & above has the lowest respondent (0.81%). Moreover, the study found that most of the respondents have bachelor degree (50.54%), and 0.54% of the respondents do not have any formal education. A very small number of respondents has masters and PhD degrees. Thus, the finding is consistent with the aim of being a developed nation by 2020.

4.2. Tests for Confirmatory Factor Analysis (CFA)

To determine the discriminate validity, confirmatory factor analysis (CFA) was applied (Davis & Consenza, 1993). The purpose of CFA is to choose the relevant items that indicate

a certain variable (Malhotra & Briks, 2007). Kline (2010) stated that the aim of measurement model is to observing the appropriateness of indicators representing latent variables. In the same context, Hair et al. (2010) argued that the purpose of measurement theory is to estimate the relationship between observed and latent variables. The competence of a measurement model is performed by CFA. In order to do that, four types of fit indices - normed chi-square, root mean square approximation (RMSEA), chi-squared statistic and comparative fit index (CFI), are used to determine how the model fits with the data. For an adequate model fit: normed chi-square has to be less than 5; RMSEA less than 0.088; and CFI values greater than 0.90 (Hair et al., 2010; Byrne, 2009). Based on the CFA tests, all four dimensions had adequate model-to-data fit: the CFI value was above 0.90; and the RMSEA value was less than 0.088. This study also shows that some items have significant factor loadings (greater than 0.70), which indicate adequate discriminant and convergent validity (see Table 2).

<Table 2> Construct validity of confirmatory factor analysis

Items	Stand. Loadings
Environmental Awareness	
<i>Regulations implemented by the government to protect the environment are still not enough (EA1)</i>	0.68
<i>Enforcement of regulations and law are not effective (EA2)</i>	0.72
<i>The level of consciousness and knowledge amongst Malaysians regarding environmental care is still inadequate (EA3)</i>	0.69
<i>There is no clear channel for making complaints about environmental pollution (EA4)</i>	0.61
<i>Pollution badly affects the flora and fauna (EA5)</i>	0.70
<i>The manufacturing industry does not care about the environment (EA6)</i>	0.56
Green Products	
<i>The purchase of green products is a good investment for future generations (GP1)</i>	0.67
<i>The purchase and demand of green products exert pressure on companies/manufacturers to be more aware about environmental conservation (GP2)</i>	0.61
<i>Green products are relatively more expensive compared to other products/brands (G3P)</i>	0.58
<i>Green products have a positive impact on the environment (GP4)</i>	0.74
<i>Application of solar energy in buildings can reduce the use of electricity (GP5)</i>	0.69
Government Policy (Govt. Policy)	
<i>Lack of exposure or publicity about the policy/programs (GvP1)</i>	0.55
<i>Implementation of the policy/programme is less effective (GvP2)</i>	0.69
<i>The introduction of green technology modules at all school levels (GvP3)</i>	0.74
<i>Enhance awareness and knowledge of public through suitable programs and campaigns (GvP4)</i>	0.64
Green Technology (Green Tech)	
<i>Have you ever heard of green technology? (GT4)</i>	0.62
<i>Do you know about the green technology initiative promoted by the government? (GT5)</i>	0.51
<i>To your knowledge, paper (green technology product) currently found in the market? (GT6)</i>	0.20

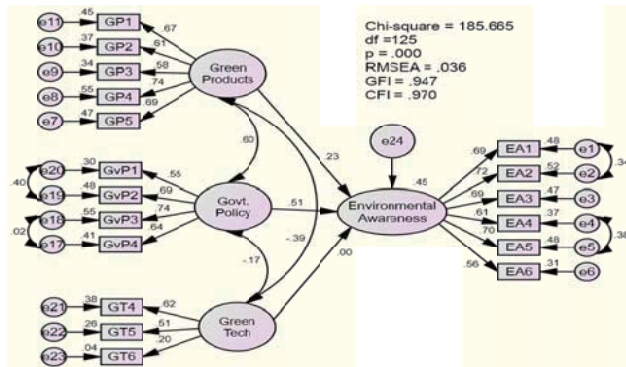
4.3. Test for Structural Equation Modeling (SEM)

Structural equation modeling (SEM) is used to assess the association among the main constructs of a hypothesized model (Kline, 2010). In this study, a structural model was tested to examine the relationship between green products, green technology, government policy and environmental awareness (see Figure 2).

