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DRIVING FACTORS OF SUSTAINABLE ENVIRONMENTAL MANUFACTURING PRACTICES IN MALAYSIA

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ABSTRACT

An increased demand has been placed on the manufacturing industries to be more responsible to their environment with respect to their operational activities. This demand is due to various antecedent factors driving sustainable environmental practices in manufacturing firms. This study therefore, investigated the factors that drive the sustainable environmental practices in Malaysian manufacturing sector. Survey questionnaire was used to collect data from 103 manufacturing firms and was analyzed using PLS path modelling technique. The result of the study found that top management commitment and stakeholder pressure significantly influence sustainable environmental manufacturing practices while public concern did not show significant evidence.

Keywords: sustainable environmental manufacturing practices (SEMP), top management commitment, stakeholder pressure and public concern

INTRODUCTION

Manufacturing firms has obviously contribute positively to the economic development especially in the aspect of employment opportunities and gross domestic products, however, statistical evidences have revealed that manufacturing industry contribute adversely to the environment. This is evidenced in the report of the International Environmental Agency [IEA], (2007) that manufacturing industries are significantly responsible for the consumption of a huge amount of resources and waste generation throughout the world. Obviously, 61% of energy was consumed by manufacturing industries between 1972 and 2004; it was also responsible for about a third of the world's global usage of energy and emission of 36%t of carbon dioxide ($C0_2$) in the world (OECD, 2009).

In Malaysia, manufacturing sector is responsible for a large portion of the environmental degradation. This is witnessed in the increasing volume of generated waste from stationary source from industries (Department of Environment, 2012). Also, the result of the analysis of the Water Quality Index in Malaysia shows that there has been a continuous rise in the amount of the Biochemical Oxygen Demand (BOD_5) in river basins as a result of the untreated or partially treated sewage discharge from the manufacturing industries (CES, 2012). BOD_5 refers to the quantity of dissolved oxygen needed for the bacterial decomposition of organic wastes in water samples. In the aspect of energy consumption, manufacturing has contributed to the huge consumption of energy in Malaysia (Al-Amin et al, 2009). In addition to the adverse effect of manufacturing on environment, is the demand for water which has continued to rise in Malaysia. National Water Resources Study (Peninsular Malaysia) assert that water demand is expected to rise by 63% between year 2000 and 2050, therefore, there is a high need for sustainable environmental practices in manufacturing industry in order to reduce the adverse environmental impacts of industrial activities and to sustainably manage its resources to ensure social, economic and environmental development (Compendium of Environment Statistics, 2012).

As a result of the above mentioned environmental impacts of manufacturing companies on the natural resources and the environments, a renewed focus of the manufacturing industries' stakeholders such as the

regulatory policy makers, shareholders, customers and employees on the manufacturing organizations has been shifted to becoming more responsible to the environments with respect to the products and the process (Galdeano-Gomez, 2008; Rusinko, 2007). As such, demand has been given to sustainable environmental manufacturing practices which is refers to the initiatives of creating manufactured products by using processes that minimize the negative environmental impacts, conserve energy and natural resources by providing a safe and economically sound environment (The U.S Department of Commerce, 2010)

These demands are due to various antecedent factors driving sustainable environmental practices, such as: stakeholder pressure, public concern, and top management commitment of the organizations from being environmentally sustainable (Rusinko, 2007; Adebambo et al. 2013). Thus, sustainable environmental practices have been seen as a primary source of better firm performance of many manufacturing companies in many countries of the world including the Asia-pacific region, UK and the USA (Anis & Nurul, 2010; Seidel, Shahbazpour & Siedel, 2007). Therefore, this study aims at investigating the factors that drives the sustainable environmental practices in Malaysian manufacturing sector.

