

Environmental Protection through Small Businesses: An Analysis of the Role of Stakeholders in Green Operations

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In this paper we investigate key causal linkages in proactive environmental practices based on an empirical study of 232 Malaysian Small and Medium Enterprises (SMEs). We propose a conceptual framework and test this framework using Structural Equation Modelling (SEM). The key focus of this study is to explore SMEs' environmental initiatives and the impact of stakeholders' involvement in determining SMEs' environmental strategies. The study examines the relationship between stakeholders' involvement (customers, suppliers, government, top managers and employees) and proactive environmental practices (internal management systems, process-based changes, product-based changes). The results support the notion that SMEs have moved to develop an increasingly proactive environmental orientation. Although our survey strongly suggests that each stakeholder has a different role and impacts differently on SMEs' sustainability practices, vertical partners play the most critical roles in supporting environmental practices based on product and process-based changes.

Introduction

Small and Medium Enterprises (SMEs) have a significant impact on the environment. Collectively, it is estimated that more than 70 percent of industrial pollution is produced by SMEs [1-4]. This includes hazardous material such as lead (Pb), mercury (Hg) and cadmium (Cd) as well as a range of greenhouse gases such as sulphur and carbon dioxides [5]. Although governments can issue many directives to reduce the environmental impact, the effectiveness of such policies ultimately depends on the compliance level observed by industry. However, because of the way SMEs are influenced by their supply partners, in addition to their limited access to financial resources, ensuring a high level of compliance could be particularly challenging. SMEs capabilities to adapt to environmental practices are fundamental to ensuring sustainable environmental protection. This paper highlights the status of environmental practices of SMEs and presents the analysis of stakeholders' roles in the development of sustainable practices.

Literature Review

SMEs green operation management

During the past 20 years, much more information has become available on a range of green operations management. These practices range from proactive to reactive approaches. Proactive approaches are reflected in the unbinding and innovative operations that go beyond the laws. Reactive approaches, on the other hand, are often driven by minimum compliance standards, which are meant to minimise liabilities and pressures. It is assumed that SMEs managers respond to the similar pressures for their environmental management responsibilities that drive managers in large organizations to implement policies, programs and practices. However, due to the different nature of both types of organizations, it is expected that they respond differently to the sources of pressures. Pressures from direct associates (suppliers and customers) are particularly important for small businesses. Compared to large organizations that by nature need to respond to stakeholders'

requirements to maintain their reputations, SMEs do not need to be as concerned about their public image. SMEs' priority is to ensure the organization's survival and so their relationships with their suppliers and customers are expected to be critical. Research in green operations explores supplier-customer relations and the connection between supply networks and the adoption of environmental practices. While relationships with other stakeholders such as the government, top managers and employees are important, customer-supplier relationships appear to be the most valuable to SMEs. Previous research suggests many benefits of environmental relations between supply partners. At least three types of relationships have been investigated between supply partners in the supply chain literature: environmental requirements [6-8], environmental sharing [9, 10] and environmental collaboration for products and processes improvements [11, 12]. Since SMEs face various difficulties, including conceptual or know-how capabilities, the nature of the customer-supplier relations may help SMEs to develop the necessary skills required to improve environmental performances.

In terms of green operations available for SMEs, there are two types of environmental initiatives: (i) pollution control initiatives; and (ii) pollution prevention initiatives. Pollution control is considered a reactive strategy which utilizes structural investments that capture, treat or dispose of pollutants or harmful by-products at the end of a manufacturing process [10, 13]. This includes end-of-pipe equipment and remediation projects to clean-up earlier harmful practices such as treating water, air and solid wastes at the end of production. While these practices can help to minimize the amount of production waste, they also incur the unnecessary cost for pollution treatment and management.

Conversely, pollution prevention (P2) is a proactive strategy that goes beyond compliance. It focuses on process modifications and material substitutions in order to reduce emissions of pollutants and waste [10, 13]. This technology often deals with various changes in production processes, products design and management systems such as Total Quality Management (TQM) [14]. The P2 technology leads to a reduction of environmental impact through reducing usage of both by-products and energy and resource inputs. The establishment of P2 technologies improve organizations' performances and eventually serve as an organizations' competitive advantage. However, P2 initiatives are often encumbered by the need for substantial investment cost and lack of organizational capabilities.

