



ANTECEDENTS AND OUTCOME OF SUSTAINABLE ENVIRONMENTAL MANUFACTURING PRACTICES

Hameed Olusegun Adebambo¹ --- Hasbullah Ashari² --- Norani Nordin³

^{1,2,3}School of Technology Management & Logistic, University Utara Malaysia, Malaysia

ABSTRACT

An increased demand has been placed on the manufacturing industries to be more responsible to their environment with respect to their product and processes. This demand is due to various antecedent factors driving sustainable environmental practices in manufacturing firms. However, environmental value is not only the concern of firms. The impacts of this environmental initiative on the performance of these firms are as well important. The aim of this study is twofold: (i) to propose a comprehensive framework that encompasses the antecedents and the outcome of sustainable environmental manufacturing practices and (ii) as a validation process for the developed instrument of the ongoing research for the identified constructs of the study. Data were collected from thirty respondents using a seventy-seven item instrument. The data collected was analyzed using SPSS software. The results of the Cronbach's Alpha test reveal a strong internal reliability of the construct and the overall instrument. The research is significant because it explores the implementation of sustainable environmental manufacturing practices in Malaysia and validates the instrument in which most of these constructs still need further exploration.

Keywords: Sustainable environmental manufacturing practices, Framework, Instrument, Validation, Reliability.

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1. INTRODUCTION

Sustainability among manufacturing companies has become a concern of various organizational sectors as there is increase in the issues of sustainability around the world (Bajracharya and Too, 2009; United Nations Environment Programme UNEP, 2011). Presently, sustainability issues are now receiving noticeable attentions globally and have become a critical and major factor of competition and firm performance (United Nations Environment Programme UNEP, 2011) among manufacturers thereby compelling many manufacturing firms both at the international and local level to include sustainable environmental practices in their strategies and

activities (Amrina and Yusof, 2011). Thus, forcing a renewed focus on the manufacturing industries' stakeholders such as the regulatory policy makers, shareholders, customers and employees has resulted in demanding from the companies to be more responsible to the environments with respect to their products and the process (Ahmed *et al.*, 2003; Naffziger *et al.*, 2003; Rusinko, 2007; Galdeano-Gomez *et al.*, 2008).

This demand is due to various factors driving sustainable environmental practices, such as: stakeholder pressure, public concern and commitment of the top management of the organizations from being environmentally sustainable (Rusinko, 2007; Adebambo *et al.*, 2013). As such, 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 and Nurul, 2012); (Siedel *et al.*, 2007). Corporate organizations responded to the environmental issues due to their concerns for the drivers of sustainable environmental manufacturing practices (Bansal and Roth, 2000) or what they perceive to benefit from the implementation of sustainable environmental practices (Al-Shourah and Ibrahim, 2007). The question to ask here is how companies perceive environmental practices and the effect of their perception on the performance of their companies.

Literatures show that firms are not only concerned about their environmental values but also about the economic success and performance of their organizations (Henri and Journeault, 2008). Thus, the implementation of sustainable environmental manufacturing practices in industries could be as a result of different factors motivating the implementation of the initiative and influenced by regulation and benefits anticipated by the firms from implementing the initiatives (Bansal and Roth, 2000; Al-Shourah and Ibrahim, 2007). However, the conclusion of practitioners about the impact of SEMP on what drives/motivates firms into implementing sustainable environmental practices and in-turn, the effects of the practices on firm performances remains inconsistent (Gonzalez-Benito and Gonzalez-Benito, 2006; Schoenherr and Talluri, 2012) (Arafat *et al.*, 2012) The reason for this could be as a result of the failure of the past empirical researchers to integrate the antecedents, SEMP and the outcomes in a single comprehensive framework (Gonzalez-Benito and Gonzalez-Benito, 2006).

Practitioners have often view the implementation of environmental practices in two different ways: (Choi and Zhang, 2011): Some group of practitioners assert that sustainable environmental manufacturing practices is integral to the performance of manufacturing companies as it provides a long-term economic gain to companies (Ahmed *et al.*, 1998; Ahmed *et al.*, 2003; Hartmut and Sami, 2006) and Hart (1995) however, the other groups view environmental sustainable practices as a mere investment on a practices that add more to the cost of manufacturing companies as firms incur more cost while implementing this practices (Judge and Krishnan, 1994; Walley and Whitehead, 1994); (Freeman, 1994).