LITERATURE REVIEW

Sustainable Environmental manufacturing practices (SEMP)

The U.S. Department of commerce (2010) defined sustainable environmental manufacturing for the purpose of commerce as the initiatives of creating manufactured products by using processes that minimize the negative environmental impacts, conserve energy and natural resources by providing a safe and economically sound environment for employees, communities and consumers. Schoenherr & Talluri (2012) viewed sustainable environmental practices as techniques, policies and the procedures taken by a firm with specific aim of monitoring and controlling the effects of the operations of the firm on the natural environment.

Evidences from literatures have shown that sustainable manufacturing has globally received great interests from researchers (Shah & Ward, 2007; Schoenherr & Talluri, 2012). This can be linked with the Bruntland commission and their campaign for a sustainable development that is “meeting the need of the present generation without compromising the ability of the future generation to meet their own needs” (OECD, 1987). This has therefore motivated many manufacturing organizations and governments to seek and embark on sustainable environmental manufacturing practices. Hence, research on sustainable environmental practices among manufacturing companies is important especially the investigation of the antecedent factors.

Omar & Samuel (2011) among the few empirical studies in Malaysia examined the stages of environmental management in Malaysia. He classified environmental practices in Malaysian manufacturing firms into five (5) different stages based on the five-stage categorization of Hunt & Aurter (1996). The study found that Malaysian manufacturing firms irrespective of their ownership type are in the third stage of environmental manufacturing practices. They perceive environmental initiative as a corporate social responsibility with moderate effort to ensure compliance with environmental regulations. At this stage, environmental practices are only seen as ethical behaviours without considering it as a strategic factor to achieving better firm performance.

Antecedent factors of SEMP

Previous researches revealed that many firms respond to the issues of environment while other companies with related circumstance do not respond despite the existence of regulatory requirements (Bansal and Roth, 2000). The explanation of the rationale behind organizational response to environmental issues has been provided by past literatures. Chien & Shih (2007), Harmut & Sami (2006) identified the reasons that

drive organizations to adopt environmental practices, such reasons are: Stakeholders pressure (Chien & Shih, 2007, Henriques & Sharma, 2005; Darmal et al., 2010) and because "it pays to be green" including ethical concerns, top management commitment/initiatives and public concerns (Carter et al 2009; Banerjee 2003). These factors are of widespread interest among firms with their ability to predict the response of firms in implementing sustainable environmental practices is limited (Bansal & Roth, 2000). As such, this study regards top management commitment, stakeholder pressure and public concern as the factors that drive the implementation of sustainable environmental manufacturing practices.

Top management commitment and SEMP

Top management commitment refers to the involvement and the support received from the top management of organizations towards adding value and shaping the environmental manufacturing practices implemented by the firm (Drumwright, 1994). Top management of an organization shows their commitment to the implementation of environmental practices through direct involvement in the environmental issues of the firm (Carter *et al.,* 2009). This commitment is shown by appointing senior managers to oversee the environmental issues of the firm (Banerjee *et al*., 1998). Top management must understand the implementation of the environmental initiatives and make provision for the necessary resources for the successful implementation of environmental practices (Yen & Yen, 2012).

Past researches assert that the commitment and support of top management have tendency of influencing the proactiveness of the implementation of environmental manufacturing practices through human resources management activities (Gonzalez-Benito & Gonzalez Benito, 2006; Zutshi & Sohal, 2004). Top management is significant in setting realistic objectives for environmental initiatives, providing related trainings to the employees, giving factual decisions, enhancing team work efforts towards environmental practices implementation, and providing priority and attention to both the internal and the external stakeholders of the organization (Deros, *et al*., 2009). Wee & Quazi (2005) and Huang & Wu (2010) regard top management commitment as a critical and vital factor of proactive environmental management practices. Huang & Wu (2010) found top management commitment as significant to the implementation of green initiatives. As a result of the above discussion, top management commitment is regarded as an antecedent factor of SEMP and it is posited in this study that top management commitment will positively influence sustainable environmental manufacturing practices.