Questions remain about the level of implementation of these green operations practices. As stakeholders, are considered as institutional driver that are significant in determining SMEs environmental activities, understanding of these relations are important to the managers as well as to key stakeholders. Different stakeholders are perceived differently by SMEs, suggesting that different effects are expected from such relations. The conceptual framework for this study is presented in Figure 1. Therefore, the study specifically focuses on studying the hypotheses below:

H1: There is evidence of proactive environmental practices among SMEs manufacturers in Malaysia

H2: Stakeholders involvements (customers, suppliers, the government, senior managers, and employees) is positively associated with environmental management practices

H3: The impact of stakeholder involvement varies depending on the partners chosen

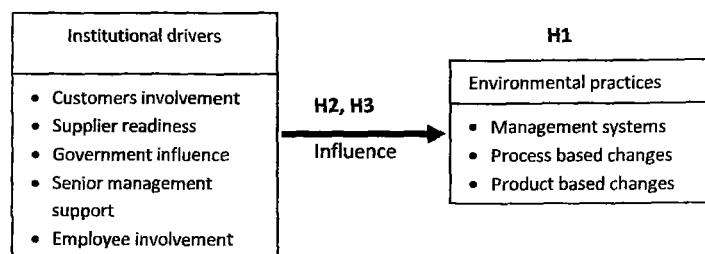


Figure 1: Conceptual Model

The Conceptual Model

The model aims to explain the relationships between sources of institutional stakeholders and the status of environmental practices. This segment of the model generally uses the paradigm of industrial organization, in particular from the Structure-Conduct-Performance (SCP) literature [15] and the theory of stakeholder [16].

The SCP assumes that industry structure will determine the actions or conducts necessary for organizations within an industry. Borrowing the idea from SCP, specific features of the industry structure such as the intensity of the regulation, the power of stakeholders and the cost of entry and exit, within which an organization operates define the choice of options and constraints. In some industries, an organization might actually have few options and deal with various constraints. Such complexity might develop the significance of the relationship with stakeholders. Accordingly, the relationships between stakeholders and the development of environmental practices can explain an organization's motivation for pursuing specific environmental activities. The model will help to predict and explain why organizations will determine to invest in proactive environmental practices and develop the features of environmental systems suitable for small businesses.

Methodology

Sample

The sample included 1051 Malaysian SMEs in the Electric and Electronic industry (E&E) registered with the Small and Medium Development Corporation (SMIDEC) in three industrial states, Johor, Melaka and Selangor. Questionnaires were administered to senior managers, as they are familiar with the environmental challenges as well as an overall knowledge of the business unit's strategies, resources and capabilities. The questionnaire, comprising 73 items, was mailed out using the Dillman Method [17]. A week after the first mailing, an email was sent to ensure that the participants had received the mail and to encourage them to participate. After two weeks, a second lot of questionnaires were posted to remind them about the survey.

Measures

Environmental management practices

The questionnaires used validated scales adopted from Aragon-Correa [18] and Tapia [19] (see appendix A). A five-point Likert scale was used. The respondents were asked to measure the degree of development of their organization in relation to the environmental activities mentioned. Exploratory analysis using principal axis factoring and direct oblimin rotation showed that items of environmental strategy contained three dimensions. The dimensions were named as internal management, product-based changes and process-based changes. Thus, these three dimensions were the dependent variables for the study. These three variables were studied separately to evaluate the different types of environmental practices SMEs might embrace.

