# SUSTAINABLE ENVIRONMENTAL MANUFACTURING PRACTICES AND FIRM PERFORMANCES: MODERATING ROLE OF ENVIRONMENTAL REGULATION AND PERCEIVED BENEFITS

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# ABSTRACT

More attention has been shifted to the environmental impacts of manufacturing companies on firm performance as sustainable environmental manufacturing practice has become an issue of concern to most researchers and practitioners. Theoretical evidence from previous studies showed that a considerable amount of attention has been given to environmental issues in academic studies in the past years and the link between environmental practices and performance of firms has been widely discussed, which results into different views. Thus, the relationship between sustainable environmental practices and firm performance remains inconclusive. This study investigates the impact of sustainable environmental manufacturing practices (SEMP) on firm performance through the moderating effects of perceived benefits (PB) and environmental regulation (ER). In addition, the relationships between the antecedent factors and SEMP were investigated. Data was collected from manufacturing companies in Malaysia using a cross sectional study design and stratified random sampling method. 103 usable questionnaires were collected by using a mail survey method and analysed with SmartPLS-SEM. The result indicated that five out of the 12 hypothesized relationships (both the direct and moderating hypotheses) were supported. Specifically, the study found that top management commitment and stakeholder pressure positively influence sustainable environmental manufacturing practices and that sustainable environmental manufacturing practice has a direct positive influence on environmental performance. The study also established that perceived benefits moderates the relationship between sustainable environmental manufacturing practice and operational performance, while the relationship between sustainable environmental manufacturing practice and environmental performance is moderated by environmental regulation. In addition, it was found that sustainable environmental manufacturing practice is still regarded as ethical behaviour and yet to be considered as a strategic factor of firms in Malaysia. Hence, important implication f this study to the environmental regulatory policy makers, academics and manufacturing practitioners in Malaysia is to create more awareness on the perception of SEMP as a strategic factor towards achieving better firm performance. It also reveals the need for environmental policy makers and the concerned authorities to revisit the environmental regulations on manufacturing practices to provide supportive environmental policies that will enhance a better firm performance in the Malaysian manufacturing industry.

**Keywords:** antecedent factors of SEMP, environmental regulation, firm performance, sustainable environmental manufacturing practices and perceived benefits.

## ABSTRAK

Pada masa kini, lebih tumpuan diberikan kepada kesan alam sekitar terhadap prestasi syarikat pembuatan. Ini adalah kerana amalan pembuatan alam sekitar mampan telah menjadi satu isu yang manarik perhatian kebanyakan penyelidik dan pengamal industri. Bukti-bukti teori daripada kajian sebelum ini menunjukkan bahawa sejumlah besar perhatian telah diberikan kepada isu-isu alam sekitar dalam kajian akademik. Perhubungan di antara amalan alam sekitar dan prestasi firma juga telah dibincangkan secara meluas dan telah mengahsilkan pandangan yang berbeza. Oleh itu, hubungan antara amalan alam sekitar yang mampan dan prestasi firma masih belum meyakinkan. Kajian ini mengkaji kesan amalan pembuatan alam sekitar mampan (SEMP) ke atas prestasi firma melalui kesan menyederhana manfaat yang dirasakan (PB) dan peraturan alam sekitar (ER). Di samping itu, hubungan antara faktor-faktor anteseden dan SEMP dikaji. Data dikumpulkan daripada syarikat-syarikat pembuatan di Malaysia dengan menggunakan reka bentuk kajian rentas dan kaedah persampelan berstrata rawak. 103 borang soal selidik telah dikumpulkan dengan menggunakan teknik kaji selidik melalui pos dan dianalisis dengan menggunakan SmartPLS-SEM. Hasil menunjukkan bahawa lima daripada 12 hubungan hipotesis (kedua-dua hipotesis langsung dan menyederhana) telah disokong. Secara khusus, kajian ini mendapati komitmen pengurusan atasan dan tekanan dari pihak berkepentingan secara positif mempengaruhi amalan pembuatan mampan alam sekitar (SEMP) dan juga, amalan pembuatan mampan alam sekitar mempunyai pengaruh yang positif secara langsung terhadap prestasi alam sekitar. Kajian ini juga membuktikan manfaat teranggar menyederhanakan hubungan antara SEMP dan prestasi operasi, manakala hubungan antara SEMP dan prestasi alam sekitar disederhanakan oleh peraturan alam sekitar. Di samping itu, kajian ini mendapati bahawa amalan pembuatan mampan alam sekitar masih dianggap sebagai tingkah laku beretika dan belum dianggap sebagai faktor strategik firma di Malaysia. Oleh itu, implikasi penting kajian ini kepada penggubal dasar peraturan alam sekitar, ahli akademik dan pengamal pembuatan di Malaysia adalah, mereka perlu membentuk lebih banyak kesedaran mengenai tanggapan SEMP sebagai faktor strategik ke arah mencapai prestasi firma yang lebih baik. Ia juga mendedahkan keperluan untuk penggubal dasar alam sekitar dan pihak yang terbabit untuk mengkaji semula peraturan alam sekitar berkaitan pengamalan pembuatan untuk menyediakan dasar menyokong alam sekitar yang akan meningkatkan prestasi firma dalam industri pembuatan Malaysia.



**Kata kunci:** factor-faktor anteseden SEMP, peraturan alam sekitar, prestasi firma, amalan pembuatan alam sekitar mampan dan manfaat teranggar.

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| | |
|---|---|
| AVE | Average Variance Extracted |
| BNM | Bank Negara Malaysia |
| $BOD_5$ | Biochemical Oxygen Demand |
| CES | Compendium of Environmental Statistics |
| CFA | Confirmatory Factor Analysis |
| CMV | Common Method Variance |
| CR | Composite Reliability |
| DOE | Department of Environment |
| EIA | Environmental Investigation Agency |
| EP | Environmental Performance |
| EQA | Environmental Quality Act |
| ER | Environmental Regulation |
| ESTS | Environmental Statistics Time Series |
| FMM | Federation of Malaysian Manufacturer |
| FP | Financial Performance |

| | |
|---|---|
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GoF | Goodness of Fit |
| ISIC | International Standard industrial Classification |
| ISO | International Standard Organization |
| MIP | Malaysia Investment Performance |
| NIMRC | Nottingham Institute of Innovative Manufacturing Center |
| NRBV | Natural Resource Based View |
| OECD - | Organization for Economic Co-operation and Development |
| OP | Operational Performance |
| PB | Perceived Benefits |
| PC | Public Concern |
| PLS-SEM | Partial Least Square Structural Equation Modelling |
| RBV | Resource Based View |
| SEM | Structural Equation Modelling |
| SPSS | Statistical Package for Social Sciences |
| STML | School of Technology Management and Logistics |
| UUM | Universiti Utara Malaysia |

# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the study

The beginning of the new millennium witnessed an increasing awareness of the impact of manufacturing firms on the environment, thereby enhancing the implementation of sustainable manufacturing practices that prevents environmental degradation (Seidel, Shahbazpour & Siedel, 2007; Millar & Russel, 2011; Anis & Nurul, 2012). Various labels such as environmentally conscious manufacturing (Richards, 1994) or Green manufacturing (Rusinko, 2007) have given birth to the concept of sustainable environmental manufacturing practices which is aimed at minimizing the environmental impact linked to manufacturing activities. Manufacturing firms contribute positively to economy in term of gross domestic product (GDP) and employment opportunities, but their operational activities have detrimental impacts on the environment.

Environmental problem has been linked to the operational activities of manufacturing firms (Gutowski, Branham, Dahmus, Jones, Thiriez, & Sekulic, 2009). Traditionally, association exists between manufacturing firms and the undesirable environmental negative impacts (Frosch & Gallopoulos, 1989; Despeisse, Ball & Evans, 2012). As such, environmental practices have thereby become a vital global issue that creates challenges for the society and manufacturing practitioners (Jovane, Yoshikawa, AltingBoër, Westkämper, Williams, Tseng, Seliger, & Paci 2008). The next section of this study explored the need for sustainable environmental practices in manufacturing industries.

Since the emergence of the industrial revolution, manufacturing industry has gone through phases of advancement which lead to the era of automations and advanced manufacturing (Gandhi, Selladurai & Santhi, 2006). In the context of Malaysia, this country has witnessed a shift from the agricultural based economy to the manufacturing based economy (Rao, 2004). The advancement in manufacturing has both negative and positive effects on the economy of Malaysia (Al-Amin, Siwar, Huda & Hamid, 2009).

Positively, manufacturing contributed 27.2% of the GDP of Malaysian economy in 2012 and thereby expanding its value added by 4.5% (Malaysia Investment Performance [MIP], 2011). The Malaysian manufacturing sector was also responsible for 67.7% of the total manufacturing, product exports in 2011 which increased by 2% from RM 461 billion in year 2010 to RM 470.3 in 2011 (Malaysian Investment Performance, 2011). Bank Negara Malaysia [BNM], (2011), regarded manufacturing as the largest contributor to the economy of Malaysia. In addition to the contribution of the manufacturing sectors in Malaysia, the Malaysian manufacturing industry contributed 28.9% of the total employment which was estimated to be 3.5 million.

Negatively, the report of the Environmental Investigation Agency [EIA], (2007) revealed that manufacturing industries are significantly responsible for the consumption of a huge amount of resources and waste generation throughout the world. This is evidenced in the obvious increase of 61% in the consumption of energy by manufacturing industries between 1972 and 2004, they are also responsible for about a third of the world's global usage of energy and emission of 36% of carbon dioxide ($C0_2$) in the world (OECD, 2009). In Malaysia, manufacturing sector is responsible for a portion of the environmental degradation. This is witnessed in the increasing volume of generated waste of stationary source from industries (20%). (See Figure 1.1 for the summary of the schedule waste generated between 2002 and 2010 in Malaysia) (Department of Environment [DOE], 2012; Environmental Statistics Time Series, 2012).

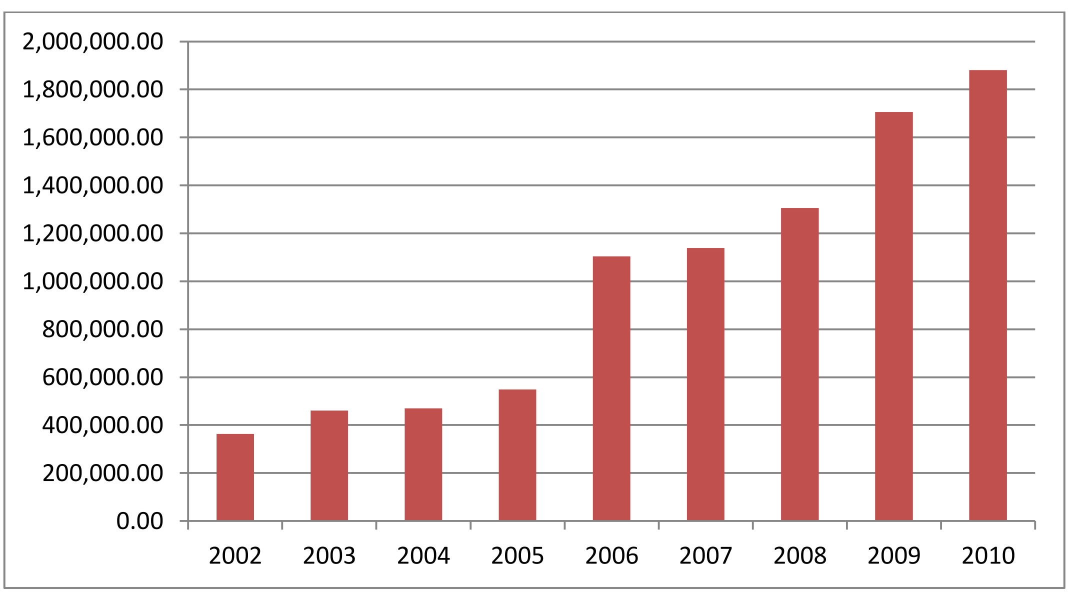


Figure 1.1
*Summary of the schedule waste generated between 2002 and 2010 in Malaysia*

In addition, the result 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 industrial activities (Compendium of Environmental Statistics [CES], 2012). $BOD_5$ refers to the quantity of dissolved oxygen needed for the bacterial decomposition of organic wastes in water samples. Table 1.2 summarizes the percentage of $BOD_5$ pollutant between 2007 and 2011 in Malaysia. Besides the Water quality problem, the consumption of water in this country is in an increasing mode year by year. National Water Resources Study (Peninsular Malaysia) asserts that water demand is expected to rise by 63% between year 2000 and 2050. In the aspect of energy consumption, manufacturing has contributed to the huge consumption of energy in Malaysia (Al-Amin, Huda, & Hamid, 2009). Therefore, there is a need for sustainable environmental practices in the 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 Environmental Statistics, 2012).

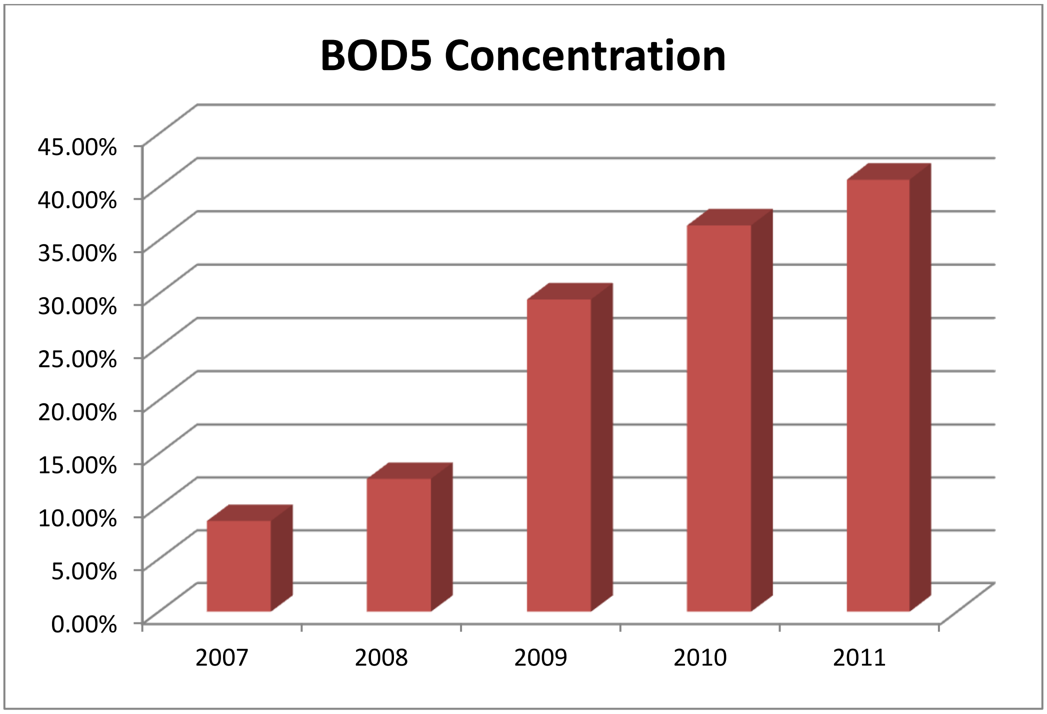


Figure 1.2
*Percentage of BOD5 Pollutant between 2007 and 2011*
*Source: Department of Environment (2012)*

In addition, the need for sustainable environmental practices has been emphasized in the worldwide, by environmental data experts who revealed that the estimated cost of land use, water consumption, Greenhouse Gases (GHG) emission, waste pollution, land and water pollution of the world amounts to about US $7.2 trillion. Ranking this estimation by their impact revealed that land use is responsible for US $ 1.8 trillion, water consumption is estimated to cost US $ 1.9 trillion, GHG is responsible for US $2.7 trillion, waste costs US $0.5 trillion while land and water pollution costs US $ 0.3 trillion (Trucost, 2013).

Due to the impacts of manufacturing industries and companies on the environments, the focus of the manufacturing industries' stakeholders such as the regulatory policy makers, shareholders, customers and employees has been shifted to being more responsible to the environments with respect to their manufacturing activities (Naffzinger, Ahmed & Montagno 2003; Rusinko, 2007; Galdeano-Gomez, 2008). This shift in focus is due to factors driving sustainable environmental practices, such as pressure from the stakeholder, public concern, and the commitment of the top management of the organisations to implement sustainable environmental manufacturing practices (Rusinko, 2007; Adebambo, Abdulkadir, Nik, Alkafaagi & Kanaan, 2013).

However, the concerns of firms on environmental issues are not only on their environmental values but also on the economic success and performance of their organisations (Henri & Journeault, 2008). Thus, sustainable environmental manufacturing practices may be regarded as a primary source of better firm performance of many manufacturing companies in many countries of the world, including the Asia-pacific region (Seidel, Shahbazpour & Siedel, 2007; Anis & Nurul, 2010). As such, many academic researchers have investigated the relationship between environmental practices and firm performance, but the findings have resulted into conflicting views on firm performance. Therefore, in order to understand the relationship between sustainable environmental practices and the performance of manufacturing firms in Malaysia, this study seeks to further investigate the effect of sustainable environmental manufacturing practices on firm performance and the antecedent factors that affect the implementation of sustainable environmental manufacturing practices in Malaysia.

## 1.2 Problem Statement

Malaysia like the developed countries has been dealing with the issues of environmental degradation caused by the activities of manufacturing firms to achieve economic growth which has resulted into environmental pollution (DOE, 2012; ESTS, 2012). Thus, there requires the need to strike a balance between the environmental and developmental issues in order to ensure that the economic benefits are not negated by the cost of environmental changes which has long been recognized by Malaysia through enactments of law, policies, regulations (DOE, 2012; ESTS, 2012). Therefore, there is a need to ensure that manufacturing firms embark on sustainable environmental practices to minimize their environmental impacts and ensure that resources are conserved.

Theoretical evidences from previous studies show that a considerable amount of attention has been given to environmental issues in academic researches in the past years and the link between environmental practices and performance of firms has been widely discussed which results into different views (Ahmed, Motagno,. & Firenze, 1998; Ahmed & Hassan, 2003; Barnet, 2007; Cho & Patten, 2007; Clarkson, Richardson & Vasvari, 2011; and Nyirenda, Ngwakwe, & Ambe, 2013). One of the debated points of view is that the implementation of sustainable environmental manufacturing practices is integral to the performance of manufacturing companies as it provides a long-term economic gain to companies (Hart, 1995; Ahmed *et al.,* 1998; Hartmut & Kara, 2006; Clarkson *et al.,* 2008; 2011) by inducing cost savings and increasing sales. Another engaging view of environmental sustainable practices is that it is a mere investment on practices that increase the cost of manufacturing companies as firms incur extra cost while implementing this environmentally friendly practices (Judge & Krishman 1994; Walley & Whitehead, 1994, Freeman, 1994; Cho & Patten, 2007) and thus, reduces firms' profitability, while some studies found that there is no existing relationship between the two concepts (Ullman, 1985; Watson *et al.,* 2004; Link & Naveh, 2006). Thus, the relationship between sustainable environmental practices and firm performance remains inconclusive (Lopez-Gamero, Molina-Azorin & Claver-Cortes, 2009; Schoenherr & Talluri, 2012; Arafat, Warokka & Dewi, 2012). To clarify this inconclusive assertion in previous studies, an empirical study is needed for further investigation in this domain.