Stakeholder Pressure and SEMP

Stakeholder pressure refers to the influence exerted by individuals or groups on companies (Henrique & Sadorsky, 1999). Any company facing a high level of pressure from stakeholders direct their environmental activities towards the awareness of stakeholders of the risk borne by their manufacturing activities (Al-Tuwajiri *et al*., 2004). Following the empirical investigation of the past researchers, it has been established that there tend to be a positive relationship between the stakeholder pressure and implementation of SEMP. Bansal & Roth (2000) found a relationship between stakeholder pressure and corporate ecological response. Gonzalez-Benito & Gonzalez-Benito (2005) identified a positive relationship between perceived stakeholder environmental pressure and environmental logistic practices. Cespedes-Lorente (2003) found a positive relationship between stakeholders' pressure and the adoption of corporate environmental practices. Also, Henrique & Sadorsky (1999) found that pressure from regulatory, organizational and community stakeholders drive firm to implement environmental management practices. As a result of the discussion above, it is hypothesized that stakeholder pressure will positively influence sustainable environmental manufacturing practices.

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Public concern and SEMP

Public concern in this study regards to the individual sensitivity towards environmental issues (Berkiroglu, 2011). Recently, more attention has been given by the public to the unsustainable environmental practices

(Banerjee, 2003; Stisser, 1994). For example, many manufacturing firms have been forced to close down through public interest litigation and the intervention of the judiciary through public concern (UNEP, 1992). The concern of the public focus more on the: provision for better health services and improvement in the standard of living with main target towards alleviating environmental degradation (land, water and air); loss or reduce habitation as a result of unsustainable acquisition of raw materials for industrialization; and globalization of standards for the environment and social ethic in the manufacturing sector.

Evidences from the past empirical studies on environmental practices have shown that public concern motivates the implementation of environmental practices (Carter *et al.*, 2009; Banerjee *et al*. 2003). Firms implement environmental green practices as response to the concern of the public (Carter *et al*. 2009). The result of the research of Banerjee *et al*. (2003) on corporate environmentalism reveals that public concern is an antecedent of corporate environmentalism. Individual will be more concern and sensitive to the following issues: more difficulties in getting access to more energy (Berkiroglu, 2011). There will be much more problems in the future as a result of the changes in the climate (Hamans, 2009). Firms will have to minimize wastefulness in resources and enhance efficiency (Hamans, 2009). The cost of resources will be more expensive (Hamans, 2009). Firms causing more harm to the environment in the future will be fined (Berkiroglu, 2011). As a result of the above discussion, public concern is hypothesized to positively influence sustainable environmental manufacturing practices.

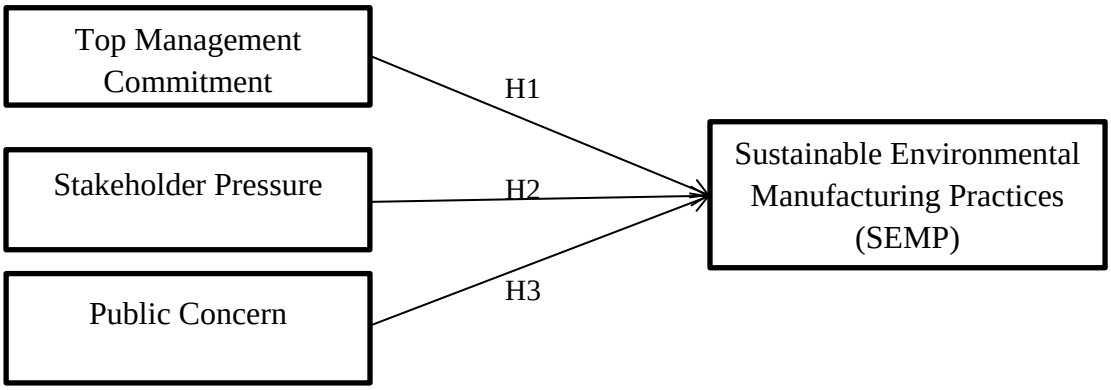

Figure 1: Research Framework

METHODOLOGY

The population of this study is the manufacturing companies that are registered in Malaysia with more than 50 full-times employees. These companies are regarded as technically and financially feasible for implementing sustainable environmental manufacturing practices. Sample of this study was selected from the directory of the Federation on Malaysian Manufacturer (FMM, 2013) by using stratified random sampling technique. Data for this study were collected from the operation manger, manufacturing manager or the environmental, health and safety manager of the selected sample company by using a mail-survey questionnaire.