Stakeholder involvement

Relevant stakeholders were carefully identified to ensure the significant stakeholders were included. It is important to focus on key stakeholders as SMEs may face difficulties balancing and managing the different interests of the stakeholders [20]. Given limited organizational capabilities, SMEs may not be able to deal with all stakeholders' issues. Therefore, for the purpose of this study, the stakeholders to be investigated are the primary stakeholders (customers, suppliers, the government, senior manager and employees) who are been identified as stakeholders that engage in formal relationships with the organization [21]. The stakeholders identified herein are closely chosen based on [22];

- (1) the priorities established by the organizational values
- (2) the relative power of the stakeholder
- (3) the legitimacy of the issues presented

Customers and suppliers involvement are among the most frequent cited key drivers that lead SMEs to implement environmental practices. Their involvement in proactive environmental strategies require an adequate commitment of resources such as financial, knowledge and human capital- towards activities such as product redesign or process reengineering. Customer involvement items were identified by the strategic management literature [23, 24]. Items for supplier involvement were identified by supply chain studies [24]. In total, five items are used to measure customers' involvement and seven items are used to measure suppliers' involvement.

The government is recognized as an agent that has sufficient power to enforce SMEs environmental responsiveness [25, 26]. Although, the enforcement is intended to improve environmental practices among SMEs, its accomplishment is subtle as legislations imposed by the government is mainly aimed at large organizations. Thus, it actually does not fit the nature of SMEs (too complex or need huge financial commitment). From this perspective, we decided to measure the government involvement based on partnerships or networking approaches. The partnership between the government and SMEs is a very effective mode to improve environmental performances [27]. The items for the government involvement includes seven items that measure collaborative and commitment activities which include guidance, profile-raising as well as finance.

Senior manager and employees are internal stakeholders that are considered the "back-bone" of organizations who play a significant role to ensure successful integration of management systems and operations.

Data analysis

The analysis is conducted in two parts; the first part of this research is aimed at exploring environmental initiatives within SMEs. It further explores the role of stakeholders in influencing SMEs to implement their own sustainability methods in the second part. The role of stakeholders at different locations in the organization's network (ie: upstream partners and downstream partners) will be distinguished to provide a clear understanding of their relationships.

In order to answer the research hypothesis for the first part, exploratory analysis is conducted to investigate environmental initiatives undertaken by SMEs using descriptive statistics and graphical presentations. For the part two analysis, the research uses a Structural Equation Modelling (SEM) approach where models determining causal relationships between stakeholders' involvement and proactive environmental practices are validated. For the analysis of the survey data in this study, AMOS is used. Before one could carrying out SEM analysis, research model and hypothesize causal relationships must be specified. The model will then be tested and respecifies if the results do not support the hypothesized model. The SEM two-stage process allows the measurement model to be estimated priori, and fixed in the final model. The goodness-of-fit test is carried out by using chi-square and other tests such as Normed (NFI) and Nonnormed Fit Indices (NNFI) [28] and the Comparative Fit Index (CFI) [29].

The adoption of Environmental Management Practices

This section describes environmental practices adopted by SMEs. Table 1 shows that SMEs are undertaking environmental initiatives broadly, with a mean scores (out of 5) ranging from 1.87 to 3.63.

Table 1 - Descriptive Statistics of SMEs' Environmental Strategies

Environmental initiatives	N	Mean	Std. Deviation
Recycling activities	232	3.63	1.300
Natural environmental aspects in administrative work (goals to reduce waste)	232	2.95	1.183
Filters and controls for emissions and discharges	232	2.75	1.011
Systematic control of energy consumption so as to reduce the organization's demand	232	2.70	.986
A formal environmental management system procedures manual	232	2.67	1.226
Natural environmental training for the firm's employees	232	2.66	1.231
Recycling and reusing water	232	2.66	1.163
An ISO 14001 environmental management system certification	232	2.58	1.314
Waste audit or waste management system	232	2.57	1.294
Use of ecological ingredients in the manufacturing of our products	232	2.44	1.103
Purchasing manual with ecological guidelines	232	2.34	1.202
A pollution prevention program	232	2.31	1.142
A life cycle assessment program	232	2.00	1.111
Natural environmental analysis of the product life-cycle (LCA)	232	1.87	.804
Design of products and services according to ecological criteria (Eco-design)	232	1.87	.793

For the purpose of this study, environmental initiatives are divided into three different levels. Based on the Likert scale, scores above 3 indicate that organizations have implemented environmental programmes. Questionnaires scores between 2 and 3 indicate that organizations are planning or developing environmental programmes. Scores lower than 2 suggest that organizations have no environmental programmes implemented. Therefore, the levels are [30]:

- 1) High: those initiatives with a mean score above 3.00
- 2) Moderate: those initiatives with a mean score between 2.00 to 3.00
- 3) Low: those initiatives with a mean score below 2.00

There is only one activity, which is recycling activities that has a mean score above 3. This implies that on average, this activity has been implemented and SMEs are gaining experience from the activity.