According to Buysse and Verbeke (2002), many of the past studies on environmental practices have often investigated environmental regulation and perceived benefits as antecedents to the implementation of sustainable environmental manufacturing practices. However, little consideration has been given to their impacts on the relationship between environmental practices and firm performance. Only few among the previous studies like Lai and Wong (2012) investigated the influence of environmental regulatory policy as a moderator on the relationship between green logistic management practices and firm performance, while Al-shourah and Ibrahim (2007) investigated the impact of perceived benefit on the relationship between environmental management practices and hotel performance. Therefore, this study is of the opinion that environmental regulation and perceived benefit will moderate the relationship between sustainable environmental manufacturing practice (SEMP) and firm performance.

The regulatory requirements of the environmental sustainable practices of firm have become increasingly stringent on a yearly basis (Hartmut & Kara, 2006). Thus, it provides the need for firms to implement sustainable environmental practices. However, the motive of firms in implementing sustainable environmental practices is either to avoid sanctions and punishments in the form of penalties, fines or withdrawal of license as a result of non-compliance with environmental regulations (Lai & Wong, 2012; Davidson & Worreli, 2001). In this case, if environmental regulation is low, firms will implement environmental initiative just to satisfy the basic requirement of the regulation and which will not pay off on performance achievement. However, in the wake of a more stringent environmental regulation, the needs to comply with the regulation will increase the implementation of sustainable environmental practices by manufacturing firms which lead to better firm performance, such as reduced scrap and production waste, reduced emission and solid wastes, increased environmental innovation and better firm reputation. Lai and Wong (2012) found that a more stringent regulatory pressure enhances the green logistic management and firm performance relationship. Therefore, this study argues that more stringent environmental regulation will moderate the relationship between SEMP and firm performance.

In addition to the above, the benefit perceived by firms may influence the successful implementation of sustainable environmental manufacturing practices as the implementation of SEMP is either perceived as a burden (mere additional cost of operations) or benefits (Choi & Zhang, 2011)  by inducing the cost of saving. More dedication will be given by firms to the implementation of SEMP if it is perceived as beneficial and will thus improve performance achievement. However, firms that do not perceive the implementation of SEMP as benefits will not be dedicated to the implementation of environmental initiatives, and as such may not yield better firm performance (Choi & Zhang, 2011). These two different contentions on the motives of the implementation of SEMP by firm require the need for investigating the influence of perceived benefits on the relationship between SEMP and the performance of firms. Therefore, this study conceptualizes perceived benefits as a moderator between SEMP and firm performance.

Although, many studies have been conducted on the antecedent factors and outcomes of sustainable environmental practices, they did not integrate the antecedent factors, sustainable environmental practices and the performance of firms in a single framework. For example, Carter, Prasnikar and Carter (2009); Lee and Rhee (2006) and Ravi et al., (2005) investigated the relationship between the drivers and environmental practices while, Ameer and Othman (2011); Lopez-Gamero, Molina-Azorin, and Claver-Cortes (2009); Wagner (2005); Zhu and Sarkis (2004) investigated the relationship between environmental practices and firm performance. These investigations were separately conducted on the antecedent factors/drivers, environmental practices, and firm performance and does not represent a complete view of the relationships. Lucas (2010) emphasized that environmental management field lacks definition and a clear theoretical framework. Therefore, investigating the antecedents, sustainable environmental manufacturing practices and firm performance in a single and comprehensive framework is necessary to have a complete view of the relationships.

Many of the empirical investigations on environmental practices and firm performance were conducted in the developed countries such as U.S.A and U.K (Arafat *et al.,* 2012; Rose *et al.,* 2011). Evidences from literatures show that there is a dearth of empirical investigation in developing countries on the existing relationship between sustainable environmental manufacturing practices and firm performance (Schoenherr & Talluri, 2012; Anis & Nurul, 2012). Therefore, there is need to investigate the effect of sustainable environmental manufacturing practices on the performance of firms in the Malaysian manufacturing industry where environmental concerns have become important to the manufacturing industry and the development of the economy (Anis & Nurul, 2012; Islam, Hamid & Karim, 2007).

Due to the earlier mentioned issues (the increasing trend of environmental degradation caused by manufacturing firms), and the theoretical gap (the inconclusive relationship between SEMP and firm performance, and the lack of a clear single theoretical framework that integrates the link between the antecedent/drivers, SEMP and performance of firms) therefore, this study seeks to investigate the relationships between the antecedent factors that drive the implementation of SEMP and the effect of the practices on firm performance. Though, these relationships have been separately investigated in a few studies, but an investigation of these variables in a single framework will provide a complete view of the relationships among the variables. As such, this study seeks to investigate the relationship among the variables in order to enhance a better understanding of the link among the variables. In addition, this study differs from the previous studies by investigating the moderating effects of environmental regulation and perceived benefits on the relationship between SEMP and performance.

## 1.3 Research Questions

Based on the discussion in the problem statements of this research, the following research questions are addressed in this study:

1. What are the effects of the antecedents/drivers of SEMP on sustainable environmental manufacturing practices?
2. What is the effect of sustainable environmental manufacturing practices (SEMP) on the performance of manufacturing firms?

3. Does perceived benefit moderate the relationship between SEMP and firm performance?
4. Does environmental regulation moderate the relationship between SEMP and firm performance?

## 1.4 Research objectives

The aim of this study is to provide answers to the aforementioned research questions. Therefore, the specific objectives of this research are:

1. To investigate the effects of the antecedents/drivers on sustainable environmental manufacturing practices.
2. To investigate the effects of sustainable environmental manufacturing practices on firm performance.
3. To investigate the moderating effect of perceived benefits on the relationship between SEMP and firm performance.
4. To investigate the moderating effect of environmental regulation between SEMP and firm performance.
5. To suggest a framework that provides a better scenario of sustainable environmental manufacturing practices in the Malaysian manufacturing industry.

## 1.5 Significance of the Study

This study contributes to the body of knowledge by providing empirical evidences on the relationship between sustainable environmental practices and firm performance, and the moderating role of environmental regulation and perceived benefits. It also contributes to the body of knowledge by integrating sustainable environmental manufacturing practices, antecedent factors/drivers of SEMP; perceived benefits, environmental regulation and firm performance in a single framework. Previous researches have investigated the relationship between the antecedents, SEMP and firm performance in isolation either by investigating the antecedents and SEMP separately in a different model (Carter *et al.*, 2009; Chien & Shih, 2007; Huang, 2005; Lee & Rhee (2006) and Ravi *et al.*, (2005)) or between environmental practices and firm performance separately in another model (Ameer & Othman, 2011; Lopez-Gomez *et al.*, 2009; Wagner, 2005; Zhu & Sarkis, 2004). Thus, investigating this constructs in a single framework will provide the practitioners and the academicians with a comprehensive view and understanding of the relationships among the constructs.

In addition, through the investigation of the moderating role of environmental regulation on the relationship between SEMP and firm performance, this study will benefit the practitioners such as the operation managers, business practitioners, companies' owners, the environmental policy makers such as the department of environment (DOE) by signaling the reconsideration of the effect of environmental regulation on the relationship between SEMP and firm performance in order to assist firms in achieving better performance.

The relationship between sustainable environmental practices and the performance of manufacturing firms is still not conclusive (Schoenherr & Talluri, 2012; Anis & Nurul, 2012) as environmental management field lacks a comprehensive framework (Lucas, 2010) that provide a better understanding of the scenario of the effect of sustainable environmental manufacturing practices on firm performance. As such, this study will contribute to knowledge by investigating the antecedent factors of SEMP, SEMP, firm performance, perceived benefits of SEMP and environmental regulation in a single framework to better reveal the scenario of sustainable environmental practices in Malaysian manufacturing industry.

Sustainable environmental manufacturing practice is still considered as a relatively new concept in developing countries as most studies on it were conducted in the developed countries (Arafat, *et al.* 2012). Therefore, much more about the theoretical relationship between SEMP and firm performance requires more investigation, especially in Malaysia (Arafat *et al*., 2012). Empirical evidences on the relationship between SEMP and firm performance and the moderating impact of environmental regulation and perceived benefits will no doubt benefit the academicians, practitioners and enrich literatures in this area of study. Hence, it will provide justification to the continuous investment and investigation on sustainable environmental manufacturing practices.

## 1.6 Scope of the Research

This study focusses its survey on registered manufacturing companies in Malaysia, where sustainable environmental manufacturing practices is a concern. The need, goals and challenges of smaller firms are different from that of larger firms as smaller firms are often characterized by limited resources (Sidek & Backhome, 2014). Thus, manufacturing companies with full-time numbers of employees greater than 50 were investigated. Jamian, Rahman, Ismail and Ismail (2012) stated that small and medium enterprises are constrained by financial resources and difficulties in assigning expertise to tackle sustainable developmental issues. Carter *et al.,* (2009) regarded companies with full-time numbers of employees ranging between zero and 50 as not feasible for this study due to their financial and technical limitations.

The unit of analysis of this study is organisation drawn from the directory of the Federation of Malaysian Manufacturer (FMM, 2013). The survey is limited to only the operating, manufacturing managers and environmental, safety and health managers of the selected firms. These are the ones that can fully give the true view of environmental practices of the organisations. This research used survey questionnaires to collect primary data from the selected sample in Malaysia.

## 1.7 Organization of the Thesis

The composition of this study is presented in six chapters. Chapter one contains the introduction of the whole concept of the study. It consists of the background of the study, the problem statement of the research, research questions, and the objectives of the research, research significance, scope and lastly, the organization of the thesis.

Chapter two discusses the review of related literature to the concept of the study, the theoretical background of the research, the underpinning theory of the study, relationship between variables of the study and the synthesizing the previously conducted studies on the key constructs of the study. This chapter covers the areas of sustainable environmental manufacturing practices, antecedents/drivers of environmental practices and firm performance.

Chapter three discusses the hypotheses development and conceptual framework of the study. This arises as a result of the review of the previous literature on this study, the relationship existing between the variables of this research which are: antecedents of SEMP, SEMP, environmental regulation, perceived benefits and firm performance (financial, operational and environmental performance).

The research methodology employed in this study was discussed in the chapter four. This emphasizes on the research design, measurement of the variables, research settings, sampling techniques, data collection, instrument development and the data analysis method employed in testing the formulated hypotheses of the study.

Chapter five of this research presents in detail the results of the analysis of this research. Explanation was provided on the use of Statistical package for Social Sciences (SPSS) and smartPLS used in data analysis. Specifically, explanation on the evaluation of the measurement and the structural models were presented.

Chapter six of this study discusses the presentation of the empirical results and findings of the hypotheses testing of the research. In this chapter, a comprehensive discussion of some key findings from the hypotheses is presented which provides insight on the previous finding of past researchers. In addition, this chapter also gives detail explanations of the theoretical and practical implications of this study, including the limitation of the research as well as future recommendation and summary of the research.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Chapter one presented the background, problem statement, objectives, scope and the significance of the study. Therefore, chapter two attempts to address the research questions from the theoretical perspective. Hence, the discussion of the previous literatures on the concept of sustainable environmental manufacturing practices (SEMP), firm performance, antecedent factors/drivers of SEMP, environmental regulation and perceived benefits is presented in this chapter. The theoretical linkage between the variables of the antecedent factors, sustainable environmental manufacturing practices and firm performance were also presented as well as the moderating role of environmental regulation and perceived benefits of SEMP. Regarding the underpinning theory, the natural resources based view (NRBV) of the firm was discussed and the reason for the choice of this theory was explained in this chapter.

## 2.2 Firm Performance

Performance is a critical concern which is usually pursued by corporation (Lin & Fang, 2006). It is an integrated concept that reveals the outcome of the operations of firm. Thus, it is an important aspect of manufacturing strategy (Parthiban & Goh, 2011; and Kafetzopoulos, 2014). Effectiveness and efficiency are the elements that contribute to the performance of an organization (Szilagyi, 1984). Performance originated in 1900 as a result of the demand of government to evaluate the outcome of its operations (Johnson & Kaplan, 1987), therefore, it has ultimately been used as an indicator of the extent to which an organization moves closer to the achievement of its objectives and goals of the business (Kassen & Moursi, 1971).

Firm performance is regarded by Robbins and Coulter (2002) as the building up of the organizations' operations and outcomes, therefore; the link between organizational strategy and performance is regarded as the core of strategic management because of performance improvement. The measure of organizational performance includes the actual organizational output or organizational result against the inputs. Thus, measuring organizational performance enables companies to focus on the specific aspects of the organization that needs to be improved through the evaluation of work done relating to time, cost and quality.

The success of a firm is relative to its manufacturing practices which results into firm competitiveness, thus, the performance of a firm must be regularly evaluated for firms to stay competitive (Amrina & Yusof, 2011). Therefore, manufacturing firms must recognize and achieve performance in the global competition. It is relevant to evaluate performance in order to guide organizational change, development as well as setting a target for future performance (Mola, 2004; Ramaa, Ragaswanmy & Subramanya, 2009). Organisation must identify the indicators of performance as they simply do not describe what has happened in the past, but provides information that enhances the decision makers to predict the future competitive position of organizations (Jagdev *et al*., 2004).

### 2.2.1 Measuring performance in firm

The measure of performance in firm has become an indispensable and increasing issue as it is necessary to the continuous survival of the firm, by helping firm to ascertain its success or failure and the achievement of sustainable improvement of firms' operations (Trkman & McCormak, 2009). It provides all information relating to decision making in the task of managing the performance of firms (Hernaus, Bauch & Vuksic, 2012). Accurate measurement of firm performance is critical as it helps firm to determine their success or failure (Murphy, Trailer and Hill, 1996).

Previous researches on the measurement of performance in firm have witnessed different phases during the last couple of years. Researchers in the 1970s investigated the usage of management accounting measure such as budgeting as a measuring tool for performance. However; the focus was shifted to the process of budgeting and its impact on firm performance during the 80s. Thus, there began an increase in the broadness of research concerning the measurement of performance in the 90s (Gosselin, 2005). Researchers like Dixon et al., (1990); Kaplan and Norton (1996) established framework to enhance the measure of performance but it was suggested by Nanni et al., (1992) that the level of the competence of performance measurement of firms should be increased in which the degree of the competence of the measurement will solely depend on the extent to which the firm strategy fits with the design of the performance measurement system of the firm. Kaplan and Norton (1996) suggested that there will be an increase in the level of the firm performance if they maintain a balanced used of the scorecard. Though, few studies were conducted during this period to empirically investigate the above prescription and its impacts on firm performance (Gosselin, 2005). However, much of the studies that measured the performance of firms had used the indicators of past performance effectiveness (Neff,2011). While being useful to a certain extent, there is a need for performance measurement indicators with predictive values (Neff, 2011). The weaknesses of the traditional measure of financial performance are well documented in literatures and include the failure to effectively convey the strategies of firms within an organization (Hernans et al.,2012). Thus, the non-financial measure of firm performance was suggested to be included in firm performance measurement (Gaedeke, 1987; Ittner & Larcker, 2003; Campbell, 2007 and Neff, 2011; Kafetzopoulos, 2014).

Many literatures have suggested that performance in manufacturing firms be measured from a multiple dimension, including both the financial and the non-financial performance measure (Garg & Ma, 2005; Meybodi, 2005; Lai, 2010; Agues & Hajinoor, 2012; and Kaetzzopoulos, 2014). Thus, following the suggestion of the previous studies, the measurement of performance in this study is classified into financial and non-financial measurement of performance. There have been series of argument among researchers on which of the measurement best measures the performance of firms. Venkatraman and Ramanujam, (1986); Murphy *et al.,* (1996);

Panigyrakis & Theodoridis, (2007) argued in favour of financial measure as the best measure of performance. The reason for this is because financial measure covers all the objective aspects of firms without excluding small firms (Murphy *et al.,* 1996). He further explained that financial measure is the primary source of the success and performance of firms. However, the use of financial measure of performance of firms often times lead to accrual manipulation (Gijsel, 2012).

Other researchers argued in favour of the inclusion of the non-financial measure in firm performance (Gaedeke, 1987; Ittner & Larcker, 2003; Garg & Ma, 2005; Meybodi, 2005; Campbell, 2007; Lai, 2010; Agues & Hajinoor, 2012; and Kaetzzopoulos, 2014). Itner and Lacker (2003) argued that the inclusion of the non-financial measure of performance enables managers to ascertain the improvement of their operations, though it is more difficult to manipulate, unlike the financial measure. The non-financial measure serves as a compliment of the financial measure of performance (Keegan et al., 1989; Kaplan & Norton, 1992; Chow & Van der Steede,2006; Campbell, 2007; Kihn, 2010 and Hernans et al., 2012 ). Therefore,translating the operational actions of firms into specific objective requires both the financial and the non-financial measure of performance (Hernans et al., 2012).

The non-financial performance assessment measure was offered by Tootelian and Gaedeke (1987) in which they identified 21 points measurement which is divided into five facets: (1) Customer Service:  customer satisfaction rate, rate of service delivery, quality of process/procedure and service quality. (2) Market performance: marketing efficiency, marketing growth and market share. (3) Goal reaching degree: productivity, environmental cooperation and strategy fulfillment (4) Innovation; the development of new merchandise, flexibility of production, technology capital, power of research and development and originality. (5) Employee involvement: employee satisfaction degree, employee flow rate, education/training, core ability, internal identity and corporate culture.

Academics, practitioners and consulting firms since the beginning of 1990s have all emphasized and recommended the inclusion of non-financial measures as being more appropriate in performance measurement. The argument presented by Venkatraman and Ramanujam (1986) and Panigyrakis and Theodoridis (2007) shows the importance of adopting the use of both financial and non-financial measure of performance. They asserted that the adoption of both financial and non-financial measure of performance offer a broader perspective of performance measure in a firm. Thus, it tends to clarify the relationship between the financial and the non-financial aspect of performance.

A typical previous measurement of firm performance is usually done using an aggregate of financial measure (Sara and Morris 1997; Ketokivi & Schroender, 2004). However, Ketokivi and Schroender (2004) argued that this financial measure of performance is one-directional and it is not adequate to empirically capture the actual relationship between manufacturing practices and performance. Therefore, it becomes difficult to measure the significance of the relationship between firm's practices and the financial performance as the aggregate firm performance entails more several factors beyond the measure of financial gain (Bozarth & Edwards, 1997).

According to Bozarth & Edwards (1997), researchers have argued in support of other measure of performance, such as operational performance, which usually measure several performance dimensions by producing a strategic measure of firm performance. Researchers in sustainable environmental manufacturing practices have adopted different measures such as financial, operational and environmental measure of performance in relation to the environmental practices adopted by firms. Therefore, several dimensions or measurement; environmental, financial and operational measure which include cost, quality, flexibility and delivery are the different dimensions employed by researcher in measuring the performance.