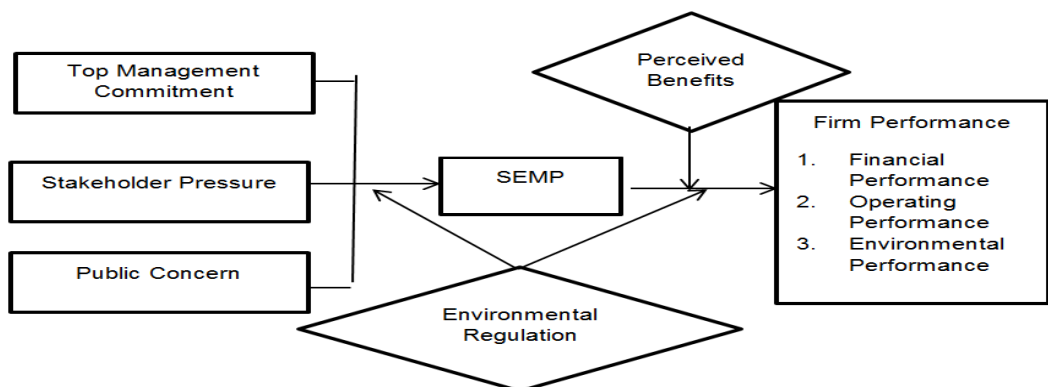
In addition, the preliminary investigation of this study shows that the motives of firms in implementing sustainable environmental practices is either to avoid sanctions and punishments in form of penalties, fines or withdrawal of license as a result of non-compliance with environmental

regulations (Bansal and Roth, 2000; Lai and Wong, 2012); (Davidson and Worrel, 2001), in this case, firms implement environmental initiative just to satisfy the requirement of the regulation. On the other hand, firms implement sustainable environmental practices as a corporate strategy by going beyond the basic environmental requirements and regulations in order to contribute to the success of the firms (Omar and Samuel, 2011). Therefore, to clarify the inconclusive assertions on the relationship between the antecedents and outcomes of SEMP, a comprehensive framework is needed to integrate the antecedents, SEMP and its outcome via the moderating influence of perceived benefits and environmental regulation is needed.

2. CONCEPTUAL FRAMEWORK

Previous literature review on the concept of sustainable environmental manufacturing practices has shown a clear need for a framework that integrates the antecedents (top management commitment, stakeholder pressure, public concern), SEMP and its outcome via the moderating role of environmental regulation and perceived benefits in a single study. In this study, firm performance is the outcome of SEMP and it's the dependent variable while the independent variables are the antecedents of SEMP (stakeholder pressure, top management commitment and public concerns), they are also regarded as the drivers of the implementation of SEMP. Perceived benefits and environmental regulation are moderators on the relationship between SEMP and its outcome. It is a general belief and regarded in environmental practices literatures that only when the factors that drive the implementation of environmental practices in firms have been identified that the firm can have a successful implementation of sustainable environmental practices. The proposed framework for this study is presented in figure 1 below.

Figure-1. Conceptual Framework



2.1. Sustainable Environmental Manufacturing Practices

Sustainable environmental manufacturing practices (SEMP) is a technique, policy and the procedures taken by firms with specific aim of monitoring and controlling the effects of the operations of the firm on the environment (Schoenherr and Talluri, 2012). It aims at minimizing

the negative effect on the environment, minimizes the use of energy and natural resources, provides safe environment for the employees and the consumers. It is commonly perceived as recycling of materials, sourcing renewable energy and emission reduction however, it also entails the other practices that spread the environmental perspectives to the public and stakeholders, such activities include research and design, employees training and customer awareness (Rusinko, 2007). Previous researches have highlighted that the successful implementation of SEMP is a function of the identification of its antecedents. Thus, top management commitment, stakeholder pressure and public pressure have been identified in this study as the antecedents of SEMP.

2.2. Top Management Commitment

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 by directly involved 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, 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. According to Banerjee *et al.* (2003), he asserts that the commitment of the top management directly influences the implementation of corporate environmentalism. The empirical investigation of Al-Shourah and Ibrahim (2007) also confirms that top management positively support and influences the implementation of environmental practices. Thus, this study posits top management commitment as an antecedent of SEMP in firm.