Next, more than half of the listed activities had a mean score between 2.00 and 3.00, indicating "Planning or developing program" or "Newly Implemented program". The activities are shown in Table 1 with highlighted colour.

The activities that have lowest interest among SMEs were "Natural environmental analysis of the product life-cycle (LCA)" and "Design of products and services according to ecological criteria (Eco-design.)"

Next is part two analysis.

Structural Equation Modelling: Two Stage processes

In the first stage, the constructs measurement scales or “congeneric” models were first assessed to determine their psychometric properties: unidimensionality, convergent and discriminant validity. The analysis was conducted by testing a hypothesized measurement model using Confirmatory Factor Analysis (CFA). A first order CFA was conducted for each measurement model, whereby every item was restricted to load on its a priori specified factor[31]. Once the congeneric models are confirmed, a full structural equation modelling is accessed in the second stage. The full SEM model included all of the measurement models depicting the hypothesized relationships between constructs. Paths from customers’ involvement, suppliers’ involvement, the government influence [GOV], senior management support [SMS] and employees’ involvement [EMP] to three categories of environmental practices, namely, processes-based practices [PROCESS], design-based practices [PRODUCT] and environmental systems [ENV-SYSTEMS] were specified. All fit indices of the model indicate that the data was an excellent fit to the hypothesized measurement model, χ^2 (N=232, df = 352; χ^2/df = 1.424; AGFI = 0.848; RMSEA = 0.043), except p-value that fell outside the recommended range of $p > 0.05$ ($p=0.000$). It can be argued that p-value was highly sensitive to large sample sizes, and that was often found to be so in cases involving more than 200 respondents such as in the present research [32, 33]. To further estimate the model fit, the Boolean-Strine bootstrap analysis was run on the model. The result shows that Boolean-Strine bootstrap was $p = 0.094$, hence, the model was deemed acceptable.

Discussion

H1: There is evidence of proactive environmental practices among SMEs manufacturers in Malaysia

Referring to Table 1 above, it was ascertained that the proactive environmental practices among Malaysian SMEs are at moderate implementation level. Thus, H1 statement is supported. However, it is worth considering that, of the three proactive environmental practices included in this research, the result clearly shows that most of the practices seem to take place at a management level. These practices are for example, setting up specific goals to reduce waste and resource use, implementation of an environmental management system (EMS) and adoption of ISO 14001. However, these environmental systems are not properly translated into practices in their operations. This is palpable because environmental practices associated with process-based changes are at moderate implementation levels. Product-based changes are even lower than other environmental improvements. These results are evident in Table 1, with most items of manufacturing attaining mean values around 2, while items for product based practices such as “Design of products and services according to ecological criteria” and “Natural environmental analysis of the product life-cycle” have the lowest mean scores, around or even less than 2.

One of the reasons for this may be that SMEs often deal with large organizations as suppliers. Accordingly, their products are based on customers’ specifications. Generally, SMEs may not even have a department or a unit specialized for activities related to product research and development. Therefore, SMEs’ investments in green product development are still lagging. Moreover, it is no surprise that SMEs’ pay less attention to eco-design or LCA, since SMEs typically have fewer resources, inadequate expertise and lower awareness.

Recycling activities are the most common end-of-pipe practices implemented by SMEs. It is not surprising as reactive approaches are very straightforward and easy to install. The practice however, does not eliminate the source of pollutions, but it is the early move of SMEs when embarking on proactive initiatives. Optimization of these activities, by carefully and systematically

sorting production waste could improve the environment as well as reduce costs. In Malaysia, recycled materials are sold to a third party or a waste collector. Indeed, recycling activities give SMEs additional income. SMEs often take this opportunity to achieve both environmental performance and cost saving.

H2: Stakeholders' Involvement is positively associated with Environmental Management Practices.