Literatures have revealed that good environmental performance is a result of quality environmental practices (Zhu & Sarkis, 2004). Firms achieve a better performance level from different types of environmental practices, but the effect of the environmental practices is not the same on firm performance (Lopez-Gamero *et al.,* 2009). Many researchers have used different dimensions to investigate the environmental practices of a firm. Lopez-Gamero et al., (2009) on the relationship between environmental variables and environmental performance in the IPPC law sector in the US and UK measured environmental performance with efficient use of resources, reduction of emission, residues and acoustic pollution.

The environmental dimension of performance consists of the management and the operational indicators. Chien and Shih (2007) in their study on the implementation of green supply chain management practices in electrical and electronic industry on organizational performance identified environmental performance as including management performance and operational performance. The management performance indicates the policies of the firms relating to the environment and approval rate of management system, improvement in the relationship with the community and the image of the corporation while the operational performance measures indicates the improvement in using the energy resources, reduction of emission and waste disposal.

Many previous literatures on the financial performance of a firm have used the subjective perception of managers in measuring the financial aspect of firm performance (Judge & Douglas, 1998; Sharma & Vredenburg, 1998), as it was argued by Ketokivi and Schroender (2004) that the objective measure of financial performance of firm is not the most appropriate to assess the financial performance level of firms. Many literatures have shown the various dimensions using the objective measures in which financial performance is measured. However, this current study argues in line with Rusinko (2007) that using objective measure may not reveal the actual relationship between sustainable environmental manufacturing practices and financial performance because the objective measure of financial performance entails some other activities contributing to the financial performance of firms

To support the argument of this study, Aragon-Correa (2008); Judge and Douglas (1998); Sharma and Vredenburg (1998) used the subjective perception of the managers in measuring the firm financial performance. The reason for the subjective measurement is that the managers of firms will provide a better understanding of the impact of SEMP on firm performance than the precise quantitative data (objective measurement) from the firms. As such, rsearches argue to support that subjective perception of the managers of firms measures the contribution of SEMP more accurately than objective measurement and it will be employed in this study.

Levy (1995) measures the financial performance of a firm with return n asset (ROA), return on sales (ROS) and current ratio of the firm. The research of Zhu and Sarkis (2004) on the impact of green supply chain practices and performance measured financial performance from the economic dimension. Zhuang, *et al.,* (2009) measure the return on asset (ROA) as an indicator of firm performance. Additionally, Wagner (2005) conducted an empirical research on the relationship between environmental performance and economic performance of firms. He operationalized economic performance as the measure of the operating profit and financial ratios of firms. He therefore considered the return on sales (ROS), return on capital employed (ROCE) by the owners of the firm and the return on equity (ROE) as the profitability ratios used in measuring financial performance of firms.

Many researchers such as Tuanmat and Smith (2011); Weerakoon (1996); Nanni et al., (1992); Kaplan and Norton, (1992; 1993; 1996) have all recommended the inclusion of non-financial measurement of firm performance. Kaplan and Norton (1992, 1993, & 1996) established the balanced scoreboard, though not the only but the most established and popularly used. Weerakoon (1996) developed the multi-model performance framework having four dimensions. As such, firm performance in this study indicates the financial, operational and environmental dimension of the activities of firms that focus on achieving the objectives of the firm.

Islam *et al.,* (2007) conducted an investigation on the manufacturing practices and manufacturing performance in Malaysia where they employed the use of on-time delivery of goods, customer return rate (or faulty products) and improvement of the quality of product as the indices for evaluating manufacturing firm performance. The result of their research found a relationship between manufacturing practices and firm performance in Malaysia. Lopez-Gamero (2009) included the use of environmental performance in his investigation of the relationship between environmental management and firm performance. He identified environmental performance as a measure of reduction in energy use, reduction in material use and emission reduction.

In Summary, as a result of the significant impact of various authors to identify the appropriate indicator for measuring firms' performance, it is realized from the review of literature in this study that financial indicator as the only measure of performance in firm is not adequate and the measure of the firm performance is better from the subjective view of the perception of the managers rather than the objective quantitative measures. Therefore, the inclusion of the environmental and the operational dimension of performance are considered in addition to the financial dimension in measuring firm performance in this study.

## 2.3 The Concept of Sustainability

Basically, sustainability refers to the quality of preserving and maintenance practices. Sustainability has been defined by literature from three different dimensions: environmental, economic and social. These dimensions gained popularity from the triple bottom line concept by Elkington (2007), also known as the three pillars (profit, planet and people). From the social perspective, meeting the needs of human remains the fundamental objective of sustainability. Economically, it indicates the requirement for economic growth where basic needs are not met. But from the environmental perspective, sustainability indicates that natural systems and quality of life should not be endangered at the expense of development. According to Szeckely and Knirsch (2005), sustainability is the creation of balance between the economic, social and environmental aims of organizations. This is indicated in business as expanding economic growth, shareholder value, corporate reputation and the quality firms' outputs.

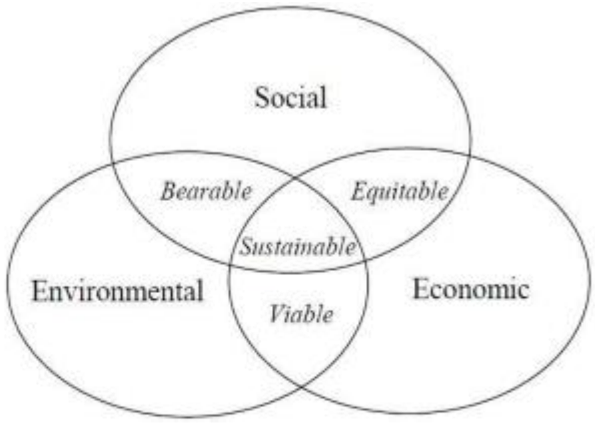


Figure 2.1
*Triple bottom line principle of sustainability (Elkington, 2007)*

### 2.3.1 Sustainable Manufacturing Practices

The united nation conference on environmental development (UNCED) held in Rio de Janerio in 1992 regarded the adoption of sustainable production as the principle guiding both the government and the business to move from unsustainable to a sustainable development. Sustainable development regards to the ability of the present generation to meet their needs without compromising the ability of the future generation to meet their own needs as well (WCED, 1987). This concept of sustainable development revolves around the essential needs of the world which should be given a high priority and the limitation in the ability of the present and future generation to meet their required needs (Leahu-Aluas, 2010).

Sustainable manufacturing is a sub-section of the concept of sustainable development which started in the 1980s as an answer to the call for increasing the awareness and the concern over the effect of the environment on the economic growth and global expansion on business (Leahu-Aluas, 2010). Thus, sustainable practices have become an integral part of design development and implementation in manufacturing companies (Leahu-Aluas, 2010).

Several definitions have been given by different authors on sustainable manufacturing. The U.S. Department of commerce (2010) defined sustainable 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. Lowell center for sustainable production [LCSP] (2003) regards it as the creation of goods and services through the usage of processes and systems that are non-polluting but conserve energy and natural resources, economically viable, safe and healthy for the workers, communities and consumers, and socially and creatively beneficial to the working people. Also, Institute of manufacturing, University of Cambridge recognize sustainable manufacturing as the “developing technologies in transforming materials with zero emission of greenhouse gasses (GHG), use of non-renewable or toxic materials or generation of waste” (Leahu-Aluas, 2010).

The focus of sustainable manufacturing practices involves the evaluation of the current manufacturing processes to reduce energy, water consumption, green-house gas (GHG) emission and production of products that are economically friendly (Afsharmanesh, 2010). In order to achieve sustainable manufacturing practices, environmentally friendly products are produced by manufacturing processes that are energy, water and material efficiency (Afsharmanesh, 2010).

### 2.3.2 Sustainable Environmental Manufacturing Practices

Early works on sustainable environmental manufacturing begins under the label of Environmental Conscious Manufacturing (ECM) which includes consideration for source reduction (Owen, 1993). Further improvement was done by Sarkis (1995) which identified three (3) dimensions of ECM strategies (Product, process and technologies). More improvement was made to include lean manufacturing, product design and the Rs' strategies.

Sidek and Backhome (2014) regard environmental sustainability as the management of the operations and resources of firm to conserve and avoid the destruction of the environment. According to Cramer (1998) and Omar & Samuel (2011), sustainable environmental manufacturing practices (SEMP) is regarded as the initiatives responsible for the technical and organisational activities exhibited by firms to minimize the impact of the environment and its effects on the natural environment.

Schoenherr and Talluri (2012) viewed sustainable environmental practices as techniques, policies and the procedures taken by a firm with the specific aim of monitoring and controlling the effects of the operations of the firm on the natural environment. Chien and Shih (2007) assert that sustainable environmental practice is implemented by organisations to achieve both organisational and environmental performance. Therefore, considering the different definitions given above, sustainable environmental manufacturing practices in this study is regarded as the business practices of a firm that is directed towards achieving a certain level of firm performance by reducing the negative environmental impacts of the firm.

Evidences from literatures have shown that sustainable environmental manufacturing has globally received great interests from researchers (Kleindofor, 2007; Linton et al., 2007; Sarkis, 2006; 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” (Gladium and Krause, 1996; 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 relationship between different environmental practices and firm performance (Schoenherr and Talluri, 2012; Anis and Nurul, 2012).

Various labels have been assigned by researchers to differentiate the types of environmentally sustainable practices (Rusinko, 2007). To differentiate these environmental approaches in manufacturing, pollution control, pollution prevention practices and product stewardship practices are often practiced by researchers (Hart, 1995; Bansal, 2005; Rusinko, 2007). Pollution control is a method applied at the end-of-pipe to tap, store, treat or dispose of pollution after which it has been created (Rusinko, 2007). This usually involves the installation of filters or smokestacks as a control of emission. However, the pollution control approach to environmental practices is costly and unproductive as it does not provide any opportunities to achieve competitive advantage and better firm performance due to its associated level of minimum regulatory compliance (Hart, 1995). As a result, pollution prevention and product stewardship practices are embarked on upon by manufacturing firms.

The focus of pollution and waste management is on the prevention and avoidance rather than control. Unlike pollution control, pollution prevention practices reduce the usage of resources, amount of waste generated and recycling. Though, it is sometimes highly difficult and costly, if not impossible to achieve (Barrow, 2006). Many reputable firms such as Fords, General Motors and Christler have been pushed by the increased cost of pollution control to adopting pollution prevention practices (Randinelli & Berry, 2000; Hemenway, 1996). Thus, the high cost required t implement pollution prevention practices thereby raises a fundamental question towards the effect of pollution prevention on the performance of organization, whether pollution abatement will add more costs to the burden on firms by reducing its competitiveness or reduction of pollution will increase the efficiency of firms (Hart & Ahuja, 1996) and enhance performance.

Dispute, whether firms will benefit from the implementation of pollution prevention is more than a mere argument on the cost that firms incur in implementing pollution prevention practices and also, the benefits missed by firms by not preventing pollution at the beginning of their production process (King and Lenox, 2002). As such, researchers over the time have assigned different labels to the management of pollution in an environment. According to Porter & van der Linde (1995), pollution indicates waste in the firm and thereby reduces firm productivity, therefore; competitiveness, resource productivity and better firm performance are improved by environmental practices that prevent pollution.

The cost of products on environment may require that companies improve their stewardship practices (Hansen & Mowen, 2006). Product stewardship practices extend the environmental initiatives to the stakeholders of the companies (Hart, 1995). It is a shared responsibility between manufacturing firms, their suppliers, and the customers which require that close information are maintained along the value chains to ensure safe environment. This practice includes redesigning products to be friendlier to the environment, using renewable resources and the encouragement of the suppliers to implement pollution prevention practices and product stewardship, research and design, use eco-friendly energy, employee training and consumer awareness (Rusinko, 2007).

Firms benefit from product stewardship practices by identifying risk at the early stage and provides a platform for the management of those risks along the value chain, thus enabling adequate protection of human health and the environment. This practice increases the loyalty of customers to the company and also increases the positive effect of the practices along the value chain. It increases the achievements of the expectation of the stakeholders of firms, improves the confidence of the public in the products of the firms and support compliance with the environmental regulations of the firm (International Council of Chemical Association, 2007)

### 2.3.3 Sustainable Environmental Manufacturing Practices in Malaysia

There are several studies that have been conducted on sustainable environmental manufacturing practices in developing countries especially Malaysia. Many of these studies are conceptual: Zubir et al., (2012); Heng et al., (2012) and Jamian et al., (2012). Only few empirical studies are conducted in the automotive industry (Amrina & Yusof, 2012; Nordin et al., 2014). Amrina and Yusof (2013) investigated the drivers and barriers of sustainable manufacturing practices and found high cost of implementation as the barrier of sustainable initiative in the automotive industry. Nordin et al., (2014) in their case study sheds more light into the successful implementation of sustainable manufacturing in Malaysia by classifying the critical factors into management, internal and external factors and also highlighted that on-time delivery, recycling of carbon fiber and trend to green material are the benefits of sustainable manufacturing practices in Malaysia.

Concerning the extent of sustainable environmental manufacturing practices in Malaysia, Omar and Samuel (2011) examined the environmental management stages among manufacturing firms in Malaysia and found that Malaysian manufacturing firms are classified into five different stages based on the five-stage categorization of Hunt and Aurter (1996). The stage one (the beginner) are the firms which perceive environmental practices as unnecessary; stage two (the fire fighter) identifies environmental practices as inconvenience and increases the cost of competitiveness; stage three (concern citizens) perceive environmental practices as an ethical and corporate social responsibility to the society; Stage four (the pragmatists) perceive environmental practices as an initiative that contributes to the success of the firm while stage five (5) (the pro-activists) provides a maximum priority to environmental initiatives with a high environmental performance. In the stage five, all employees of the organization are fully involved with a sufficient fund and support of the top management to successfully implement the initiatives (Omar and Samuel, 2011)

The findings of Omar and Samuel (2011) reveal that the majority of the manufacturing companies in Malaysia regardless of their ownership is in stage three.

They perceive environmental initiative as a corporate social responsibility with moderate effort to ensure compliance with environmental regulations. Tough, fully owned Malaysian companies fall in stage three, but the majority of the foreign owned companies is in stage four where environmental initiatives are perceived as a contributor to the firm's success. This corroborates the assertion of Omar, et al., (2009) which state that foreign companies environmentally perform better than the domestic companies. In addition, the findings of their study also reveal that environmental initiatives do not only protect the environment, but also significantly contributes to the sales and financial performance of the companies.

## 2.4 Perceived Benefits of Sustainable environmental Manufacturing Practices

Benefits are a set of favourable outcomes which can either be quantifiable or non-quantifiable (Zutchi and Sohal, 2004). According to Mortiner (2000), they are expected to be delivered from the implementation of environmental practices and certification. The derived benefits from implementing sustainable environmental manufacturing practices can be segregated in two different forms: the internal and the external benefits. The internal benefits are the positive outcomes derived from the internal operations of implementing environmental practices (Hillary, 2004). These include reduction of risks, lowering of insurance premiums, cost savings and reduction, and gaining and retention of new and old customers (Holt, 1998; Matuzak-Flejszman, 2010). Good environmental practices will help firms to identify opportunities for cost savings on raw materials, reduction of wastes, pollution prevention, efficiency of energy and reduction of accidents (Gbedemah, 2004; Briggs 2007).

International Organization for Standardization (ISO) conclude that firms certified in ISO14001 benefit reduced cost of waste management, reduced energy and material consumption, reduced cost of distribution, improved corporate image and a better framework to enhance continuous performance (ISO, 2010). To enhance the claims of ISO (2010), BSI (2009) corroborates that firms certified in sustainable environmental practices first benefits increase access to new customers and business, followed by a better management of environmental risks, reduction of public liability insurance cost, enhance company's reputation and demonstration of innovative thinking among employees and customers.

The external benefits on the other hand are the positive outcomes gained by an organization from the implementation of management system that relates to the external interaction of the firms. Review of past studies has shown that external benefits are grouped into three different categories, these are: communication benefits, commercial benefits and environmental benefits (Zutshi et al., 2003: Dodds, 1997). Manufacturing firms perceived both quantifiable and non-quantifiable benefits from the implementation of sustainable environmental practices.

Numerous benefits in term of financial, competitive and business were found by firms in implementing formal environmental initiatives (Hillary, 2000). The key benefit is the attraction and retention of new customers to the business (Hillary, 1999). Sustainable environmental practices can be employed by firms to achieve varieties of goals regarded as benefits of implementing management systems. These benefits in this current study can be categorized as internal benefits. Examples are: cost reduction, improved management control, staying ahead of legislation, risk/liability prevention, improves integration of environmental practices and external benefits which are meeting customers' expectations and environmental commitment demonstration. Matuzak-Flejzman (2010) added that quality product improvement, increased access to market share, increase employees' morale and satisfaction and access to financial aid are benefited from environmental consciousness practices of firms.

Basically, good environmental practices will enable firms to uncover a better way in which firms' environmental impact can be reduced while at the same time reduce cost and improve productivity (Al-Shourah, 2007). Christensen and Rasmussen (1998) reported that environmental improvement such as material use reduction and energy conservation were achieved following the adoption of environmental management practices. According to Erdogan and Baris (2007), environmental practices are implemented in hotel industries to reduce energy consumption, water and mineral consumption and also the cost of operation. The more often mentioned benefit of environmental practices is in the aspect of operational efficiency of firms. In this aspect, operational safety was identified as a benefit perceived by firms (Pullin, 1998; Sayre, 1996). In addition, Miles, et al., (1999) mentioned improved efficiency in the utilization of materials and improved process efficiency resulting into cost-based competitive advantage was achieved in environmental practices. One important benefit mentioned by Asian companies especially those in Hong Kong is the expansion of market for business. However, profitability and competitive products or services are mentioned as benefits of firms in industrialized countries (Lin, 1995).

Adoption of sustainable environmental practices will enhance manufacturing firms to achieve greater organizational efficiency. According to Petroni (2000), it will enhance green image among firms. Hence, the relationship between firms and its stakeholders will improve (Hillary, 1999), enhance customers to become more loyal to the firm and improve company's public image (Chan & Wong, 2006). Relating to people in the organization, change in the behaviour of the employees is the strongest effect of implementation of EMS/ISO 14001 (Rondineli & Vastag, 2000). The awareness of environmental sustainability practices has become more increased among managers and employees, not only at their work place but also at home and in their community (Baylis, *et al*., 1997).

Lee and Back (2003) investigated the perceived benefits of ISO 14001 certification adoption and found that all the companies investigated in their studied agreed that they benefited reduced damage to the environment as well as improvement in company's image and operational efficiency by the adoption of ISO 14001. Thus, the study classified the benefit from environmental management practices into three categories: environmental benefits, competitive advantages and operational improvement.