Items of the questionnaire used were adapted from previous literatures similar to this study. All the items used in this study was measured on a scale of 1- 6 in which 1 indicates strongly disagree and 6 indicates strongly agree. Specifically, items used in measuring sustainable environmental manufacturing practices was adapted from Gonzalez-Benito & Gonzalez-Benito (2006), top management commitment was measured with items adapted from Benerjee *et al* (203); Carter *et al.* (2009) Stakeholder pressure was measured with items adapted from Alvares-Gills *et al.*, (2007): while public concern was measured with items adapted from Carter et al., (2009) and Benerjee et al. (2003).

Out of the 790 survey questionnaires distributed to the respondents, 103 usable questionnaires were received which represents a total of 13% response rate. Similar response rate of 12.6% was obtained by

Wong et al., (2011) and 11.5% was obtained by Ahmed & Hassan (2003) in their study in Malaysia. Therefore, a response rate of 13% denoting 103 responses was considered reasonable and it was used in this study.

Data analysis procedure was conducted by using both SPSS version 20 and PLS-SEM 2.0 M3 (Ringle *et al.,* 2005). The use of SPSS was employed in the preliminary analysis of the study including the detection and treatment of missing data, outliers and linearity assumption. While PLS-SEM was employed based on the reasons that it offers several benefits regarding its ability to predict significance relationship with small sample size, types of variables used, model complexity and place minimum requirement on data normality. As such, PLS analysis technique was used to assess the measurement and the structural model in this study.

FINDINGS

The demographic profile of the respondents reveals that the majority of the respondents are from the electrical, electronics and computing machinery sector (30.1%), many of which are environmental, health & safety managers (50.5%) from the multinational companies (45.6%) with their companies having more than 251 full-time employees.

The model was assessed by using SmartPLS 2.0 M3 (Ringle *et al.,* 2005) in order to estimate the parameters of both the outer and the inner model in order to maximize the variance explained in the dependent variable. Also, the non-parametric bootstrapping method with 5000 resampling was used to obtain the standard errors of the estimates (Chin 1998; Tenenhaus *et al*., 2005; Wetzel *et al*., 2009).

Assessment of the measurement model

The measurement model was assessed by examining the convergence validity which is the degree to which multiple items measuring the same concept agreed. Following the suggestion of Hair *et al.,* (2013), loadings, composite reliability and the average variance extracted (AVE) were used in assessing the convergent validity. The result shows that the loadings for all items exceed the recommended threshold of 0.5 by Hair *et al.,* (2013). The result of the composite reliability which indicate the extent to which the items indicates the latent construct shows that values range between 0.898 and 0.941 has exceeded the threshold values of 0.7 (Hair *et al.,* 2013). In addition, the amount of the variance accounted for by the latent construct is shown in the result of the AVE which have values between 0.548 and 0.747 proved that the recommended threshold values of 0.5 is exceeded (Hair *et al.,* 2013). The above evidenced the achievement of convergent validity in this study. The result of the items loading, composite reliability and AVE is presented in Table 2.