2.3. Stakeholder Pressure

Similarly, previous researches have proven that the pressure of the stakeholders is significantly related to the implementation of environmental practices (Henriques and Sadorsky, 1999; Chen and Shih, 2007; Darnall *et al.*, 2008). Stakeholders may exert pressure on firms to get their claims from the firms, thus initiating the implementation of SEMP in firms. Following the empirical investigation of the past researchers, it is established that there tend to be a positive relationship between the stakeholder pressure and implementation of SEMP (Cespede-Lorente *et al.*, 2003; Chen and Shih, 2007). Gonzalenz-Benito and Gonzalenz-Benito (2006) highlight a positive relationship between perceived stakeholder environmental pressure and environmental logistic practices. Cespede-Lorente *et al.* (2003) found a positive relationship between stakeholders' pressure and the adoption of environmental practices in firms. Henriques and Sadorsky (1999) found that pressure from stakeholders drive firm to implement environmental management practices. As a result, is regarded in this study as an antecedent of SEMP.

2.4. Public Concern

Public concern is the certain level of expectation a firm is expected to meet by the public. It is one of the forces driving the implementation of environmental manufacturing practices. The more the concern of the public on environmental issues of a firm, the more the implementation of SEMP by the firm. Firms are concerned about how they are perceived by the public, thus having a tendency of influencing their environmental manufacturing practices. Firms may intend to maintain their reputation through their responsiveness to sustainable environmental manufacturing practices, and as well implement environmental manufacturing practices to stay in market competition (Banerjee *et al.*, 2003). The empirical investigation of Carter *et al.* (2009) and Banerjee *et al.* (2003) conclude that public concern drives the implementation of proactive environmental practices. As such, it is posited in this as an antecedent of SEMP.

2.5. Firm Performance

There has been a growing concern on firm performance as an outcome of sustainable environmental manufacturing practices. It is generally believed that a trade-off exists between environmental proactiveness and firm's productivity (Porter and Van Der Linde, 1995). The pursuit of environmental goals is usually associated with increased cost at the beginning of the implementation of SEMP; however, it results into benefits such as cost savings and better financial performance in the long run (King and Lenox, 2001). The concept of SEMP is directed towards eco-efficiency and pollution prevention practices such as reduction of energy consumption, carbon emission reduction and waste minimization which lessen environmental degradation caused by manufacturing industry. Thus, this study posits that the implementation of SEMP will positively improve environmental performance. In a similar vein, pollution prevention activities such products life cycle analysis, collection and use of the reusable parts and components of products is tended towards reducing environmental degradation and creates avenue for the identification of the areas that requires improvement in the quality of products of firms which can reduce damages due to waste disposal and cost of manufacturing operations (Lai and Wong, 2012) as rework is avoided and quality is ensured from the beginning of operations. As such it is posited that implementation of SEMP positively increases operational performance.

The outcomes of sustainable environmental manufacturing practices such as financial performance, environmental performance and operating performance have been previously examined (Ameer and Othma, 2011); (Wagner *et al.*, 2002; Zhu and Sarkis, 2004; Chen and Shih, 2007; Lopez-Gamero *et al.*, 2009). Ameer and Othma (2011) and (Chen and Shih, 2007) found a positive relationship between environmental practices and financial performance of firms. Lopez-Gamero *et al.* (2009) on the relationship between environmental variables and firm performance affirmed that proactive environmental practice is significantly related to firm performance. Chen and Shih (2007) in their investigation on green manufacturing practices among the Chinese industries established that green manufacturing practices is positively related to the environmental and financial performance. Zhu and Sarkis (2004) affirmed that there is a direct

positive relationship between internal environmental management practices and environmental performance. Furthermore, Hart and Ahuja (1996) confirmed that a significant relationship exists between reducing emission and operating and financial performance. Schoenherr and Talluri (2012) found a positive relationship between sustainable environmental practices and plant efficiency while Lai and Wong (2012) affirmed a positive relationship between environmental management and operational performance in green logistics. As a result, this study posited a positive relationship between the implementation of SEMP and firm performance.