Benefits from sustainable environmental practices can either be in form of a direct or indirect benefits (Chwelos, et al., 2001; Shang and Seddon, 2002; Jimenez-Martinez and Polo-Redondo, 2004). The direct benefits can be easily identified, monitored and measured (Jimenez-Martinez and Polo-Redondo, 2004). These include operational cost savings, and order internal efficiency (Chwelos, et al., 2001). Those benefits that are not tangible are regarded as the indirect benefits (Jimenez-Martinez and Polo-Redondo, 2004). The indirect benefits enhance firms to change to a better operational process and provide better opportunities to firms from the use of technology.

The existing relationship between environmental practices and the benefits perceived by firms may vary depending on the legislation, firm size, industrial type and time span (Schaltergger & Synnestvedt, 2002). According to Christmann (2000), performance superiority does not necessarily indicate competitive advantage as such, firms can adopt voluntary implementation of sustainable environmental practices by finding the appropriate mix of incentives within a specific business context and this is attributed to key success in organisation.

### 2.5 Antecedents/Drivers of Sustainable Environmental Practices

Many firms respond to the issues of environment while other companies with related circumstance do not respond despite the existence of regulatory requirements (Bansal & Roth, 2000). The explanation of the rationale behind organizational response to environmental issues has been provided by past literatures. Among the identified reasons that drive organizations to implement environmental practices are: Stakeholders pressure (Chien & Shih, 2007, Henriques & Sharma, 2005; Darmal et al., 2010; Tutore, 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 (Bansal & Roth, 2000). As such, this study regards top management commitment, stakeholder pressure and public concern as the antecedent factors that drive the implementation of sustainable environmental manufacturing practices.

#### 2.5.1 Stakeholder Pressure

Stakeholders in this study refer to those (individual or groups) that can affect or be affected by the environmental objectives of firms (Freeman, 1984). Stakeholder pressure refers to the influence exerted by individuals or groups on companies (Henrique & Sadorsky, 1999). According to Fassin (2009); Kassinis and Vafens (2006) stakeholder pressure is the ability and the capacity of stakeholders to affect the objectives of a firm by influencing the decision taken by the firm.

The ability of stakeholders to exert pressure on the decision of firms is relative to country's specific characteristic (Doh & Guay, 2006). These country specific characteristics are explained that power, legitimacy and urgency are the important factors that are prominent to how a stakeholder is salient to a specific country (Agle *et al.*, 1999). Without neglecting the three important salient factors of stakeholder pressure, this study focused on a broader relationship of stakeholder pressure perceived by the manufacturing firms through different groups on the implementation of sustainable environmental manufacturing irrespective of their power, legitimacy and urgency.

In order to enhance the conduct of empirical investigation of stakeholder pressure, it is necessary to first identify relevant stakeholders (Helmig, Spraul & Ingenhoff, 2013). With reference to stakeholder pressure on implementing environmental manufacturing practices, previous researches focused on pressure by group of activists (Fassin, 2009) or special movement organizations (Holzer, 2008). However, this current study focusses on the broad concept of stakeholder pressure. The reason given is because the current study aims at determining the influence of stakeholder pressure on sustainable environmental manufacturing practices but not on financial performance (see Berman *et al*., 1999).

Stakeholders were classified into either primary or secondary (Clarkson, 1995). This typology is based on the influence of stakeholders as having the ability to directly influence the behaviors of organization either through direct pressure or information conveyance (Henriques and Sadorsky, 1999). Buysse and Verbeke (2003) discussed the classification of stakeholders and stated that pressure from stakeholders in an organization is of two classifications: primary and secondary pressure. The primary stakeholders such as the employees, suppliers and customers are those that maintain formal relationship with the organizations. They are important in ensuring the survival of the companies. Secondary stakeholder, on the other hand are those groups or actors having interest but do not have a formal relationship with the firms. Secondary stakeholder (such as media or nonprofits) have tendency to damage or enhance the public reputation of firms (Clarkson, 1995; Harrison *et al.*, 2010). These claims above match the stakeholder theory which referred to stakeholders as persons or groups that can affect or be affected by the objectives and the decision of firms. Also, the claims are well supported by the dependence theory which affirms that firms must attend to the demands of those that provide necessary resource in its environment for it to continue surviving (Helmig *et al.*, 2013)

Previously, stakeholders' pressure has been regarded as one of the main drivers in determining the adoption of environmental practices in firms (Henriques & Sadorsky, 1999; Buysse & Verbeke, 2003; Gonzalez-Benito & Gonzalez-Benito, 2006; Delmas & Toffel 2008; Murillo-Luna *et al.,* 2008; Springel & Busch, 2010). Therefore, several classifications and analysis of stakeholders' pressure have been given by these researchers following the platform provided by the stakeholder's theory. These previous studies have found a significant influence of stakeholder pressure on environmental practices (Hyatt, 2011). Stakeholders are perceived by firms' managers as important antecedents to environmental practices (Bansal & Roth, 2000; Buysse & Verbeke, 2003). Stakeholders of a firm might be able to reveal their concern about the activities of a firm either by directly mounting pressure on the firm or through information to influence the firm's operations. Therefore, stakeholder pressure is chosen in this study as an antecedent factor of sustainable environmental manufacturing practices.

### 2.5.2 Top Management Commitment

Top management is a team of individuals in a firm charged with the responsibilities of managing the daily activities of a firm (Deros, *et al*., 2009). They include the board of directors and shareholders of a company which are the highest levels of responsibilities in an organization. Mainly, they are responsible for managing the senior managers rather than the daily organisational business activities (Deros *et al.,* 2009). Top management support and commitment can influence the proactiveness of the implementation of environmental manufacturing practices through human resources management activities (Zutshi and Sohal, 2004; Gonzalez-Benito & Gonzalez Benito, 2006). Hence, there is a need for the top management to show more commitment to the sustainable environmental manufacturing practices as highlighted as important by the prominent researchers (Ravi et al., 2004; Wee & Quasi, 2005; Lee & Rhee, 2006; Deros et al., 2009; Huang & Wu, 2010).

Top management commitment is significant in setting a realistic objectives for environmental initiatives, providing related trainings to the employees, giving a factual decision, 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. Top management will be more committed to environmental sustainability when they understand the potential benefits of the initiative. Huang and Wu (2010) found top management commitment as significant to the implementation of green initiatives.

In addition to the above, the result of Spencer *et al.,* (2013) found an association between top management commitment and environmental sustainability among the 200 top listed Australian companies is similar to Albeida-Perez et al., (2007) which found that commitment of managers acted as a catalyst for change in adopting environmental management practices. Also, Lee and Ball (2003) indicated that top management commitment will directly describe how firms will respond to corporate environmental issues and strategy formulation.

Similarly, Lee and Rhee (2006) in their longitudinal study on corporate environmental strategies classified top management commitment based on attitude and firm size and found a significant relationship between the two attributes of top management and environmental strategic types. They conclude that the extent at which environmental management has relied on the commitment of top management has made top management an influential factor in determining the proactiveness of a firm in sustainable environmental practices. According to Sangle (2010), firms with positive managerial attitude towards the environment will encourage the implementation of proactive environmental practices. Also, Ravi *et al*., (2006) conclude that top management among other drivers is the main driver of reverse logistics that enhance performance. As a result, this study view top management commitment as an antecedent factor for the implementation of sustainable environmental manufacturing practices.

### 2.5.3 Public Concern

Public concern for the poor environmental practices started in the developed countries in the 1960s. This began in the U.S. through the poisoning of love canal with toxic industrial wastes. In Minimata, public concern began as a result of mercury poisoning. In the developing countries of Asia, attention to public concern started as a result of the increased pollution of Asian rivers, Bhopal Gas tragedy in India and the Arsenic poisoning in Bangladesh which gave rise to the concern of the public to environmental unsound practices (UNEP, 1992).

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.

The concern of the public towards environmental unsustainable practices has been expressed in term of: protests or lawsuits, products boycott by the consumer and the willingness of the public to pay a premium for economically friendly products (UNEP, 1992). Nowadays, the concern of the public about environmental deterioration ranges from the cost of health damages and to the total deterioration of the quality of life itself.

Public concern in this study regards to the individual sensitivity towards environmental issues (Berkiroglu, 2011). The managers of firms increase their intention towards the implementation of environmental practices increases as the concern of the individual public increases. Previous literatures often interchange the use of stakeholder for public, however, the usage of the two words are not same. Business literatures often identified the stakeholders based on their relationship with the organization while public in organization are segmented by demographic, geographic or psychographics (Rawlins, 2006). The difference between the stakeholders and the publics of an organization are further emphasized by Grunnig (1992). He asserts that stakeholders of a firm are selected by the firms based on their marketing strategies, recruiting and investment plans whereas, the public arise on their own and choose the organizations for attention.

Evidences from the past empirical studies on environmental practices have shown that public concern motivates the implementation of sustainable environmental manufacturing 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. Therefore, it was concluded that public concern is an external political force that motivates the implementation of environmental friendliness practices in firms.

Previous studies show that individual will be more concern and sensitive to the following issues: more difficulties in getting access to more energy (Berkiroglu, 2011). Hamans (2009) is of the opinion that the public will be much more sensitive to the future environmental problems as a result of the changes in the climate, thus, firms will have to minimize wastefulness in resources and enhance friendly environment (Hamans, 2009). The public are also concerned that the cost of resources will be more expensive as the natural environmental resources are endangered by the activities of manufacturing firms (Hamans, 2009). In addition, Berkiroglu (2011) affirmed that firms causing more harm to the environment in the future will be fined due to litigation by the public in relation to the implication of firm activities on the natural environment. Thus, manufacturing firms are friendly to the environment in responding to the expectation of the public on their activities. As a result of the above discussion, public concern is regarded as an antecedent of sustainable environmental manufacturing practices. Table 2.1 below shows the summary of the past drivers of sustainable environmental practices.

Table 2.1
*Summary of the drivers of sustainable environmental manufacturing practices used by previous authors*

| **Authors** | **Drivers** | | |
|---|---|---|---|
| | **Stakeholder Pressure** | **Top Mgt. Commitment** | **Public Concern** |
| Gonzalez-Benito and Gonzalez-Benito (2006) | √ | * | * |
| Cespede-Lorente at al., (2003) | √ | * | * |

| Authors | Drivers | | |
|---|---|---|---|
| | **Stakeholder Pressure** | **Top Mgt. Commitment** | **Public Concern** |
| Chen and Shih (2007) | √ | * | * |
| Henriques and Sadorsky (1999) | √ | * | * |
| Huang (2005) | √ | * | * |
| Carter et al., (2009) | * | √ | √ |
| Berkiroglu et al., (2011) | * | √ | √ |
| Al-Shourah & Ibrahim (2007) | * | √ | * |
| Lee and Rhee (2006) | * | √ | * |
| Ravi et al., (2005) | * | √ | √ |
| Zhu et al., (2005) | √ | * | * |
| Cobertt and Cutler (2000) | * | √ | √ |
| Zhu et al., (2010) | * | * | * |
| Rivera (2004) | √ | * | * |
| Bansal and Roth (2000) | √ | * | * |

## *2.6* Environmental Regulation

Environmental regulation refers to the law, policy, rules and standards enacted by the regulatory bodies to govern and control the unsustainable environmental practices caused by manufacturing activities (Lai & Wong, 2012). Environmental regulations are formulated by the government to either directly or indirectly control the negative impact of firms on the environment. Hence, most regulations that are focused on manufacturing sectors either affect the operations and performance of the sectors positively or negatively (Chakraborty, 2014).

Organizations have been prompted to be more aware of the consequence of their environment as a result of standards and regulations (Chien & Shuh, 2007). The effect of the external system on the decision and the behavior of an organization are emphasized by the system theory. This includes the regulations, the law, professional standards, interest organizations and social belief (Oliver, 1991). According to Zhu and Sarkis (2006); Hall (2000) and Sarkis (1998) environmental regulation can be categorized to include the domestic environmental regulations, government environmental policies and international environmental agreement.

Companies are encouraged by the domestic environmental regulation to adopt appropriate strategies and practices in order to achieve environmental performance (Chien & Shuh, 2007). Zhu and Sarkis (2006) regarded the two main sources of pressure from domestic environmental regulations to be the domestic regulations and the environmental missions of the corporations. However, the main drive behind the corporation awareness of environmental practices is to increase the role of environmental regulation (Chien & Shih, 2007; Handfield *et al.,* 1997).

The statutory requirement and the environmental consciousness of the public are increasing due to regulations and government policy (Chien & Shuh, 2007). According to Cordano (1993), regulation compliance has been punctuated by the escalating penalties, fines and legal cost. Firms act on the presence of regulatory policy and utilize the policy to improve their performance. Therefore, the more stringent an environmental policy within a jurisdiction is, the more the environmental performance of the firm (Fremeht & Shaver, 2011).

The effects of domestic environmental regulations on the incentives attached to companies are greater and more immediate than that of the international standards (Gottberg *et al.*, 2006). Although, the international environmental agreement also affects many countries and government policies such as the Kyoto agreement, the climate changes treaty and the Montreal protocol. However, the aim of the international agreement is to tackle the challenges of making producers become more responsible to their cost, collection and recycling of their product to be more environmentally friendly (Gottberg *et al.*, 2006).

### 2.6.1 National Environmental Policy in Malaysia

National environmental policy in Malaysia aims at integrating the economic, social and the environmental conservation towards enhancing the quality of life among Malaysians through environmentally sound and sustainable development (DOE, 2010). The policy is based on eight (8) interrelated principles that jointly support the coordination of the economic development goals in relation to the necessities of the environment. The eight principles are:

i. Environmental stewardship practices
ii. Conservation of the vitality and the diversity of the nature
iii. Continuous environmental quality improvement

iv. Sustainable use of natural resources
v. Decision making integration
vi. Role of the private sector
vii. Commitment and accountability
viii. Active participation in the international community

The policy represents a national guide to the stakeholders in order to keep the nation abreast of the rapid economic growth and to ensure the achievement of the improved quality environment. Environmental Quality Act, 1974 was enacted in Malaysia to enhance the prevention, reduction and control of environmental pollution. The EQA act strictly restricts the pollution of the environment and stated the violation of the enacted conditions (DOE, 2010).

Industries in Malaysia are required to obtain approval from the Director General of Environmental Quality prior to their embankment on projects and activities. The following are the requirements to be met by industries in Malaysia:

i. Subject to sub-section 34A of the EQA 1974, Industries in Malaysia are required to provide reports on the Environmental Impact assessment for prescribed activities.
ii. Industries are required to conduct an evaluation of the suitability of the site for the non-prescribed activities.
iii. Subject to the sub-section 19 of the EQA 1974, firms are required to obtain a written permission to construct (for prescribed premises-scheduled waste

treatment and disposal facilities, crude palm oil mills and raw-rubber processing mills).

iv. Subject to the Environmental Quality regulation, 1978 (Clean Air) and Environmental Quality Act, 1974, firms are required to obtain a written approval before installing incinerator, fuel burning equipment and Chimney

v. Sub-section 18 of the EQA 1974 requires that firms must obtain license to use and occupy prescribed premises and prescribed conveyances.

Environmental regulation in Malaysia under the notification for a new source of sewage, industrial effluents and leachate discharge prohibits firms/individual starting from October, 2009 from the following:

i. Discharging sewage into any soil, inland waters or water in Malaysia without a prior written notification of the Director General of Environment.

ii. Carrying out work on solid waste transfer without a prior written notification of the Director General of the Environment

iii. Carrying out any form of activities that may result into a new form of industrial effluent or mixed effluent.

In the aspect of gaseous emission, the following are the gaseous or air emission standards required for compliance by industries in Malaysia:

i. Stack Gas Emission Standards from Environmental Quality (Clean Air) Regulations 1978
ii. Recommended Malaysian Air Quality Standards (Ambient Standards)

The gaseous emission standard in Malaysia requires that all projects relating to environmental impact assessment must employ the use of the best available techniques (BAT) in their designs and operations.

Concerning sewage, industrial effluent and leachate discharge, it is required from the industries in Malaysia that discharge from the industries, effluent and Leachate discharge in Malaysia must comply with: the standard for sewage discharge; industrial effluent discharge limits and the standards for sewage discharge.

From the aspect of scheduled waste management, a comprehensive set of principles were put in place under the national environmental policy in Malaysia to cover the storage, transport, treatment and disposal of toxic and hazardous wastes. The policies are subject to the following environmental regulations in Malaysia:

i. Environmental Quality (Preserved Conveyance and Scheduled Wastes) order 2005
ii. Environmental Quality (Prescribed premises and Scheduled Waste Treatment and Disposal Facilities,) Order and Regulation 1989.

## 2.7 Past Literatures on the Variables of the Studies

This section presents the review of literatures related to antecedent factors (top management commitment, stakeholder pressure and public concern); sustainable environmental manufacturing practices; firm performance; environmental regulation and perceived benefits of SEMP. Previous studies between SEMP and firm performance is presented in the following section.

### 2.7.1 Previous Literatures on SEMP and Firm Performance

Previously conducted researches on the relationship between sustainable environmental manufacturing practices and firm performance have highlighted the importance of the relationship between sustainable environmental practices and firm performance (Schoenherr & Talluri, 2012). Even though, literatures have revealed that sustainable environmental practices are significantly related to the performance of the firms implementing environmental initiatives but many of these researchers still believe that this relationship between environmental practices and firm performance are not consistent (Chen & Shih, 2007; Lopez-Gamero, *et al.*, 2009; Artiach *et al.*, 2010; Ameer & Othman, 2012; Lai & Wong, 2012; Schoenherr & Talluri, 2012; Arafat *et al.,* 2012; Nyirenda, *et al.,* 2013). Over the years, series of relationships have been developed by researchers with the aim of determining the association between environmental practices and firm performance. The findings of these relationships ranged between positive, neutral, and negative relationship among the variables earlier stated (Artiach *et al.,* 2010).

One of the views of the earlier literatures suggests that there is no association between environmental practices and performance of firms (Ullman, 1985; Artiach et al., 2010). The argument was based on the fact that ascertaining the theoretical link between these constructs is difficult due to many intervening variables posing a challenge on the relationship. The reason included is that lack of theoretical support made it too much for any researcher or practitioner to expect a relationship between environmental management practices and firm performance (Nyirenda *et al.,* 2013). Similarly, Watson *et al.,* (2004) and Link & Naveh (2006) investigated the relationship between environmental practices and firm performance and found that environmental practices do not influence the financial performance of firm. Thus, they concluded that environmental practices neither help nor hurt firm performance.

Another perspective found a negative effect of environmental practices on firm performance (Barnet, 2007; Cho & Patten, 2007). The reason given to the negative relationship relates to the cost involved in implementing sustainable and environmental practices which distributed the resources of the firm from the investors of business to the external stakeholders such as the local communities (Nyirenda *et al.,* 2013; Barnett, 2007). In addition, Wagner (2005) also found a negative relationship between environmental performance and economic performance.