Table 2.
Result of the factor loading, AVE and composite reliability

Constructs	Items	Loadings	AVE	CR
Public Concern	PC1	0.823	0.674	0.912
	PC2	0.826		
	PC3	0.737		
	PC4	0.858		
	PC5	0.857		
Sustainable Environmental Manufacturing Practices	SEMP11	0.725	0.548	0.906
	SEMP12	0.767		
	SEMP13	0.761		
	SEMP16	0.707		
	SEMP4	0.809		

	SEMP5	0.705		
	SEMP6	0.733		
	SEMP7	0.710		
Stakeholder Pressure	SP1	0.781	0.747	0.898
	SP2	0.927		
	SP3	0.878		
Top Management Commitment	TMC1	0.745	0.665	0.941
	TMC2	0.807		
	TMC3	0.827		
	TMC4	0.843		
	TMC5	0.868		
	TMC6	0.767		
	TMC7	0.851		
	TMC8	0.809		

Discriminant Validity of the constructs

Different from the convergent validity, discriminant validity is concerned about the uniqueness of a construct, whether the phenomenon captured by a construct is unique and not represented by the other constructs in the model (Hair *et al.,* 2013). Discriminant validity in this study was assessed by using Fornel-Larcker criterion. This was done by comparing the square root of the AVE values with latent variable correlations (Fornell & Larcker, 1981). The square roots of AVE coefficients are presented in the correlation matrix along the diagonal. The squared root of each constructs' AVE should be greater than its highest correlation with any other construct to evidence discriminant validity (Hair *et al.,* 2013). Discriminant validity in this study is achieved as shown in Table 2 below that the squared correlations for each construct is less than the average variance extracted by the indicators measuring that construct.

Table 3
Discriminant Validity

Constructs	**PC**	**SEMP**	**SP**	**TMC**
PC	**0.821**			
SEMP	0.431	**0.740**		
SP	0.413	0.438	**0.864**	
TMC	0.570	0.583	0.535	**0.816**

Note: Values in the diagonals represent the squared root of average variance extracted while the other entries (off diagonals) represent the variable correlations.

Assessment of the Structural Model

The structural model was used in testing the formulated hypotheses in this study. Table 3 presents the results of the standard path coefficients (β), standard error, t-value and the decision taken in this study. The result revealed two (2) of the three (3) stated hypotheses were supported. The two (2) significant relationship include: (1) top management commitment (TMC) and SEMP ($\beta = 0.430$; $t = 3.255$, $P < 0.10$); (2) stakeholder pressure (SP) and SEMP ($\beta = 0.158$; $t = 1.634$; $P < 0.10$) while the remaining path (Pubic

concern (PC) and SEMP ($\beta = 0.121$; $t = 0.844$; $P < 0.10$) demonstrated an evidence of a non-significant positive relationship.

Table 4
Results for the hypotheses testing

Hypotheses	Path coefficient	Beta	Std. Error	T-Value	*Decision*
H1	**TMC -> SEMP**	0.430*	0.132	3.255	***Supported***
H2	**SP -> SEMP**	0.158*	0.097	1.634	***Supported***
H3	**PC -> SEMP**	0.121	0.143	0.844	***Not Supported***

***Note**: * P<0.10, Indicates the item is significant at 10% significant level. Seven (7) Hypotheses were supported based on their t-values.*

DISCUSSION

Top management commitment was posited to positively influence sustainable environmental manufacturing practices. Expectedly, the findings of the study provided an evidence to support the hypothesis. Manufacturing firms with a positive managerial attitude towards the environment will increase the proactiveness of the implementation of sustainable manufacturing practices (Sangle, 2010). Top management commitment is a critical and vital factor of proactive environmental practice (Wee & Quazi, 2005; Huang & Wu 2010). Top management is responsible in setting realistic objectives for environmental initiatives, providing related trainings to the employees, giving factual decisions, enhancing team work efforts towards environmental practices implementation, and providing priority and attention to both the internal and the external stakeholders of the organization (Deros, *et al*., 2009). The implication of the positive significant relationship between top management commitment and SEMP is that increase in the commitment of top management of firm will result into an increase in the implementation of sustainable environmental practices. The finding of the current study is consistent and corroborates most of the previous studies on environmental practices such as Banerjee et al., (2003); Yen & Yen (2012); Carter et al., (2009); Al-shourah & Ibrahim, (2007).