2.6. Moderating Role of Perceived Benefit

Perceived benefit is conceptualized in this study as a moderator between sustainable environmental manufacturing practices and firm performance. It is a set of favourable outcomes anticipated by firms as benefits from the implementation of SEMP (Al-Shourah and Ibrahim, 2007). The implementation of SEMP will be more proactive when firm perceive the initiatives as a potential benefits and reactive when they feel that environmental initiative is a threat (Sharma *et al.*, 1999). This was empirically tested in the study of Sharma (2000) using a sample of 99 Canadian oil and gas firm in which it was concluded that the greater a firm interprets environmental practices as opportunities the more likelihood they implement the initiative. (Al-Shourah and Ibrahim, 2007) on the relationship between environmental management practices and the performance of five-star hotels in Malaysia indicate that benefits perceived by the companies moderate the relationship between the environmental management practices and hotel performance. In line with this argument, Bansal and Roth (2000); Porter and Van Der Linde (1995); (Gonzalez-Benito and Gonzalez-Benito, 2006), Claver *et al.* (2007) assert that company will implement environmental practices if they perceive some benefits either by drastically reducing costs of operations, cost reduction, greater product efficiency, enhanced product image as potential benefits, they will implement sustainable environmental practice. As a result of the aforementioned discussion, perceived benefit is posited as a moderator between SEMP and its outcome.

2.7. Moderating Role of Environmental Regulations

Environmental regulations are enacted to control the environmental damages caused by the operations of firms therefore, manufacturing firms are mandated to operate under the requirements of the regulation (Lai and Wong, 2012). Results of the past researches have shown that environmental regulations that are focused on the manufacturing sectors have a set of implications on operations and the performances of the manufacturing firms (Lai and Wong, 2012); Chen and Shih (2007); Henriques and Sadorsky (1999). In the presence of an increased public concern, stakeholder pressure, top management commitment and the growth of a more stringent environmental regulation, a sustainable environmental manufacturing practice is a proactive approach and a more sustainable way to develop a friendly environment to enhance firm performance. Environmental regulation strengthens the implementation of SEMP in

manufacturing firms by providing standards and requirements on environmental conformances. Therefore, there is a need for environmental regulation compliances to strengthen the dedication of the manufacturing firm to the implementation of SEMP.

In the same vein, polluting firms are punished by paying penalties and fines for not complying with environmental standards and regulations (Davidson and Worrel, 2001). Manufacturers are in so many cases pressurized to be proactive in order to achieve performance and benefits. This pressure indicates the essence for the manufacturing firms to improve their environmental manufacturing practices (Lai and Wong, 2012). Environmental regulation provides the need for firms to implement SEMP while the requirements of regulation guide the practices of manufacturing firms to preserve the environment. In order for firm to gain more competence in an environment with stringent environmental regulation, SEMP is required to offset the unproductive cost of non-compliance. In view of a stringent environmental regulations and requirements, SEMP is required to boost the financial, environmental and operational performance of manufacturing firms. This assertion was supported in the empirical findings of Lai and Wong (2012) which found environmental performance as a moderator on the relationship between environmental practices in green Logistic and firm performance.

3. METHODS

Putting into consideration that this study is a pilot test of an on-going research, samples of the Malaysian manufacturing companies was randomly selected. A pilot study mainly requires a range of few respondents (15-30), though there may be a substantial increase in the sample size for a pilot study (Malhotra, 2008). Hence, a total of forty questionnaires were personally administered. Thirty five questionnaires were returned out of which 30 are qualified for the analysis.

3.1. Instrument Design

Asika (1991) regard questionnaire as one of the most appropriate instrument for survey research. To ensure that all the variables in this study are fully measured, items for this study were drawn from several sources in order to establish item pool and content validity including previous research findings on the constructs of this study (antecedents of SEMP, SEMP, firm performance, perceived benefits and environmental regulation). These items were adapted and modified from previous literatures (Gonzalez-Benito and Gonzalez-Benito, 2005); Lai and Wong (2012); Carter *et al.* (2009); (Henri and Journeault, 2008); Amrina and Yusof (2011); (Lin *et al.*, 2012) with the aim of establishing the validity of the construct including: (a) establish contact between the researcher and the organizations prior to the main study (b) determine the reliability of the constructs and (c) foresee the challenges that may possibly arise before the main data collection of the study. This study adopted the use of a six-point likert scale rating to measure the responses to the questions. A rating scale helps researchers in computing the means and standard deviation responses on variables as much as the mid-point of the scale (Sekaran, 2003;

(Sekaran and Bougie, 2009). Previous literatures such as Krosnick and Fabrigar (1991) argued that a scale between 5 to 7 points reliably and validly measure items than a shorter or a longer scale point. However, Dawis (1987) and Garland (1991) suggested that the decision of the measurement scale largely depends on the preference of the researcher as there is no single best method for scale construction. A suitable method for one research problem may not be good for another. It was argued by Krosnick and Fabrigar (1991) that the behaviour demonstrated by respondents is either to optimize or satisfy the survey. Thus, this study adopts the use of a six-point scale in order to prevent the respondents from choosing a neutral point due to easy choice of answer to avoid reducing the quality of the measurement of the responses which could be reduced if a neutral point is included in the scale. The following are the key variables contained in this study:

- Sustainable environmental manufacturing practices (SEMP)
- Top management commitment
- Stakeholder pressure
- Public concern
- Firm performance

All the constructs/variables in this study are uni-dimensional except firm performance (Financial, operational and environmental performance) which is multidimensional. The detail of the constructs and their corresponding dimensions are presented in Table 1.