Contrary to the negative effect of the said relationships, other literatures maintain that the relationship between environmental practices and firm performance is positive (Clarkson *et al.,* 2008; 2011; Ahmed *et al*., 2003). Past literatures identified various factors that determine the positive association between environmental initiatives and firm performance. Thus, it was concluded that the cost of environmental practices is outweighed by the financial rewards benefited in the long run (Nyirenda *et al.*, 2013). Another study examined from the perspective of the resource view indicated that firm resources are increased by environmental practices (Clarkson, *et al*., 2011; Artiach et al., 2010). According to Montabon, Stroufe and Narasimhan (2007), a positive significant relationship exist between management of environmental practices and measurement of performance in firms.

Investigation of Ameer and Othman (2012) on the relationship between sustainable practices and firm financial performance found that the application of sustainable practices adopted by global sustainable companies leads to a better financial performance. It was concluded in their study that companies with superior sustainable practices have better financial performance than the companies which do not place emphasis on sustainable practices. Lopez-Gamero (2009) found that environmental proactiveness is statistically and significantly related to firm's financial and environmental performance. This is supported by the study of Ahmed *et al.*, (1998) which found a significant relationship between the environmental concern of a company and the company's attributes of performance.

King and Lenox (2001) in their study "Does it pay to be green?" found an association between environmental practices and financial performance. In their study, they found that an association exists between pollution reduction and financial performance of firms. Though, their research did not include the direction of the relationship between environmental practices and financial performance. In addition, Russo and Fouts (1997); Hart and Ahuja (1994) found a positive impacts between pollution prevention initiatives and return on assets (ROA), return on sales (ROS) and return on equity (ROE). However, the findings of Christman (2000) on chemical companies found a positive correlation relationship between pollution prevention technology and cost savings.

A meta-analysis study conducted by Golicic and Smith (2013) on the relationship between environmental sustainability practices and firm performance among supply chain companies found that environmental sustainable practices is positively significant to firm performance. Their study operationalized firm performance into market based, operational based and accounting based performance. Similar to the current study, the accounting based performance is regarded as the financial dimension of performance.

Arafat *et al.*, (2012) on their study titled "Does environmental performance really matter? A lesson from the debate of environmental disclosure and firm performance" investigated the relationship between environmental performance, environmental disclosure and financial performance among 33 manufacturing firms in Indonesia and reveal that environmental practices significantly influences firms' financial performance. It was also shown that environmental disclosure is insignificant with the financial performance of firms despite the result showing a significant influence of both environmental performance and disclosure on firms' financial performance.

In addition, Zhu and Sarkis (2004) studied the relationship between operational practices and performance among the early adopters of green supply chain management practices in the Chinese manufacturing enterprises and found a direct positive significant relationship between environmental practices and environmental performance. However, the result shows that there is a significant relationship between environmental practices and positive economic performance but shows no significant relationship with negative economic outcomes. This inconsistency in their finding may be explained as a result of objective measures of financial numbers, therefore, confirming the actual direction of the relationship with economic performance was difficult to ascertain.

Furthermore, Mahmood *et al.,* (2011) investigated the relationship between manufacturing system performance and green practices among the Malaysian certified ISO 14001 manufacturing companies and found a positive significant influence of green practices on manufacturing systems performance. Also, Chien and Shih (2007) found a positive relationship between environmental practices in green supply chain and both environmental performance and financial performance. Similar to Chien and Shih (2007) is the study of Lai and Wong (2012) which found a positive association between environmental practices in green logistic management in Chinese manufacturing and both environmental and financial performance. Additionally, Ahmed *et al.,* (2002) on the perception of environmental consciousness in U.S. small businesses found a positive correlation between company's environmental effort and its impact on the characteristics of firm performance. They regard such performance characteristics as operations efficiency and company's image which is similar to the study of Mahmood *et al.,* (2011) and Islam *et al.,* (2007) which found a relationship between manufacturing practices and performance in Malaysia. Therefore, they conclude that improvement in environmental manufacturing practices allows the achievement of a better performance level in firms.

### 2.7.2 Previous studies on the Antecedents/Drivers of SEMP

Previous researches on environmental practices have indicated that several antecedents/drivers such as stakeholder pressure, top management commitment, and public concern motivate the implementation of sustainable environmental practices in manufacturing companies (Hyatt, 2011; Tutore, 2010; Bansal & Roth, 2000). As a result, it has been indicated that there are relationships between the antecedent factors and sustainable environmental practices. Therefore, the identification of the link between the antecedent factors and the implementation of SEMP from previous literatures on this concept are explored.

Cespedes-Lorente *et al.*, (2003) on the exploration of stakeholders' theory in determining the extent to which stakeholders' pressure among 279 hotels in Spain can drive environmental management practices revealed that genuine firm concern instigate the responses to corporate environmental management. The study found that there is positive relationship between stakeholders' power and the extensive implementation of corporate environmental practices. Gonzalez-Benito and Gonzalez-Benito (2006) investigated the role of stakeholder pressure and managerial values in the implementation of environmental logistics practices among Spanish industrial sectors. A relationship between the pressure of the stakeholder and environmental practices was identified. Though, the result indicates that only the non-governmental dimension of the stakeholder pressure is significant to environmental management practices. Therefore, they conclude that the pressure received from regulatory agents do not drive environmental practices. Darnall et al., (2008) compared the factors that affect environmental strategy and performance among several countries and found that stakeholders' institutional pressure is positively related to environmental strategies.

The empirical study of Chen and Shih (2007) on the implementation of environmental manufacturing practices among electrical and electronic industries in Taiwan identified external stakeholders as having influence on green manufacturing practices. Also, it was revealed that stakeholders' pressure is positively related to the implementation of environmental manufacturing practices. Therefore, they conclude that pressure from stakeholders drive the implementation of environmental practices in manufacturing.

The findings of the study of Henriques and Sadorsky (1999) on the perceptions of managers on the relative importance of different stakeholders reveal that managers who perceive all stakeholders of the firm as important except media admits that environmental management is important to business function. Therefore it was inferred from the findings of their investigation that stakeholders relate to the initiation of environmental practices in organizations. Similar to the study of Henriques and Sadorsky (1999) is Huang (2005) which investigated the stakeholders influence on environmental management and found that it is significantly positive to environmental management practices. Therefore, he concludes that the more influences exerted by the stakeholders, the more environmental management will be practiced in firms. However, his conclusion is different from Henrique and Sadorsky (1999) which state that media as stakeholder only drives firms to implement environmental practices during crisis therefore; it does not drive firms in implementing environmental practices when there is no environmental crisis.

Another antecedent factor of the implementation of sustainable environmental practices is the commitment of the top management of firms. According to Carter *et al.,* (2009) in their study about the motives and results of environmental strategies among 153 Slovenian manufacturing companies found that implementation of companies' environmental strategies reflects the commitment of the top management of the companies' environmental practices. The result of the study reveals that top management commitment is the most important driver of environmental manufacturing practices in Slovenia. Also, the findings of the research of Park (2009) show a positive correlation relationship between top management environmental attitude and the perceived advantages of environmental management. Banerjee (2003) found top management commitment as having a strong influence on corporate environmentalism and hereby concludes top management as an antecedent of corporate environmentalism.

This study has also identified public concern as having relationship with SEMP. The result of the study of Bekiroglu *et al.,* (2011) in the Turkish construction sector revealed that there is a positive relationship between the public environmental sensitivity and implementation of environmental practices. The more the worries about the future environmental concern increases, the more there is an increase in the sensitivity of the individuals. According to Kent (2008), the more there is an increase in the worry about the expensiveness of resources, the more the public concern increases. Banerjee (2003) and Carter *et al*., (2009) also contented that public concern is significantly related to corporate environmental practices. Therefore, public concern is viewed as antecedent factors of the implementation of sustainable environmental manufacturing practices.

In summary, this study in line with the previous studies viewed top management commitment, stakeholder pressure and public concern as antecedent factors for implementing sustainable environmental manufacturing practices. The detail relationships between each of the variables with sustainable environmental manufacturing practices are explicitly presented in the hypothesis development.

### 2.7.3 Previous Literatures on Perceived Benefits of SEMP

Environmental management manuals and many other case studies have proven that there is a link between the perceived benefits of environmental manufacturing practices, environmental practices and firm performance (CECC, 2005). The interview conducted by Beeton *et al.,* (2007) on environmental sustainable practices found that the perceived benefits of sustainable environmental, manufacturing practices are significant for being involved in environmental management practices. To, Lee and Yu (2012) investigated the differences among companies on their perception of the benefits of implementing management system standards by sampling 157 certified companies in the Pearl River China. The Anova test of the study found that there is significant difference between companies and their perceived benefits in implementing environmental management practices. Therefore, the study concludes that companies that are certified in environmental practices are significant to corporate performance and quality performance.

The findings of the case studies, research and survey of companies by Murrow and Rondinelli (2002) reveal that companies practicing sustainable environmental practices perceive the benefits and experience positive impacts of sustainable environmental practices implementation and these benefits satisfy their expectations. Reputation enhancement and corporate governance have benefited from the implementation of sustainability practices (Dimitrov & Davey, 2011).

Many of the previous studies on environmental practices have seen perceived benefits as factors that influence the implementation of sustainable environmental practices, only a few has conceptualized perceived benefits as a moderator. Al-Shourah and Ibrahim (2007) investigated the moderating effect of perceived benefits on the relationship between environmental management practices and the performance among the five-star hotel companies in Malaysia. He found that benefits perceived by the hotel companies in implementing environmental manufacturing practices moderates the relationship between the environmental management practices and hotel performance. Therefore, this study is of the opinion that the benefits perceived by firms in implementing SEMP may influence the relationship between SEMP and the performance of the firm. The moderating role of perceived benefits of SEMP is explained in the hypotheses development section.

### 2.7.4 Past Literatures on Environmental Regulation

Past researches have featured the dimensions of environmental regulation in two: the first is the stringency of the regulation and the second is the form. This affects the response of firms to the regulations which may be reactive or proactive (Delmas *et al.*, 2003). When environmental regulation is stringent on firms, firms may take a distinct role to integrate sustainable environmental practices in their manufacturing processes (Lai & Wong, 2012; Ho & Lin, 2012) to set a win-win situation as asserted by Porter and Van der Linde (1995). On the other hand, the reactive firms may experience a negative influence of strict regulations on their performance. Past literatures have shown that the rigour of environmental regulations, the more significant effect it will have on the performance of firms (Delmas, *et al.,* 2007).

According to Delmas *et al*, (2007); Porter and Van der Linde (1995), as regulation pressurizes organizations to seek new ways of triggering environmental innovation. Firms are predicted to embark on environmentally responsible practices when the regulations within their jurisdiction requires the implementation of such practices. However, firms' responses to policy outside their jurisdiction to provide a better position in the market and mobilize resources to improve its performance (Fremeth & Sharver, 2011). It was predicted that firm implements responsible environmental actions when there is a high environmental regulation demand (Fremeth & Sharver, 2011). This high regulation has a high influence in making firm become legitimate in business and refocus what their external stakeholders such as public policy makers and special interest groups expect from them.

In Summary, many of the previous researches on environmental regulations have investigated that there is a relationship between environmental regulation and proactive implementation of environmental practices; they conclude that environmental regulation is a driver of environmental practices in firms (Delmas & Toffel, 2003; Carter *et al.,* 2009). However, these past researchers did not view regulation as having an impact on the relationship between environmental practices and firm performance. Past researchers and practitioners assert that firms are either proactive when there is a stringent regulation on the implementation of environmental practices or reactive during this high regulation.

For example, firms are forced to allocate more resources and inputs to meet the stringent demands of environmental regulation, such as technological standards, environmental taxes and trade permits. These additional resources or inputs are regarded as unproductive by researchers and practitioners (Porter, 2011). However, Porter & Van der Linde (1995) argued that, though environmental regulation may be stringent on firms, but it offsets the cost of compliance if they are properly structured. Therefore, there is a high tendency of environmental regulation to moderate the relationship between environmental practices and firm performance. As such, this study regards environmental regulation as a moderator between sustainable environmental manufacturing practices and firm performance. The moderating role of environmental regulation will be explicitly explained in the hypothesis development section.

## 2.8 Theoretical Perspectives

Many theories have been used by researchers to explain how sustainable environmental practices is used to achieve better firm performance such as Resource based view (RBV) theory and Natural resource based view (NRBV) theory. While RBV theory emphasizes on the use of different firm resources to achieve competitive advantage, NRBV provides possible explanation for the missing link between environmental practices and firm performance in the RBV by emphasizing that competitive advantage of a firm depends on the application of firm resources in controlling its organizational capabilities in environmentally sustainable activities (Lengnick-Hall & Wolf, 1999). NRBV took its stand from the RBV which posits the ability of a firm to outperform its competitors through its developing diverse and unique resources (Barney 1991; Wernerfelt, 1984). NRBV has an advantage over the RBV because of its ability to link the natural environment of firm in achieving sustainable competitive advantage and thus improving firm performance (Golligic & Smith, 2013). On this basis, NRBV is employed in this study as the underpinning theory.

### 2.8.1 Natural Resources-Based View of Firm

The natural resource based view took its origin from the RBV, which posits that firms can impact capabilities and outperform its competitors to achieve competitive advantage through the combination and how its resources are managed. These resources are unique, valuable, and inimitable and cannot be perfectly substituted. It was argued that environmental practices in firms have resource attributes (Hart, 1995) that could contribute to at least a temporary advantage or sustainable competitive advantage (Barney, 2012). Previous researches on the relationship between environmental practices and firm performance have been grounded on the RBV theory (Rusot & Fouts, 1997; Pullman, Malloni & Dillard, 2010; Carter, 2004). Literature also provided a support for RBV on the association between environmental practices and cost advantages (Christmann, 2000; Lopez-Gamero et al., 2010). However, RBV suffers a limitation as argued by Hart (1995) that it failed to consider the challenges and constrained imposed by the natural environment.

The constraint of the natural environment is considered as important in establishing new resources and capabilities that can minimize the rising impact of human activities on the environment. Hart (1995) asserts that previous economic and organizational practices may not be sustained as they would not provide the same outcome in the future. As such, he proposed an advanced, appropriate and a more suitable theory known as the natural resources-based view of firms (NRBV) which asserted that competitive advantage was embedded in organizational practices that incorporate and facilitate environmentally sustainable practices.

The NRBV is based on environmental practices such as pollution prevention practices and product stewardship practices (Golligic & Smith, 2013). The pollution prevention practices focused its attention on pollution reduction, inefficient use of material and activities of human in manufacturing processes such as lean manufacturing and total quality management. Pollution prevention indicates a waste reduction, which improves operational performance through better utilization of inputs, cycle time reduction and overall reduction of production costs. Product stewardship indicates the integration of perspectives of the stakeholders of firms into manufactured products (Rusinko, 2007). Product stewardship practices involves all manufacturing activities at each level of the value chain that pays attention to the entire lifecycle of the product starting from the product design to the stage of disposal (Golligic & Smith, 2013). Firms achieve competitive differentiation advantage and reputation from implementing product stewardship practices which improves financial and operational performance.

### 2.8.2 Connection between Natural Resource Base View (NRBV) and This Study

This study is based on the natural resource based view (NRBV) theory of firm (Hart, 1995) which posits that organizational activities that incorporate environmentally sustainable practices can lead to a better firm performance. A better evaluation of the relationship between firms' sustainable environmental manufacturing practices (SEMP) and performance is provided by the NRBV through its emphasis on the link between the firms' resources and the strategic management results of the firms' actions that facilitate environmentally friendly practices. The theory regards the natural environment within which firm operates as a resource that can be strategically used to achieve better performance (Hart, 1995; Hart & Dowell, 2010). The emphasis of NRBV has enhanced researchers to identify the link between firms' sustainable environmental practices and performance.

Previous researchers have made a significant effort in identifying the capabilities of firms that affect performance (Berchicci & King, 2007; Hart & Dowell, 2010; Etzion, 2007). However, few studies have been evidenced from Journeault (2010) to provide support for the framework of NRBV (Hart, 1995; Christman, 2000; Aragon-Correa *et al,* 2008; Sharma & Vrendenburg, 1998).

The attempt on the development of NRBV was made to clarify the influence of proactive environmental strategy on the valuable capabilities that produce competitive advantage in firms. Aragon-Correa & Sanjay (2003) and Husted & Allen (2007) conceptually highlighted the influence of organizational capability in achieving competitive advantage within the context of environmental concern. Christman (2000) investigated the effects of environmental practices on cost advantages. The result of the findings of Sharma and Vredenburg (1998) reveals an association between proactive environmental responsiveness and environmental capabilities. Also, Aragon-Correa *et al*., (2008) conclude that environmental performance is achieved in the implementation of proactive environmental strategy.

Adequate evidences have been provided to support that sustainable environmental initiatives/capabilities will provide better firm performance. However, studies that explicitly investigates the contributions of environmental initiatives on environmental and operational performance using NRBV are few (Journeault, 2008). Environmental management literatures within the context of NRBV identified stakeholder integration (Nidumolu *et al.,* 2009), environmental innovation (Porter & Van der Linde, 1995) and top management leadership as environmental corporate value (Bansal, 2000) as some of the elements that make up the capabilities in determining environmental proactivity and performance.

The use of NRBV in studying value creation (Performance) in firms was also evidenced in the past studies (Sarkis *et al.,* 2010; Pullman *et al.,* 2009; Wu *et al.,* 2008; Sharma & Vrendenburg, 1998; Sroufe, 2003, Hart, 1995). NRBV was employed by Wu *et al.,* (2008) in hypothesizing the existing relationship between environmental practices and operational performance. Pullman *et al.,* (2009) based their arguments on the NRBV to identify the link between environmental practices and performance. The influence of firms' environmental practices on firm performance was postulated by Sroufe (2003) using NRBV as a basis.

The NRBV offers a theoretical connection between SEMP and firm performance (Hart, 1995) and it is thus used as the underpinning theory in this study. In addition, NRBV has become a popular theory in the field of environmental sustainability practices research (Hart, 1995; Sroufe, 2003; Journeault, 2008). The basic assumption in this study is that sustainable environmental manufacturing practices lead to better firm performance. Sustainable environmental manufacturing practice (SEMP) is positioned in this study in the perspective of the NRBV and evaluate how it can be used by manufacturing firms to achieve better firm performance through the moderating role of environmental regulations and perceived benefits. In the opinion of Porter and Van der Linde (1995), a well-designed environmental regulation will offset the cost of compliance and help firms in achieving better performance. Regarding perceived benefits, environmental practices are usually conceived by managers as either a threat or benefit (Garcia-Ayerbe *et al.,* 2012). However, the implementation of sustainable environmental manufacturing practices should be seen as a benefit and not a threat in order to achieve better performance (Sharma *et al.*, 1999).

### 2.9 Summary

This chapter presents the review of relevant previous literatures on sustainable environmental manufacturing practices and firm performance. This study employed the use of the NRBV of firm in establishing a theoretical perspective in justifying the link between the sustainable environmental manufacturing practices of firms and performance. An elaborate discussion on the relationship among the variables of this study was presented followed by the detailed discussion on the underpinning theory of this study which was used in the development of the research framework and hypotheses of the study. The next chapter of this study presents the theoretical framework of the research and the development of the research hypotheses.