Table 2 displays the results of full SEM that relates stakeholders' involvement to three categories of environmental practices. Our results indicate that there is a strong relationship between stakeholders' involvement and environmental practices. Overall, the full structural model shows that stakeholders have a significant influence on SMEs' environmental practices with β range from a low of 0.03 to a high of 0.74. The model explains 62 percent of the variance in process-based activities, 71 percent of the variance in product-based activities and 34 percent of the variance in environmental systems. Hence, this finding supports the second hypothetical statement.

Table 2: Regression weight between latent construct

Latent constructs	Regression weight	Critical ratio	sig
ENVSYSTEM <--- EMP	.004	.057	.955
PROC <--- EMP	.195	2.451	.014
PROD <--- EMP	.093	1.290	.197
ENVSYSTEM <--- CUSTOMER	-.091	-1.137	.256
PROC <--- CUSTOMER	.613	6.270	***
PROD <--- CUSTOMER	.161	2.164	.030
ENVSYSTEM <--- GOV	.158	2.138	.033
PROC <--- GOV	-.015	-.211	.833
PROD <--- GOV	.003	.050	.960
ENVSYSTEM <--- TMS	.490	5.572	***
PROC <--- TMS	-.169	-2.089	.037
PROD <--- TMS	-.072	-.973	.331
ENVSYSTEM <--- SUPP	-.035	-.455	.649
PROC <--- SUPP	.280	3.475	***
PROD <--- SUPP	.740	8.949	***

Although, stakeholders might not be able to influence all environmental practices, as evident with low β in the path model, our research suggests that each stakeholder has a different role and mean differently to SMEs. This also suggests that, to ensure successful transition of any environmental strategies by SMEs, stakeholders must act collectively, particularly, by upholding mutual relationships that are based on partnerships and networking. Although regulations and enforcements are fundamental means to change organizations' course of actions and to push for the adoption of an environmental strategy, their effectiveness could be obscured as there are many weak points and limits that may liberate SMEs from complying. Many research studies have proven that stakeholder pressures, although needed but are not perceived important enough for SMEs [34-36]. Consequently, stakeholders need to have influence on SMEs' managers through environmental awareness and education, knowledge transfers and information sharing.

H3: The impact of stakeholder involvement varies depending of the partners chosen.

As shown in Table 2, with respect to the third hypothesis (H3), it was found that the impact of stakeholder involvement on environmental practices varies depends of the partners chosen. Standardized regression weight of SUPPLIER has a strong significant relationship with both

PRODUCT and PROCESS ($\beta = 0.74$ and 0.28 respectively) but has no impact on SMEs' ENV_SYSTEMS practices. However, SMEs' downstream partners, CUSTOMER was found to be significant at 0.613 on PROCESS but was not significant on PRODUCT and ENV_SYSTEMS. Senior Manager Support (SMS) was found to be a significant driver on ENV_SYSTEMS only.

The results suggest that different practices and perspectives exist among approaches of partners and these could govern or determine how the relationship is managed and what kind of improvement can be achieved. Specifically, there are significant differences in how SMEs liaise with government agencies and with customers and suppliers (vertical partnerships). SMEs seem to be more responsive to environmental requirements from their vertical partners. There are several reasons that can explain these phenomena:

1. From SMEs' perspective, customers are significant to their survival if compared to the government. Therefore, any requirements from customers are considered highly important.
2. Cooperation with customers and suppliers allows SMEs to gain considerable knowledge on environmental technologies and systems. Eventually, as this kind of focus is typical in SMEs, they generally use their customers as a principal source of environmental information. Therefore, customers-suppliers collaboration has a significant effect on both product and process-based changes.
3. Although the government enforces and promulgates many environmental regulations, the regulations seem to have nominal impact on SMEs. Pressure on environmental criteria only has weak relationships with SMEs environmental practices. In fact, it appears to have minimum effect on internal systems and does not have any role in determining environmental changes in product or manufacturing processes.

Conclusion

This study examined the merit of various stakeholders in shaping the implementation of proactive environmental practices in SMEs. Our findings support the notion that the success of an organization depends on its capability to deal with various key stakeholders. The finding suggests that SMEs' stakeholders – or at least most of the stakeholders do have a significant role in SMEs managers' strategic choices.