In Figure 2, the model had an adequate fit to the data: chi-squared per degree of freedom (251.657/126) = 1.99 (less than 3); CFI = 0.939 (greater than 0.90); GFI = .932 (greater than 0.90); $p = 0.00$ and RMSEA = 0.052 (less than 0.088) (Masud, Kari, Yahaya, & Al-Amin, 2014; Hair et al., 2010).

Figure 2 shows that the R-squared for the endogenous variable is environmental awareness (0.45). The R-squared indicates that 45% of the endogenous factor was explained by the exogenous factors. Hypothesis H₁ and H₂ are supported at a significant level ($p < 0.10$); however, H₃ is not supported because it is not significant at level ($p < 0.10$) as shown in table 3.

The SEM model shows that green products ($\beta = .237$) and govt. policy ($\beta = .569$) have positive influence on environmental awareness and both are statistically significant. However, green technology ($\beta = -.003$) does not have positive influence on environmental awareness and is statistically insignificant. The SEM result in Table 3 also shows that, the factors of environmental awareness, green products, government policy and green technology are statistically significant ($p < 0.10$).



<Figure 2> structural equation modeling of environmental awareness

<Table 3> Hypothesis and path coefficients

Hypothesis	Path	β	P-value	Remark
H1	Environmental Awareness ← Green Products	.237	.012**	Supported
H2	Environmental Awareness ← Govt. Policy	.569	***	Supported
H3	Environmental Awareness ← Green Tech	-.003	.990	Unsupported
	EA1 ← Environmental Awareness	1.000	***	Supported
	EA2 ← Environmental Awareness	1.031	***	Supported
	EA3 ← Environmental Awareness	.985	***	Supported
	EA4 ← Environmental Awareness	.766	***	Supported
	EA5 ← Environmental Awareness	.793	***	Supported
	EA6 ← Environmental Awareness	.753	***	Supported
	GP1 ← Green Product	1.000	***	Supported
	GP2 ← Green Product	1.142	***	Supported
	GP3 ← Green Product	.939	***	Supported
	GP4 ← Green Product	.972	***	Supported
	GP5 ← Green Product	.983	***	Supported
	GvP1 ← Govt. Policy	1.000	***	Supported
	GvP2 ← Govt. Policy	1.061	***	Supported
	GvP3 ← Govt. Policy	.986	***	Supported
	GvP4 ← Govt. Policy	.739	***	Supported
	GT4 ← Green Technology	1.000	***	Supported
	GT5 ← Green Technology	1.067	***	Supported
	GT6 ← Green Technology	.418	.011**	Supported

** Significant at 5 percent level

*** Significant at 1 percent level

5. Conclusion and Recommendation

The government of Malaysia is promoting a series of programmes regarding environmental awareness through different agencies and ministries as part of the vision 2020. The main purpose of this study is to investigate the factors that have an impact on environmental awareness in Kuala Lumpur regardless of government undertaking initiatives to boost the environment awareness. The finding of the study concludes that quite a few number of respondents did not have a formal education, and more than 53% of the respondents have university degree, which is consistent with the aim of being a developed nation by 2020. The finding shows that green products and government policy have direct influence on environmental awareness. However, green technology does not have direct influence on environmental awareness.

The findings of the study suggest that government should come out with appropriate plan and policy in order to raise the environmental awareness. For instance, policymakers should play a vital role in creating awareness among communities and younger generation through campaigns, pamphlets, information dissemination, seminars and workshops. More importantly environmental awareness and

issues should be part of education curriculum in school, as early as primary school (Fisman, 2005). As awareness is a prerequisite for favourable attitude towards raising environmental consciousness, information should be circulated and displayed to the young generation so they are more confident and willing to cooperate with the environmental awareness raising activities that are proposed or implemented.

The awareness and adaptation of green technologies and products should be in top down approach. There should be support from top management for adaptation and used of green technologies and products for industries. The New Economics Model (NEM) of Malaysia focuses on the environmental issues for a sustainable development. The policies of NEM should be clearly stated, hence, it can be understood and adopted by everyone. The main problem with green technology and products is that the cost of this technology and products is high as compared to its substitute products and technology. In Malaysia the scale of productions of green technology and products is still small as compared to developed countries. Therefore, there should be initiatives from public and private sectors on production of green technology and products in a more economical manner.

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