# CHAPTER THREE

# RESEARCH FRAMEWORK

## 3.1 Introduction

Upon the completion of the preliminary information gathering, defining the problem and review of literatures about the variables under investigation in this research, the next step is the development of a framework to guide the conduct of the study. The importance of the research framework is to help in defining the concept of the study, provide the direction of the relationship among the variables and provide a more elaborate discussion on the relationships. According to Sekaran and Bougie (2009), a framework integrates the logical belief of the researcher and published research which serves as the basic foundation on which research hypotheses are developed. This section first discussed the various previous works related to this study and then provided the theoretical framework that explains the direction of this study and the relationship of various variables, and finally, the various hypotheses to be tested was presented.

## 3.2 Theoretical Framework

The motive behind this section of the study is to develop a theoretical framework along with the development of research hypotheses. Sekaran (2003) regards research framework as the basis upon which other research structures extend the boundary of knowledge. It is the foundation upon which the hypotheses of the research are developed; therefore, it represents how certain concepts (variables) of the research are related to one another (Sekaran & Bougie, 2009).

A framework is different from theory in the sense that framework provides a description of phenomena relating to the study constructs or describe the relationship among the variables of the study in order to achieve a theory (Miles & Huberman, 1994). A framework is either descriptive or prescriptive framework. In descriptive framework, the general attributes of variables are explored, while the process of implementing the concept in the variables within an organization is explored by prescriptive framework.

In this study, a framework is presented to explain the relationships and their directions among the variables (the antecedents of SEMP, SEMP, firm performance, perceived benefits and environmental regulation) within the context of manufacturing industry in Malaysia. The dependent variable which is of primary interest is firm performance (FP). It is posited that any variation in firm performance is explained by SEMP, with the antecedent variables, i.e., top management commitment, stakeholder pressure and public concern as the driving factors of SEMP. Finally, environmental regulation and perceived benefits are proposed as moderating variables between SEMP and firm performance.

A theory is regarded as “the symbolic dimension of experience, as opposed to the apprehension of brute fact” (Kaplan, 1964; p. 45) and “the negotiation of the conceptualization of observation” (Sayer, 1992). Blaug and Marcel (2000) argued that a certain phenomenon should be logically and coherently predicted and explained by a theory. Apart from this, a theory should be empirically testable as a model. A model is a simplified representation of a process or a system with the aim of simulating and/or explaining a phenomenon (Charreire & Florence, 1999). Modelling is purposely aimed at representing a reality as theory consists of statements of empirical phenomenon and model which are generated from both theory and practices (Morgan, 1998). How theory, reality and the model are comprehended and connected have implications on the research design. Thus, hypotheses can be formulated from both empirical observations and/or logical deductions. Hypotheses development can be formulated inductively from empirical observations or alternatively deducted in a logical manner from explanation and predictions of theoretical propositions (Charreire et al., 1999; Sayer, 1992).

An integrated framework was developed based on the comprehensive review of the relevant literatures in order to capture the link between sustainable environmental manufacturing practices and firm performance. Figure 3.1 presents the theoretical framework that proposes to describe and explain the linkages between the concepts involved in this study. The framework is basically supported by the Natural Resource-Based view (NRBV), which posits that the natural environment within which a firm operates can be strategically used to achieve competitive advantage and firm performance.

The NRBV theory of firm (Hart, 1995) propounds those organizational activities that incorporate environmentally sustainable practices can lead to better firm performance. A better evaluation of the relationship between firms' sustainable environmental manufacturing practices (SEMP) and performance is provided by the NRBV through its emphasis on the link between the firms' resources, capabilities and the strategic management results of the firms' actions. The theory regards the natural environment within which firm operates as a resource that can be strategically used to achieve better performance.

Theoretically, five major variables are involved in the conceptual model of this study. The perceived benefits of SEMP and environmental regulation act as moderators of the relationship between SEMP and firm performance (dependent variable) because the performance of firms is expected to increase when sustainable environmental manufacturing practice is perceived to be a benefit. Likewise, in the wake of a stringent environmental regulation, firms will implement SEMP to avoid punishments in the form of fine or withdrawal of licence which pays off on the performance. Through the NRBV theory, this study seeks to establish the extent of sustainable environmental practices strategically from the perspective of the natural environment of manufacturing firms. This includes establishing the link between SEMP and firm performance as well as the antecedent factors of SEMP. This study is of the opinion that only when the antecedent 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 and which will result into better firm performance. Finally, an in-depth understanding of complex phenomena is presented in this model, which is the effect of SEMP on firm performance. Figure 3.1 provides an illustration of the relationship among these variables.

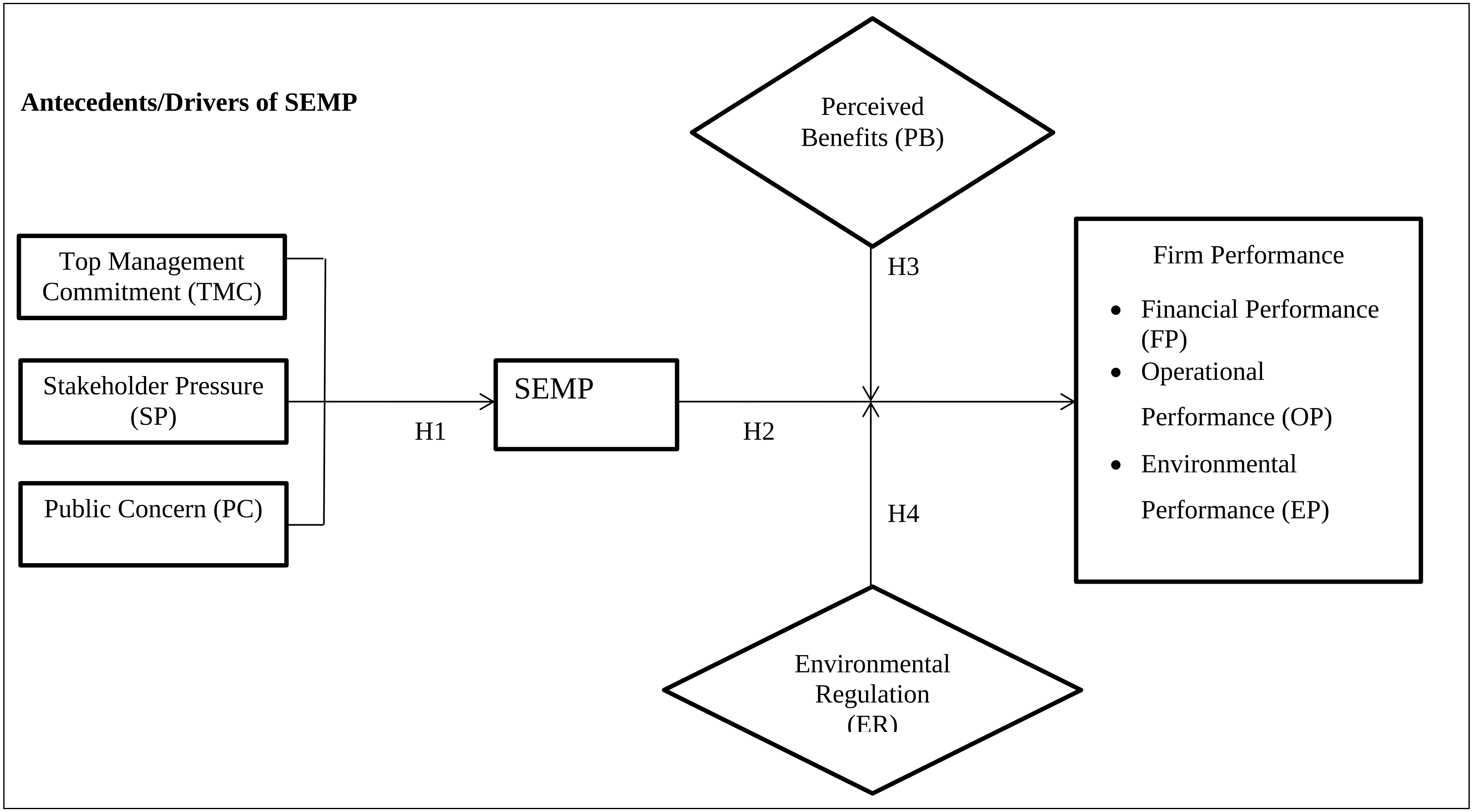


Figure 3.1
*Research/ Theoretical Framework of the Study*

The next section provides a set of theoretical assumptions and arguments on the development of the conceptual schema to support the model. In order to focus on this study, four main hypotheses were developed to explain the framework of the relationships, which cover the major aspects of the framework indicated as H1, H2, H3 and H4. Section 3.3 discussed the development of these hypotheses.

## 3.3 Hypotheses Development

The overall theoretical framework and the underpinning theoretical consideration discussed in this study present the relationship among the antecedent factors of SEMP, sustainable environmental manufacturing practices (SEMP) and firm performance with environmental regulation and perceived benefits of SEMP as moderators. The components of the framework were formalized into several hypotheses based on the research questions and the objectives and in accordance with the proposed theoretical framework in order to establish relationships among the research variables. The following section elaborates each hypothesis outlined in this study.

### 3.3.1 Relationship between antecedent factors (TMC, SP and PC) and SEMP

The first hypothesis of this study relate to the antecedent factors that drive the implementation of sustainable environmental manufacturing practices in firms. Based on the extensive search of literatures, top management commitment, stakeholder pressure and public concern were identified as antecedent factors of SEMP.

According to literatures, the drivers for firms to respond to environmental issues consist of: (1) top management commitment (Cobertt & Cutler,2000; Lee & Rhee, 2005; Ravi et al., 2005; Al-Shourah & Ibrahim, 2007; Carter et al., 2009; Berkiroglu et al., 2007;); (2) stakeholder pressure (Henrique & Sardorsky 1999; Bansal & Roth,2000; Cespedes-Lorente *et al.*, 2003; Rivera, 2004; Huang, 2005; Zhu *et al.*, 2005; Chen Shih, 2007) and (3) public pressure (Cobertt & Cutler, 2000; Banerjee *et al.*, 2003; Ravi *et al.*, 2005; Carter *et al.*, 2009). Therefore, this research proposed that:

> ***H1:*** *The antecedent factors of SEMP will positively influence the extent of sustainable environmental manufacturing practices.*

The sub-hypotheses for the antecedent factors of SEMP (top management commitment, stakeholder pressure and public concern) are presented in the next section.

#### 3.3.1.1 Top management commitment and SEMP

Top management commitment (TMC) 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). Study by Jasmine (2004) on the implementation of total quality management asserts that the degree of a successful implementation of TQM depends on the level of the commitment of the top management. According to Banerjee *et al.*, (2003), the commitment of the top management directly influences the implementation of corporate environmentalism. Also, the empirical investigation of Al-Shourah and Ibrahim (2007) confirms that top management positively support and influences the implementation of environmental practices in the hotel industry.  As a result of the above mentioned discussion, top management commitment is regarded as an antecedent of SEMP and it is posited in this study that:

> ***H1a:*** *Top management commitment will positively influence sustainable environmental manufacturing practices*.

#### 3.3.1.2 Stakeholder Pressure and SEMP

Stakeholders are individuals or groups who affect and can be affected by the objectives and actions of the organization (Freeman, 1984). In accordance with the arguments of Freeman and Liedtka (1991), this current study regards the manufacturing firm as a system that contain stakeholder group in which its success and survival depends on the ability of the firms to meet the demand and satisfy the expectation of the stakeholders. In order to attend to such stakeholders' demands, firms either behave in a more proactive or reactive manner (Gonzalenz-Benito & Gonzalez-Benito, 2006).

As regards to sustainable environmental manufacturing practices (SEMP), environmental responsibilities in term of integrity, transparency, standards and accountability are the demand of the stakeholders from firms (Gonzalenz-Benito & Gonzalez-Benito, 2006). Implementing SEMP by firms indicate harmonizing environmental performance that meets the expectation of the stakeholders of the firms (Gupta, 1994). Thus, the act of the companies in implementing SEMP is as a result of the pressure exerted by the stakeholders of the firm. Following the empirical investigation of the past researchers that pointed out the importance of pressure from stakeholders on implementing environmental practices, it has been established that there tend to be a positive relationship between the stakeholder pressure (SP) and implementation of SEMP (Cespedes-Lorente *et al.*, 2003; Chien & Shih, 2007; Henrique & Sadorsky, 1999).

Bansal and Roth (2000) found a relationship between stakeholder pressure and corporate ecological response. Gonzalez-Benito and 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 and Sadorsky (1999) found that pressure stakeholders drive firm to implement environmental management practices. Alvarez *et al.,* (2001) investigated the hotel industry and found that the industry responded to the pressure of the stakeholders.

Regarding sustainable environmental manufacturing practices, empirical studies are relatively scarce as many previously published studies focused on supply chain management and green logistic management (Gonzalez-Benito & Gonzalez-Benito, 2006). It can be said that firms does not only respond to the pressure from the stakeholders, but they are also positive and directly influenced by the implementation of the initiatives. Thus, implementation of SEMP can be improved when stakeholders demand a high level of environmental sustainable practices of the firms. As a result of the discussion above, it is hypothesized that:

> ***H1b:*** *Stakeholder pressure will positively influence sustainable environmental manufacturing practices.*

#### 3.3.1.3 Public Concern

Public concern (PC) 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 in firms. The more the concern of the public on environmental issues of a firm, the more the implementation of SEMP by the firm increases. 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 study as an antecedent of SEMP. Thus, it is hypothesized that:

> ***H1c:*** *Public concern will positively influence sustainable environmental manufacturing practices*.

### 3.3.2 Relationship between SEMP and Firm Performance

The second hypothesis is concerned with the theoretical justification for viewing the link between sustainable environmental manufacturing practices and firm performance. The initial premise of this study is that SEMP can be used by manufacturing firms as strategic competences, if well directed and implemented to improve financial, operational and environmental performance of firm. As such, it is hypothesized that:

> ***H2***: *Sustainable environmental manufacturing practices will positively influence firm performance*

The next section presented the sub-hypotheses between SEMP and firm performance.

Literatures provide that sustainable environmental practices will positively influence financial performance. Supporting arguments on this view has been provided by previous empirical researchers such Ameer and Othman, (2011); Lopez-Gomez *et al.*, (2009); Chien and Shih, (2007). Proactive environmental initiatives in firms enhance the development of resources and capabilities such as firm better reputation and stakeholder management which may be necessary for firms to achieve competitive advantages (Hart, 1995). Sustainable environmental practices have been identified by researchers as yielding better financial performance by out weighing cost involved in the pursuit of environmental practices that goes beyond legal requirement (Murillo-Luna *et al.*, 2009; Christmann, 2000; Hart, 1995).

The outcomes of sustainable environmental manufacturing practices such as financial performance have also been previously examined (Ameer & Othman, 2011; Lopez-Gomez *et al.*, 2009; Chien & Shih, 2007; Wagner, 2005; Zhu & Sarkis, 2004). Ameer and Othman (2011); Chien and Shih (2007) found a positive relationship between environmental practices and financial performance of firms. Lopez-Gomez *et al.*, (2009) on the relationship between environmental variables and firm performance affirmed that proactive environmental practice is significantly related to firm performance. Chin and Shih (2007) in their investigation on green manufacturing practices among the Chinese industries established that green manufacturing practices is positively related to the financial performance. Furthermore, Hart and Ahuja (1996) confirmed that a significant relationship exists between reducing emission and operational and financial performance. As a result, this study posited a positive relationship between the SEMP and firm performance.

In a similar vein, environmental activities such as 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 as rework is avoided and quality is ensured from the beginning of operations (Lai & Wang, 2012). Previous studies such as 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. The positive relationship between environmental practices and operational performance was also confirmed by a case study by Toru (2001).

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 & 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 & Lenox, 2000). The concept of SEMP is directed towards environmental practices such as reduction of energy consumption, carbon emission reduction and waste minimization which lessen environmental degradation caused by manufacturing industry and thus improve firm's environmental performance. Zhu and Sarkis (2004) affirmed that there is a direct positive relationship between internal environmental practices and environmental performance.

Based on the above discussion, this study posits the following hypotheses between the implementation of SEMP and firm performance:

> ***H2a:*** *Sustainable environmental manufacturing practices will positively influence financial performance.*
>
> ***H2b****: Sustainable environmental manufacturing practices will positively influence operational performance.*
>
> ***H2c****: Sustainable environmental manufacturing practices will positively influence environmental performance.*

### 3.3.3 Moderating role of Perceived Benefits between SEMP and Firm Performance

The benefits perceived by firm in implementing sustainable environmental practices can be both internal (i.e. cost savings, improved management control, prevention of risk/liability and integration of environmental management) and external benefits including meeting the expectation of the firms' customers and demonstration of sustainable environmental management commitment).

The review on the environmental management practices often identified the areas where the implementation of sustainable environmental manufacturing practices can bring about improvement in performance. When environmental practices are introduced into a manufacturing firm, the firm establishes a corporate policy that reflects the commitment of the top management of the firms to abide by the applicable laws and regulations towards sustainable environmental manufacturing practices (Begley, 1996)**.** Such a commitment often arises when the top management perceives sustainable environmental manufacturing practices as benefits that accrued through the implementation of sustainable environmental manufacturing practices in their management systems. As such, perceptions of environmental practices is usually developed and subsequently justified by the management.

Thus, it is assumed that the internal capabilities that allow firms to implement sustainable environmental manufacturing practices in order to achieve competitive advantages and better firm performance are dependent on the perception of environmental practices as benefits and not a threat (Christmann, 2000; Ondersteijn, Geissen & Huirne, 2005). Holt (1998) provided a support for this view by claiming that environmental activities of a firm would only be translated into eco-performance, only if the management of firms believes in environmental management standards and perceived the benefits of environmental sustainable practices.

The implementation of sustainable environmental practices is regarded by firms as either a threat or opportunities (Garcia-Ayerbe *et al.,* 2012; Choi & Zhang, 2007). In this regards, Sharma *et al.*, (1999) assert that the implementation of environmental practices should be seen as benefits not as a threat. 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) on 99 Canadian oil and gas firms in which it was concluded that the greater a firm interprets environmental practices as opportunities, the more likelihood they implement the initiative. Hence, if truly firms perceive environmental sustainable practices as beneficial to the performance of their firms, the impact would be of a greater magnitude on firm performance (Al-Shourah & Ibrahim, 2007).

Previous studies on environmental management practices found that perceived benefits is significant to being involved in environmental management practices (Murrow & Rondinelli, 2002; Beeton *et al.,* 2007 and Lee & Yu, 2012). However, 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, Porter and Van der Linde, (1995); Bansal and Roth (2000); Gonzalez-Benito and Gonzalez-Benito (2005, 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.