For the first part of our analysis, our study reveals that Malaysian SMEs have shown significant progress to embark on proactive environmental strategies. Although they are making slow development on the pathway to sustainability, they are integrating proactive environmental strategies into their operations, nonetheless, they are still struggling to fully understand and integrate proactive environmental practices. Consequently, they are unable to properly translate their environmental strategies into product or process based achievements.

The second part of the analysis looked at the role of stakeholders as emphasized by scholars [22, 37] and practitioners [38]. This study shows to some extent different and unique roles of each stakeholder. With regard to the stakeholder theory, our findings suggest each stakeholder has a significant impact on SMEs environmental practices. However, the most important stakeholders were vertical partners, which are customers and suppliers. Even so, we concluded that the establishment of customer-supplier relationships or supply network partnerships among SMEs are still low. It explains why many SMEs utilize only a partial implementation of environmental systems. If customers and suppliers are significant drivers for developing environmental capability, it follows that the establishment of these partnerships is crucial.

This also stands in contrast to the prominent role of the government ascribed in our discussion. It seems that in Malaysian SMEs setting, the government plays a much more limited role in influencing the adoption of environmental practices than other stakeholders. The limited role of the government indicates many partnership issues are geared towards effective implementation of environmental practices. SMEs-government partnership might be a successful driver in other countries but in the Malaysian setting, the intrinsic value from the partnership scheme might be so insignificant to be considered strategically.

Lastly, the influence of internal stakeholders is found to be significant. Nonetheless, compared with employees, senior managers' influences are found to be more constructive. Although, employees might give a meaningful effect on process-based changes activities, which may be derive from their hands-on experiences dealing with waste and pollution generated from production processes, the influences are very low. Ultimately, the success of environmental management transition will be strengthened once the implementation is extended to the entire organization. In fact, success of environmental system implementation relies on strong leadership that must be encouraged by senior management.

References

- [1.] Hillary, R., *Environmental Management Systems and the Smaller Enterprise*. Journal of Cleaner Production, 2004. **12**(6): p. 561-569.
- [2.] Smith, M.A., Kemp, R., *Small Firms and the Environment 1998: A Groundwork Report*. 1998: Birmingham.
- [3.] Marshall, *Economic Instruments and the Business Use of Energy*. 1998: London.
- [4.] Berends, H., et al., *Report on Smes and the Environment*. 2000, Ecotech Research and Consulting: Brussel.
- [5.] Reisinger, H., et al., *Lead, Cadmium and Mercury Flow Analysis – Decision Support for Austrian Environmental Policy*. Österreichische Wasser- und Abfallwirtschaft, 2009. **61**(5): p. 63-69.
- [6.] Hall, J., *Environmental Supply Chain Dynamics*. Journal of Cleaner Production, 2000. **8**(6): p. 455-471.
- [7.] Simpson, D., D. Power, and D. Samson, *Greening the Automotive Supply Chain: A Relationship Perspective*. International Journal of Operations & Production Management, 2007. **27**(1): p. 28-48.
- [8.] Theyel, G., *Customer and Supplier Relations for Environmental Performance*, in *Greening the Supply Chain*, J. Sarkis, Editor. 2006, Springer: Dordrecht.
- [9.] Jao H.C, Chung H.Y, and Chia W.T, *Trust and Knowledge Sharing in Green Supply Chains*. Supply Chain Management, 2008. **13**(4): p. 283-295.
- [10.] Vachon, S. and R.D. Klassen, *Supply Chain Management and Environmental Technologies: The Role of Integration*. International Journal of Production Research, 2007. **45**(2): p. 401-423.
- [11.] Vachon, S., *Green Supply Chain Practices and the Selection of Environmental Technologies*. International Journal of Production Research, 2007. **45**(18-19): p. 4357-4379.
- [12.] Vachon, S. and R.D. Klassen, *Environmental Management and Manufacturing Performance: The Role of Collaboration in the Supply Chain*. International Journal of Production Economics, 2008. **111**(2): p. 299-315.