3.2. Validation of Instrument Measures

The pilot test of the instrument in this study was conducted in Malaysia. Participants in this study are the operations, Manufacturing and Environmental/Health executives of the respondent companies. The essence of this was to get relevant feedback to improve the data collection techniques and the instrument used in the main study. In ensuring that the instrument (questionnaire) was properly adapted, this study conducted a content and construct test for the validation of the measuring instrument used in this study. The essence of this validity is to know whether meaningful inferences can be drawn from the measure of the instrument of this study by conducting a face validity test on the wordings and sequence of the items to determine which best suites the respondents among the alternative formats, to ascertain whether the items of this study will adequately measure the hypothetical concepts of the study (Creswell, 2009); (Sekaran and Bougie, 2009), and to foresee any challenges that may occur during the main data collection period and to prepare a back-up plan to absorb any challenges that may arise during the main collection of data.

This was done by firstly subjecting the instrument of this study to an in-depth review by the experts in quantitative study and practitioners (Creswell, 2009) and was followed by making necessary corrections based on the comments received from these experts. The validation process involved six (6) experts, four (4) among the experts are academicians while two (2) are

practitioners. The comments received from these experts were implemented in the final research instrument used in collecting data for the main study.

3.3. Reliability Test Analysis of the Construct

Upon the completion of the experts review of the instrument of this study, further test known as the reliability test was conducted to determine the internal consistency of the instrument. Pallant (2001) assert that thirty (30) or more respondents are adequate for the conduct of pilot testing. Therefore, this study used 30 respondents for the purpose of the pilot study. The result of the pilot study in this research is interpreted by using Cronbach's Alpha value summarized in Table 1 below:

Table-1. Summary of the pilot test reliability analysis of constructs

Constructs	Number of items	Cronbach's Alpha
Sustainable environmental manufacturing practices (SEMP)	20	0.964
Stakeholder Pressure	6	0.832
Top Management Commitment	8	0.972
Public Concern	5	0.973
Environmental Regulation	9	0.894
Perceived Benefits	13	0.944
Financial Performance	5	0.981
Operational Performance	6	0.943
Environmental Performance	5	0.948

4. DISCUSSION

This study has highlighted that the possible reasons for the inconsistency in the link between sustainable environmental manufacturing practices and firm performance could be because previous researches failed to consider environmental regulation and perceived benefits as moderators on the relationship. It has therefore presented a framework that integrates the antecedents, SEMP, perceived benefits, environmental regulations and firm performance as an outcome of SEMP in a single framework. This research is one among the others that considers the effect of environmental regulation and perceived benefits of SEMP on the relationship between SEMP and firm performance. This proposed framework is developed through a thorough review of literature to provide a deep understanding to academicians and practitioners on the antecedents and outcome of SEMP and the moderating effects of environmental regulation on the link between SEMP and firm performance to enable policy maker enhance performance of firms through environmental regulation. The result of the pilot test analysis indicates that the Cronbach's Alpha of the variables ranges from 0.832 to 0.981. Pallant (2011) and Hair *et al.* (2010) assert that Cronbach's Alpha greater than 0.7 is accepted; however, value greater than 0.8 is preferable. This result shows that the values of the Cronbach's Alpha are all greater than 0.8 indicating a very good reliability of the research instrument. Therefore, none of the items were

dropped from the instrument. The reliability result of this study reveal that the variables of this research as listed in Table 1 above are appropriate to be used in the main collection of data for analysis purpose in this research. Further reliability analysis is expected to be performed on the main data collected after the conduct of factor analysis on the main study based on a larger sample size.

5. CONCLUSION

This study is limited to the environmental stewardship aspect of sustainable practices therefore, future researchers are charged to investigate the social and economic aspects of sustainable practices and also endeavor to empirically validate the proposed framework in this study.

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