Therefore, the current study is of the opinion that the benefits perceived by firms in implementing SEMP may influence the relationship between SEMP and the performance of the firm. It attempts to re-affirm the view of the ability of SEMP to strongly influence the performance of firms as also contingent upon the fact that manufacturing firms continuously perceived benefits yielded through the implementation of sustainable environmental practices. Thus, it concludes that the impact of SEMP on firm performances will be stronger if manufacturing firms perceive that sustainable environmental manufacturing practices would be beneficial to the growth of their firms. Hence this study hypothesized that the higher firms perceive SEMP as benefits the stronger its relationship with performance. The sub-hypotheses are presented as follows:

> ***H3a****: Perceived benefits will moderate the relationship between SEMP and financial performance.*
>
> ***H3b****: Perceived benefits will moderate the relationship between SEMP and operational performance.*
>
> ***H3c****: Perceived benefits will moderate the relationship between SEMP and environmental performance.*

### 3.3.4 Moderating Role of Environmental Regulation on SEMP and Firm Performance

The traditional view of environmental regulation on performance of firms is that environmental regulation comes with additional cost that erodes the profits of the firm. This traditional view was argued by many researchers that if environmental regulation is well designed and properly channeled, it has a tendency to offset the cost of compliance and strive innovation which results into environmental and business performance, in this study, business performance means operational and financial performance) (Porter & Van der Linde, 1995; 1998). Based on the case studies conducted by the researchers, it was regarded that environmental pollution is a waste of resources and which its reduction may improve the resources used and improve firm performance.

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 & Wong, 2012). Results of the past researches have shown that environmental regulations that are focused on manufacturing sectors have a set of implications on operations and the performances of the manufacturing firms (Lai & Wong, 2012; Chin & Shih, 2007; Henriques & Sadorsky, 1999). This is explained that, 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.

Many empirical investigations have been conducted by several researchers to support the assertion that regulation will positively influence performance of firms. Sundquist (2000); Esty and Porter (2005) on the investigation of the impact of environmental regulation on firm performance found a positive significant relationship. Another support for the influence of environmental regulation on environmental performance was found in the research of Murty and Kumar (2003) who found an increment in the technical efficiency of firm in light of environmental regulation. Also, Lanoie *et al.,* (2010) collected data from 4000 companies in seven industrialized countries and found a significant positive relationship between environmental regulation and firm performance.

It is undeniable that manufacturing firms will spend more money when faced with stringent environmental regulation which may produce a negative impact on performance (Zhang, Bu & Yang, 2014). However, from a dynamic perspective, when environmental regulation becomes more stringent, a better firm financial and operational performance can be achieved by firms through the use of technological innovation to mitigate the negative effects of high environmental regulation on performance (Li et al., 2010). Increasingly, firms would take a countermeasure by implementing sustainable environmental practices that goes beyond the requirements of regulation to achieve a better financial and operational performance.

Environmental regulation strengthens the implementation of SEMP in manufacturing firms by providing environmental standards and requirements on environmental conformances. Therefore, there is a need for environmental regulation compliances to strengthen the dedication of the manufacturing firm on the implementation of SEMP. This assertion was corroborated by the result of Lai and Wong (2012) on green logistic management among the Chinese manufacturing exporter which found that environmental regulation moderates the relationship between the environmental practices and firm performance.

In the same vein, polluting firms are punished by paying penalties and fines for not complying with environmental standards and regulations (Davidson & 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 & 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 Green Logistic Management and firm performance.

Based on the above discussion, the following moderating effect hypotheses of environmental regulation are posited between SEMP and firm performance:

***H4a:*** *Stringent environmental regulation will moderate the relationship between SEMP and financial performance.*

***H4b:*** *Stringent environmental regulation will moderate the relationship between SEMP and operational performance*

***H4c:*** *Stringent environmental regulation will moderate the relationship between SEMP and environmental performance*

## 3.4 Statement of Hypotheses Development

This section of the study presents the statement of hypotheses from the relationship among the variables (antecedents of SEMP, SEMP, perceived benefits of SEMP, environmental regulation and firm performance) as shown in Figure 3.1 above. The following shows the statements of hypotheses for this study:

### 3.4.1 Hypotheses statement of the direct relationship

The direct relationship between the antecedents/drivers and SEMP are presented in this section.

Hypothesis 1 posits that antecedent factors of SEMP will positively influence the sustainable environmental manufacturing practices among manufacturing companies. The following sub-hypotheses are the derived from the main hypothesis:

**H1a:** Top management commitment (TMC) will positively influence the sustainable environmental manufacturing practices (SEMP).

**H1b:** Stakeholder pressure (SP) will positively influence the sustainable environmental manufacturing practices (SEMP).

**H1c:** Public concern (PC) will positively influence sustainable environmental manufacturing practices (SEMP).

Hypotheses 2 posit that Sustainable environmental manufacturing practices (SEMP) will positively influence firm performance among manufacturing companies. The following sub-hypotheses are derived:

**H2a**: Sustainable environmental manufacturing practices (SEMP) will positively influence the financial performance (FP) of firms.

**H2b**: Sustainable environmental manufacturing practices (SEMP) will positively influence the operational performance (OP) of firms.

**H2c**: Sustainable environmental manufacturing practices (SEMP) will positively influence the environmental performance (EP) of firms.

### 3.4.2 Hypotheses statement of moderating relationship

The statements of hypotheses below show the moderating effect of perceived benefit and environmental regulation on the relationships between SEMP and firm performance.

**Hypothesis 3:** Perceived benefits of SEMP will moderate the relationship between SEMP and performance of manufacturing companies.

**H3a**: Perceived benefits (PB) will positively moderate the relationship between SEMP) and financial performance (FP).

**H3**b: Perceived benefits (PB) will positively moderate the relationship between SEMP and operating performance (OP).

**H3c**: Perceived benefits (PB) will positively moderate the relationship between SEMP and environmental performance (EP).

**Hypothesis 4:** Stringent **e**nvironmental regulation will moderate the relationship between SEMP and firm performance in manufacturing companies.

**H4a**: Stringent environmental regulation (ER) will moderate the relationship between SEMP and financial performance (FP).

**H4b**: Stringent environmental regulation (ER) will moderate the relationship between SEMP and operational performance (OP).

**H4c:** Stringent environmental regulation (ER) will moderate the relationship between SEMP and environmental performance (EP).

## 3.5 Summary

Based on the theoretical foundations and reviewed literatures in this study, the research/theoretical framework was provided in this chapter. The main motive of this study is to investigate the relationship among the antecedent factors of SEMP, SEMP and firm performance via the moderating influence of perceived benefits and environmental regulation. The explanation of the relationship among the variables was provided in order to test the developed hypotheses. As such, four main hypotheses were developed in-line with the theoretical framework, problem statement of the research, research questions as well as the objectives of the research. The methodology employed in this research is presented in the next chapter.

# CHAPTER FOUR

# RESEARCH METHODOLOGY

## 4.1 Introduction

This study aims at investigating the relationship between the antecedent factors of SEMP, sustainable environmental, manufacturing practices and firm performance in the Malaysian manufacturing industry. Since this study aims at predicting the influence of the variables of this research on one another with the motive of explaining and predicting the relationship through testing of the hypotheses using statistical techniques, a quantitative approach is appropriate for the study. This chapter is divided into different sections: the first section provides information on the research design of the study, followed by the second section which provides information on the sampling design and the collection of data. The third section elucidates on the operationalisation and measurement of the variables while the fourth section focuses on the data analysis method.

## 4.2 Research Design

The aim of this section is to provide a better understanding of the conduct of the research. This study employed the use of a quantitative research approach. The choice of this research approach solely depends on the nature of the research problems under investigation (Creswell, 2009). Again, the choice of this approach over the qualitative research approach is because quantitative approach saves time, conscious of the cost of conducting the research and provides an opportunity to investigate a large sample size compared to the qualitative approach (Zawawi, 2007). The research approach in this study focused on the descriptive and the hypothesis testing due to the objectives of this study, which aim at investigating and validating the relationships among the variables of this study.

The descriptive research was employed to identify the characteristics of the study population (respondents of the study). According to DeVaus (2001); Sekaran and Bougie (2009), descriptive study aims at offering the researcher an opportunity of defining the relevant aspects of the phenomenon of the interest from the perspectives of the individual, organisations or others. It is undertaken when the researcher has a certain level of the understanding of the nature of a phenomenon with a purpose of providing the characteristics of the variables of interest in a situation (Sekaran, 2003; Sekaran & Bougie, 2009). The test of the hypotheses is to investigate the nature of the relationship among the variables and to further give explanations about the nature of the relationship by providing explanation on the variance among the variables or predict the results of the relationship and the effect of one variable on the other (Sekaran & Bougie, 2009).

The use of a survey research design which consists of using questionnaires for data collection was employed in this study with the intention of making a generalisation from a small sample to a large population (Creswell, 2009; Babbie, 1990). In this situation, the researcher does not have the control over the independent variables that determines the dependent. The only control the researcher has in this study is on the measurement of the study. The interest of the researcher lies in the collection of the data on the measurement of the performance of manufacturing companies and the effect of the antecedents/drivers, perceived benefits, environmental regulation and the implementation of sustainable environmental manufacturing practices among Malaysian manufacturing companies. As a result of the objectives of this study, a survey or non-experimental quantitative research approach was employed to administer the questionnaire used in this study.

This research was conducted in a cross-sectional design which involves gathering of data at a single point in time to achieve the stated objectives of the research (De Vaus, 2001). The choice of the cross-sectional design was in-line with Babbie (2010); Sekaran and Bougie (2009) which affirmed the use of cross-sectional studies as having advantages over the longitudinal study because the researcher, aimed at collecting data that reflects peoples' opinion and which is better obtained using cross-sectional and not secondary sources of data collection. In addition, it is affirmed that cross-sectional setting saves time, money and require less number of researchers than the longitudinal study (Creswell, 2009). As such, the above justified the choice of the research design. The instrumentation and questionnaire development is presented in the following section.

### 4.3 Instrumentation

Many researchers are of the opinion of using the publicly available data in different databases and annual reports. Reason given to this is due to the type of research being conducted and the availability of the data requested (Inoue & Lee, 2010). However, this research is constrained from using such publicly available data because it aims at investigating the opinion of the respondents. This is supported by Lopez-Gamero *et al.*, (2009) and Wagner (2007) who recommended the use of the perception of people in social and economic science in a situation where publicly documented data are not available.

Instrumentation is of high importance in researches because it is a means through which researchers are able to collect, analyze and generalize their conclusion about certain phenomenon. Varying techniques of research instrumentation exist based on the motives and interests of researchers. For example, the instrumentation techniques used in pure science field differ from that used in social and management science and even among the same discipline depending on the interest and motivations of the researches. Questionnaire is usually the most used research instrument in social and management science research (Krosnick, 1999). This current research is management oriented and therefore used questionnaire as the instrument of data collection. The development and the structure of the questionnaire are discussed in the following section.

### 4.3.1 Questionnaire Structure

Aside from choosing survey questionnaire as a research instrument, structuring the questionnaire is another important challenge facing researchers as badly structured questionnaire may affect the validity of the data and the response rate (Hair *et al.,* 2007). In order to reduce the impact of those challenges, this researcher followed the precautionary recommendations of Organ, Podsakoff and Mackenzie (2006) and Gupta

(2006) who suggested for researchers to abide by research ethics by; protecting respondents' anonymity and avoiding ambiguous item scaling. The scaling of the questionnaire is presented in the next section.

### 4.3.2 Scale of the Questionnaire

It is the believe of scholars that survey questionnaires are expected to have a common and universal pattern of design (Oppenheim, 1992) even though there are varying patterns of survey questionnaire design. Based on this, Oppenheim, (1992) asserted that the statements of the items of questionnaires should be written in a way that respondents can easily comprehend and should not mislead the respondents. Also, researcher should write the statements in such a way that will maximize the instrument's validity, reduce the stress in responding to the questionnaire and economize cost relating to data collection. Based on this, a Likert type scale was used in designing the questionnaire of this study.

This type of questionnaire uses a psychometric scale for extracting the extent of agreement or otherwise of respondents to a certain instrument item. Many types of Likert scale questionnaire exist, 5-point scale that ranges between strongly disagree and strongly agree without agree or disagree was commonly used among researchers. However, researchers recently prefer the use of a longer scale (7-point, 9-point and 11-point Likert scale). The reason given to this is that respondents are at the liberty of independently choosing options on a longer scale without being forced to do (Malhotra, 2004). In addition, many other researchers prefer to use even point Likert type scales (usually, 4-point and 6-point scale) because respondents prefer a neutral option that free them from being restricted from the choices of the researchers (Martin & Polivka, 1995). This was argued by Robert *et al.*, (2009) that the provision of a neutral option for respondents interferes with the value of the data collected.

Based on the given explanation in the previous paragraph, this study regards a 6-point Likert type scale as appropriate and it is hereby used in the development of the questionnaire in this study. The reasons for the choice of this scale lies in its ability to increase the reliability of the instrument and also reduce the potentials of social desirability bias (Krosnick, 1999). On the assessment of the quality of the psychological test between the 5-point scale and the 6-point scale, Chomeya (2010) found that the 6-point scale has a better discrimination and reliability quality than the 5-point scale. However, contrary to the usual thought of people, respondents are at liberty to skip any items with ambiguous meaning rather than choosing an option that statistically reduces the value of data. To support the above, researchers are within the liberty of choosing the instrument scale depending on the research under investigation, as effective scale in one research may be ineffective in another (Garland, 1991).

The design of the survey questionnaire in this study is divided into six (6) main sections. Section A contains questions for measuring the sustainable environmental manufacturing practices (SEMP). These items were adapted and modified from Gonzalez-Benito and Gonzalez-Benito (2006). Section B of the questionnaire consists of questions on the antecedents of SEMP (independent variables). Items for measuring the antecedents of SEMP was adapted and modified from Ragu-Nathan, Apigian, Ragu-Nathan and Qiang, (2004); Alvares-Gills *et al.*, (2007): Rodriguez, Perez and Gutierrez, (2008); Carter *et al.*, (2009); and Lai & Wong (2012). Section C measures the perception of the respondents on environmental regulation. Section D contains the items for the measurement of perceived benefits of SEMP which were adapted and modified from Hassanali (2005); Tamayo and Vicente (2008). Section E measures firm performance, items in this variable measure the financial, operational and environmental performance of the respondents' companies. The financial performance was measured by the firm's profitability and manufacturing cost indicators while the non-financial measure was indicated by the operational and environmental performance of the companies. Items in the questionnaire were adapted and modified from Henri and Journeault (2010); Lai and Wong (2012); Lin, Chan and Nguyen (2012). Section F in the instrument contains information about the demographic information of the respondents and their companies. The validation of the instrument is discussed in the following section.

### 4.3.3 Validation of the measurement Instrument

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 research. 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 & Bougie, 2009), to foresee any challenges that might occur during the main data collection period and to prepare a back-up plan that would cater for any challenges that might arise during the main collection of data.

Instrument validation in this study was done by firstly subjecting the instrument 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 who are senior lecturers in their Universities and are expertise in the field of sustainable practices. The remaining two practitioners occupy the position of operations manager and environmental, health and safety manager of their companies. The comments such as avoidance of ambiguity, double barrelled questions and the usage of a more appropriate word were recommended by the experts and these comments were implemented in the final research instrument used in collecting data for the main study. The following section presents the measurement and operational definitions of the variables in this study.

## 4.4 Measurement of Variables and Operational Definitions

The items of the questionnaire in this study are adapted from the previous literatures. The bases on which the items are included in this study are discussed in relation to the previous work on firm performance, sustainable environmental manufacturing practices (SEMP), environmental regulation, perceived benefits of SEMP and the antecedents/drivers of SEMP. The items under each variable in this study are made as simple as possible to enhance the understanding of the questions in this instrument. The list indicating each item of the questionnaire with their respective source of adoption or adoption is provided in Appendix B of this study. The specific measurement of each variable in this study is discussed as follows:

### 4.4.1 Operational definition and measurement of Firm Performance

Firm performance in this study refers to the firms' activities that focus on the achievements of its objectives. It entails: the financial performance, operational and environmental performance. This measures the perception of the respondents on the performance of the manufacturing companies. It is measured by the subjective indicators of financial, operational and the environmental performance. Items for the measurement of firm performance were adapted from various sources requiring the respondents to indicate their perception about the performance of their firms within the last three (3) years on the provided 6-point Likert scale: "1" = Strongly Disagree (SD); "2" = Disagree (D); "3" = Slightly Disagree (SDA); "4" = Slightly Agree (SLA); "5" = Agree (A) and "6" = Strongly Agree (SA). The details of the measurement of each performance are discussed below:

#### 4.4.1.1 Financial performance

In this study financial performance refers to the financial objectives attained through an organisation's manufacturing activity (Zhu & Sarkis, 2003). The financial indicators measure the perception of the respondents about the profitability ratio and growth of their firms. This dimension of performance was measured by five (5) items based on the subjective perception of the respondents about the financial performance of their companies. The items of the questionnaire were adapted from Henri and Journeault (2010).

#### 4.4.1.2 Operational Performance

This refers to a certain level of performance attained in the operational activities of an organization (Sharma & Vrendenburg, 1998; Sarkis, 2003). The operational performance indicator measures the quality, delivery and the flexibility of the respondents' companies. Six (6) items were used in measuring this dimension of firm performance and were adapted from Lai and Wong (2012).

#### 4.4.1.3 Environmental Performance

Environmental performance refers to the achievement of a certain level of environmental objectives attained by organizations in its sustainable environmental manufacturing practices (Sharma & Vrendenburg, 1998; Sarkis, 2003). The environmental performance indicator measures the improvement in pollution, emission and waste reduction of the respondents' companies. This dimension of performance was measured by five items adapted from Lai and Wong (2012); Lin, Chan and Nguyen (2012).

### 4.4.2 Operational definition and measurement of Sustainable Environmental Manufacturing Practices (SEMP)

The measure of sustainable environmental manufacturing practices in this study refers to the implementation of technical and organizational initiatives of manufacturing firms towards minimizing the impact of its manufacturing activities on the natural environment. Twenty (20) items for the measurement of this variable are adapted from Gonzalez-Benito and Gonzalez-Benito (2006) based on the perception of the respondents on the scale: “1” = Strongly Disagree (SD); “2” = Slightly Disagree (SLD); “3” = Disagree (D); “4” = Agree (A); “5” = Slightly Agree (SLA); and “6” = Strongly Agree (SA).

### 4.4.3 Operational definitions and measurement of the Antecedent factors of SEMP

The measure of this variable indicates the factors that drive the implementation of SEMP in manufacturing companies. These drivers are stakeholder pressure, top management commitment and public concern. Items for measuring these variables are adapted from previous literatures and modified. The measurement of the drivers of SEMP was measured from the perception of the respondents based on the scale: “1” = Strongly Disagree (SD); 2 = Slightly Disagree (SLD); 3 = Disagree (D); 4 = Agree (A); 5 = Slightly Agree (SLA); and 6 = Strongly Agree (SA). The measurement and operationalization of each driver of SEMP is given below:

### 4.4.4 Operational definition and measurement of Stakeholder pressure

A stakeholder is any group that can affect and be affected by the decision of a firm (Freeman, 1984; Tang & Tang, 2012). Thus, the stakeholder pressure in this study indicates the pressure exerted by the stakeholder on firm in getting their request from firms. This dimension was measured from the perception of the respondents by the six items adapted from Alvares-Gills *et al.,* (2007).