Similar to the above, a positive influence of stakeholder pressure on sustainable environmental manufacturing practices was posited. As expected, the findings of this study found an evidence to support the hypothesis. The implication of this finding as emphasized by Henrique & Sadorsky (1999) is that stakeholder can express interest to influence the environmental practices of firms via direct pressure of conveying information. When companies face a high level of pressure from the stakeholder, their attention are directed towards the awareness of stakeholders of the risk borne by their manufacturing activities (Al-Tuwajiri *et al.,* 2004). This finding corroborates most of the previous studies of stakeholder pressure (Buysse & Verbeke, 2003; Delmas & Toffel, 2008; Gonzalez-Benito & Gonzalez-Benito, 2006; Henriques & Sadorsky, 1999; Murillo-Luna et al., 2008; Springel & Busch, 2010).

The third hypothesis posited that public concern (PC) would positively influence sustainable environmental manufacturing practices (SEMP). The result demonstrated an insignificant positive relationship, contrary to the expectation of this study; the result suggested that public concern is not influential on sustainable environmental manufacturing practices in Malaysia. This finding is inconsistent with the findings of Carter *et a*l (2009) and Banerjee et al., (2003). One plausible explanation for this result may be related to the cultural orientation (concept of face) of the respondents of this study who belong to a different extreme context from the previous studies. The concept of face embraces quality and good manners and it is therefore held in high esteem among the respondents of this current study (Malaysians). Face can be lost, taken or given away and it is therefore extended to schools and companies within the cultural context of the respondents of this study. According to the cultural orientation of the respondents of this study, face can be lost by putting someone on the spot or challenging someone in authority especially if it is done publicly. As such, one of the ways to avoid losing face is to stay calm and

saying no through a non-verbal communication mode. It is obvious that cultural orientation of the respondents of the previous studies is far away different from this study's. The previous studies were conducted in the U.S and other western countries where the respondents are known to publicly cry out and challenge those in authority whenever they are discontented with certain issues such as environmental issues, unlike Malaysia where the public will prefer not to react. Therefore, it is noteworthy that the insignificant influence of public concern on sustainable environmental manufacturing practices within the context of Malaysia is considered reasonable.

CONCLUSION

This study has provided several implications both in theory and practical. Within the context of research, it has provided empirical evidence on the influence of top management commitment and stakeholder pressure on sustainable environmental manufacturing practices. It also provided evidence that public concern does not significantly drive the implementation SEMP in Malaysia. This study has also increased the available literatures on environmental practices especially in the developing nation where only few empirical studies have been conducted on sustainable environmental manufacturing practices as many of the previously conducted studies were done in the developed nation. From the practical perspective, this study has provided important insight that top management commitment and stakeholder are important driving factors that enhance environmental practices. As such, top management should be more committed by making provision for the necessary resource needed especially through human resources and management of the various stakeholders to enhance successful implementation of SEMP.

As with all other research, this study has certain limitations. In the first case, this study may not be generally applicable in some developed nations where the extent of sustainable environmental manufacturing practices has been in an advanced stage. Therefore, similar researches are encouraged to make comparism of sustainable environmental manufacturing practices in developed and developing countries. Secondly, this research is conducted in manufacturing sector and the researcher believes that these factors driving the implementation of SEMP in the companies may vary depending on a particular sector of the industry. As such, future researches should explore on the remaining factors that may drive SEMP using a specified sector of manufacturing industry.

This study has shown that manufacturing firms with a positive managerial attitude towards the environment will increase the proactiveness of the implementation of sustainable environmental manufacturing practices. Also, companies facing a high level of pressure from the stakeholder, direct their attention towards the awareness of stakeholders of the risk borne by their manufacturing activities. Therefore, top management commitment and stakeholder pressure are important driving factors for implementing sustainable environmental manufacturing practices.

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