### 4.4.5 Operational definition and measurement of Top management commitment

This 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; Starick & Rands, 1995). Top management commitment measures the extent to which the top management of the firms is committed to the implementation of sustainable environmental manufacturing practices within their companies. Eight (8) items adapted from Benerjee *et al* (2003); Carter *et al.* (2009); Ragu-Nathan, *et al.* (2004); and Rodriguez, *et al*. (2008) were used in measuring the variable.

### 4.4.6 Operational definition and measurement of Public concern

This refers to the certain level of expectation a firm is expected to meet by the public. Public concern measures the extent to which the concern of the public drives the implementation of SEMP. This dimension was measured by five (5) items adapted from Carter *et al.,* (2009) and Benerjee *et al*. (2003).

### 4.4.7 Operational Definition and Measurement of Perceived benefits

Perceived benefit measures the favourable outcomes anticipated by the manufacturing companies as benefits from the implementation of sustainable environmental manufacturing practices. This variable is measured by items adapted from Ali (2005); Tamayo and Vicente (2008). The respondents were required to indicate the extent to which their companies perceived the benefits of SEMP based on scale: '1" = Strongly Disagree (SD); "2" = Slightly Disagree (SLD); "3" = Disagree (D); "4" = Agree (A); "5" = Slightly Agree (SLA); and "6" = Strongly Agree (SA). This variable was measured by 13 items based on the perception of the respondents.

### 4.4.8 Operational Definition and Measurement of Environmental regulation

This refers to the law, policy, rules, standards and international agreements enacted by the regulatory bodies prompting organizations to become conscious of its activities on the environment (Sarkis, 1998; Sarkis, 2003; Lai & Wong, 2012). This dimension of the driver of SEMP measures the influence of environmental regulation in implementing SEMP. The environmental regulation in this study was measured by nine (9) items adapted from Carter et al., (2009) and Lai & Wong (2012).

Table 4.1 below presents the summary of the number of the measurement items of the variables in this study and their respective sources of adaption and adoption.

Table 4.1
*Summary of Measurement and Scales*

| No | Construct | Items | Scales | Sources |
|---|---|---|---|---|
| **1** | **Firm Performance** | | | |
| | Financial Performance (FP) | FP1- FP5 | 6-Point Likert | Henri & Journeault (2010) |
| | Operational Performance (OP) | OP1-OP6 | 6-Point Likert | Lai & Wong (2012) |
| | Environmental Performance (EP) | EP1-EP5 | 6-Point Likert | Lai & Wong (2012) |
| **2** | Sustainable Environmental Manufacturing Practices (SEMP | SEMP1-SEMP20 | 6-Point Likert | Gonzalez-Benito & Gonzalez-Benito (2006) |
| **3** | **Antecedents/Drivers** | | | |
| | Stakeholder Pressure (SP) | SP1-SP6 | 6-Point Likert | Alvares-Gills *et al.,* (2007) |
| | Top Management Commitment (TMC) | TMC1-TMC8 | 6-Point Likert | Benerjee *et a*l (2003); Carter *et al.* (2009) |
| | Public Concern (PC) | PC1-PC5 | 6-Point Likert | Carter *et a*l., (2009) and Benerjee *et al*. (2003) |
| **4.** | Environmental Regulation (ER) | ER1-ER9 | 6-Point Likert | Lai & Wong (2012) and Carter *et al.*, (2009) |
| **5.** | Perceived Benefits (PB) | PB1-PB13 | 6-Point Likert | Hassanali (2005); Tamayo & Vicente (2008). |

## 4.5 Research Ethical Considerations

Research ethic has been considered as a set of behaviours, standard and principles that must be abided by researchers. These ethical behaviour should be considered by researchers in order to avoid infringement on the right of the respondents (Bryman & Bell, 2003). Researchers are expected to bear in mind that participants are not to be forced to partake in the research, have the right to withdraw from the research at any point in time and should have access to the results of the research upon their request to confirm if their interests are misrepresented or not. As such, a certain level of quality and objectivity in reporting is maintained when emphasis is laid on the ethical consideration of research (Zikmund, 2005).

Five rules are provided by Bouma (2000) as a guide to research consideration, these are:

i. Respondents should be treated with respect and dignity
ii. The benefits of the research should be ensured to outweigh the potential harm of the research
iii. Respondents should not be forced into any participation
iv. Researchers should ensure the safety of the respondents, while participating in the research
v. The respondents have the right to access the result of the research to ensure if their interests are misrepresented.

In relation to the rules presented above, this research addresses the ethical issues relating to the questionnaire development, data collection and analysis of this research. The ethical issues in this study are treated as follows:

- *Voluntary Participation*: this researcher provided an introductory letter with the research questionnaire indicating to the respondents that they are free to attempt any question at their convenience.
- *Adequate information*: the letter provided adequate information about the objective to be achieved in this research.
- *Privacy and confidentiality*: the respondents were assured of the confidentiality of the information provided in the course of the research. Assurance was also given that the information provided will only be used for the purpose of the academic research alone.

Based on the explained factors above, this research revealed that ethical consideration was considered in accordance with the rules highlighted by Bouma (2000). The pilot study conducted in this research is presented in the next section.

## 4.6 Pilot Test

This study conducted a pilot test on the validity and reliability of this study because it used a survey questionnaire as the research instrument. Hair *et al.,* (2010) asserted that it is necessary to ascertain both the validity and the reliability of the instrument to ensure that it measured the concept they were designed to measure.  This validation could be conducted by facial validation (Hair *et al.,* 2007) which was supported by Babbie (2010) as a crucial procedure in validating research instruments. The pilot study was conducted prior to the main data collection of this study. The essence of this was to get relevant feedback to improve the data collection process and the instrument used in the main study. The following are the aimed objectives in performing the pilot study:

i. To establish contact between the researcher and the organizations prior to the main study.
ii. To determine the validity and the reliability of the constructs.
iii. To foresee the challenges that may possibly arise before the main data collection of the study.

In ensuring that the items of the questionnaire were properly adapted, this study conducted a content and construct test for the validation of the measuring instrument used in this research. 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 & Bougie, 2009), to foresee any challenges that might occur during the main data collection period and to prepare a back-up plan that will cater for any challenges that might 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 who are senior lecturers in their Universities and are expertise in the field of sustainable practices. The remaining two practitioners occupy the position of operations manager and environmental, health and safety manager of their companies. The comments such as avoidance of ambiguity, double barrelled questions and the usage of a more appropriate word, and clarity of the questionnaire items were recommended by the experts and these comments were implemented in the final research instrument used in collecting data for the main study.

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) asserts 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 4.2 below:

Table 4.2
*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 | 0.872 |
| Public Concern | 5 | 0.873 |
| Environmental Regulation | 9 | 0.894 |
| Perceived Benefits | 13 | 0.944 |

| Constructs | Number of items | Cronbach’s Alpha |
|---|---|---|
| Financial Performance | 5 | 0.881 |
| Operational Performance | 6 | 0.943 |
| Environmental Performance | 5 | 0.848 |

The result of the pilot test analysis indicates that the Cronbach’s Alpha of the variables ranges from 0.832 to 0.964. Pallant (2011) and Hair *et al.,* (2010) assert that Cronbach’s Alpha greater than 0.7 is accepted; however, a 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 this study. The reliability result of this study has revealed that the variables of this research as listed in Table 4.2 above are appropriate to be used in this research. Further reliability analysis is performed in chapter five of the main study based on a larger sample size. The data collection procedure is presented in the following section.

### 4.7 Data Collection Method

To ensure that all the variables in this study are fully measured, a survey questionnaire was considered as the most appropriate instrument and was used in collecting data for this study. Questionnaires are an efficient method of data collection because of its ability to provide an efficient use of the time, energy and costs of the researcher (Sekaran & Bougie, 2009). Therefore, this research adopted the use of a structured questionnaire consisting of closed-ended questions which was mailed to the respondents. The choice of this data collection mechanism over the others is its ability to cover a wide geographical area and the provision for the respondents to complete the questionnaires at their convenience.

Though, researchers have shown that the response rate of mail questionnaire mechanism is usually low when compared with the other mechanisms of data collection (Bryman & Bell, 2007) but Sekaran and Bougie (2009) claimed that a response rate as low as 30% is acceptable. Therefore, to increase the response rate of this study, the researcher made a provision to include a good cover letter to accompany the stamped addressed envelope and the questionnaires. The population of the study is discussed in the following section.

## 4.8 Population and Sample

Population consists of a number of units of enquiry (Moser & Kalton, 1979). It is the group of people, or events that the researcher wishes to investigate (Sekaran & Bougie, 2009). It is regarded as one of the vital research elements that encompass common characteristics of all the individuals in the group. Population can either be a target or accessible population (Castillo, 2009). Target population is also known as the theoretical population, it is a group of individuals from which a research aims at generalizing its conclusion, while the accessible population represents that on which a researcher can apply its conclusion. In another word, an accessible population represents a study population from which study samples can be drawn.

In this study, the target population represents the manufacturing industry in Malaysia. A total of two thousand four hundred and seventy six (2476) manufacturing companies was registered with the federation of Malaysian manufacturers (FMM) (FMM, 2013) which represent the sample frame from which the sample of the study was selected. The manufacturing industry was chosen because they represent one of the major contributors to environmental degradation in Malaysia (DOE, 2010) and it's also an industry that contributes to the economic development of the nation. The list of the manufacturing companies in Malaysia was accessed via the directory of the Federation of Malaysia manufacturer (FMM, 2013). The following section of the study discussed the sample of the study.

## 4.9 Study Sample

A study sample represents a selected part of an entire population from which a statistical inference can be deduced about the entire population (Sridhar, 2009). The choice of a study sample is inevitable in a research as it is difficult to directly observe every individual element of the entire population (Herek *et al.,* 2010). The selected sample of a study ideally represents the entire population and therefore, any assumption from the sample applies correspondingly to the entire study population.

### 4.8.1 Sample Size

The calculation of the sample size of this study was computed based on the given size of the population of this study by using the formula provided by Dillman (2000) and Weaver (2006). The original size of the population from the listing of the Federation of

Malaysian Manufacturer (FMM) shows that two thousand four hundred and seventy six (2476) companies were registered with FMM, but this research further went ahead to exclude those companies with less than fifty-one (51) number of full-time employees. According to Carter *et al.*, (2009), it was asserted that companies with less than 51 full-time employees are not feasible for this study. Hence, the final population size used after excluding those companies is one thousand five hundred and eighty (1580) companies. The below shows the calculation of the sample size of this study:

$$n = \frac{N(p)(1-p)}{(N-1)\left(\frac{B}{C}\right)2 + (p)(1-p)}$$

$$N = population\ size,\ \ P = 0.5,\ \ B = 0.05, C = 1.96$$

$$n = \frac{1580(0.5)(1-0.5)}{(1580-1)\left(\frac{0.05}{1.96}\right)2\ + (0.5)(1-0.5)}$$

$$N = 1580,\ \ P = 0.5,\ \ B = 0.05, C = 1.96$$

n = 309.181

*Note*: n = calculated sample size required for the desired level of precision

N = size of the population,

P = the proportion of the population expected to be chosen

B = the acceptable amount of precision or sampling error

C = is the K value associated with the confidence level.

This study used a proportion level (P) of 0.5, as the respondents' proportion who answered yes or no is unknown before the collection of data. According to Dillman

(2000), the proportion is usually set to either 0.5 or 0.8 for a homogeneous sample, however, Weaver (2006) state that 0.5 proportion level leads to a larger sample size than the 0.8 proportion level. The acceptable amount of sampling error or precision can be set to 0.1, 0.05, or 0.03 which respectively represent the true percentage of the population value at either ± 10, 5, or 3%. Therefore, this study chooses to use a precision level of 0.05 or 5%.

It is shown that the result of the sample size computed above is in accordance with the simplified table for sample size provided by Krejcie and Morgan (1970). Krejcie and Morgan (1970) provided that a given population of 1500 will be represented by 306 samples, while a population of 1600 is represented by sample size 310. Thus, it can be deduced that the sample size for the population of 1580 for this study ranges between 306 and 310 samples. As a result, it is evidenced that the computed sample size 309.181 above (rounded up to 310) is appropriate and it is hereby chosen for this study.

### 4.8.2 Sampling Techniques

Sample was selected from this population by using a stratified random sampling method. This involves the process of segregating the population into strata (DeVaus, 2002) which was followed by randomly selecting the subjects from each stratum (Sekaran & Bougie, 2009). The advantage of this sample method is to ensure that the characteristics of the population are proportionately represented by each stratum and to guide the choice of the researcher from bias against another (Babbie, 1990; Miller, 1991). Cavana *et al.*, (2001) assert that probabilistic sampling technique allows for generalizability.

Therefore, this study drew its samples among the various manufacturing companies in Malaysia justifying the use of stratified random sampling.

The classification of the industries in this study follows the International Standard for Industrial Statistics (ISIC); the Federation of Malaysian Manufacturer [FMM] (2013) provided the list of the manufacturing companies in Malaysia. The contained data in the directory of FMM regarding the industrial sectors in accordance to the two digits ISIC code is the company's name, address, and contact information. Due to the absence of the start-up capital, company's total assets and the annual sales in the directory, a company's size, which is the only available attributes of the companies represented by the number of employees in the directory was used in selecting the study sample in the list.

Upon the elimination of those companies with number of full-time employees less than fifty one (51), the companies were categorized into industry group according to the products manufactured. The arrangement of the grouping is based on the International Standard industrial Classification (ISIC) codes. Table 4.3 shows the industry groups identified from the FMM listing of industry Grouping and the proportion of the selected industry from the above ISIC grouping which forms the strata of the study sample size.

Table 4.3
*Selection of sample from the ISIC grouping*

| **Industry Category** | **ISIC Code** | **Population Size** | **Proportionate Sample** |
|---|---|---|---|
| Food Products and Beverages | 15 | 257 | 50 |

| Industry Category | ISIC Code | Population Size | Proportionate Sample |
|---|---|---|---|
| Tobacco Products | 16 | 3 | 1 |
| Textile, Wearing Apparel; Dressing and Dying of Fur | 17, 18 | 37 | 7 |
| Tanning and Dressing of Leather; Manufacture of Luggage, Handbags, Saddlery, Harness and Footwear | 17 | 10 | 2 |
| Paper and allied Products | 21, 22 | 91 | 18 |
| Chemical and allied products | 24 | 241 | 47 |
| Rubber and Plastics | 25 | 176 | 35 |
| Other Non-metallic mineral product | 26 | 72 | 14 |
| Basic metallic and allied components | 27, 28 | 283 | 56 |
| Electrical, Electronic, Computing Machinery and allied components | 30, 31,32 | 197 | 39 |
| Medical Precision and Optical Instruments, Watches and Clocks | 33 | 45 | 8 |
| Motor vehicle, Trailers and Semi-Trailer and other Transport Equipment | 34, 35 | 83 | 16 |
| Wood, Products of Wood, Furniture and other Allied Components | 20, 36 | 70 | 14 |
| Recycling | 37 | 15 | 3 |
| **Total** | | **1580** | **310** |

Selected samples for this study were drawn from Table 4.3 above by using a simple random sampling procedure. The essence of this is to ensure that the homogeneity within each stratum and the heterogeneity among strata are achieved (Sekaran & Bougie, 2009).

### 4.8.3 Unit of Analysis

The unit of analysis in this study is the manufacturing companies in Malaysia. This choice follows the argument of DelBrio *et al*., (2007) who posited in contrast to the assertion of Delmas (2001) that researcher should focus on a single set of source for information gathering rather than facing the challenges of gathering information from multiple source as argued by Delmas (2001). As such, this study chose the manufacturing organizations as a unit of the analysis. The respondents of this study are the operation manager, manufacturing manager or the environmental, health and safety manager of the selected companies.

## 4.9 Method of Data Analysis

Upon the successful collection of data in this study, combinations of both descriptive and inferential statistics were employed for the analysis of the collected data. The data analysis was done by using the smartPLS 2.0 M3 (Ringle *et al.*, 2005) path modeling software. Prior to the main data analysis, a number of preliminary activities (data screening) were conducted by using SPSS version 20 to ascertain that the data collected are suitable for the main analysis. The main data analysis was thereafter commenced to achieve the objectives of this research.

### 4.9.1 Descriptive Analysis

The essence of the descriptive analysis is to describe the phenomenon of the interest (Sekaran & Bougie, 2009). This will statistically explain the frequency of occurrence, average score, or central tendency (mean, median and mode) and the measure of dispersion (range, variance and standard deviation) of certain phenomenon of interest. The study applied descriptive analysis mainly to avail the sample characteristics and the characteristics peculiar to the constructs of the research.

### 4.9.2 Partial Least Squares (PLS) Technique

Partial Least Square (PLS) is a second generation multivariate analysis technique (World, 1982) that combines the features of the first generation (principal components and linear regression analysis) (Fornell, 1982). This technique appropriately functions with structural equation models that have latent variables and series of cause-and-effect relationship (Hair *et al.*, 2013). PLS-SEM provides researchers an opportunity to explore relationships among variables and identify the existing pathways among the variables (Hair *et al.*, 2013). As such, it is regarded by Ringle, Wende and Will (2012) as an appropriate tool for building statistical model as well as prediction. This study specifically employed the use of PLS-SEM because of the following reasons:

Firstly, researchers have shown that PLS-SEM works efficiently by placing a minimum requirement on sample size to achieve adequate statistical power (Chin, 1998; Hair *et al.*, 2013). PLS is advantageous to researchers due to its robustness of estimations and statistical power (Reinartz *et al.*, 2009), which means that it is capable of rendering a specific relationship significant when it is indeed significant (Hair *et al.*, 2013). It is indicated by Reinartz *et al.*, (2009) that the sample size required by PLS-SEM is smaller compared to the other analytical tools. Following the rule of thumb in the application of PLS-SEM which states that the sample size should be 10 times the largest number of the structural paths directed at a construct in a structural model (Chin, 1998). This study considers the use of PLS-SEM as an appropriate tool.

Secondly, PLS path modelling has the ability to handle complex models with many structural model relations which makes it more appropriate to be applied in a real life phenomenon (Hair *et al.*, 2013; Hulland, 1999). The soft modeling assumptions of PLS technique provides it with a greater ability to flexibly develop and validate larger complex models (Akter & Hani, 2011). Hair *et al.*, (2013) asserted that PLS-SEM is without competition in a situation that involves several path models with latent variables and complex structural relationships. This study involved nine path models within the structural model, and thus using PLS-SEM technique is appropriate for better validation.

Thirdly, one of the issues in social science researches is data non-normality (Mutum, 2011), and the statistical properties of PLS-SEM provides a very robust estimation with data that have normal and extremely distributional properties (i.e skewness and Kurtosis) (Reinartz *et al.*, 2009; Ringle *et al.*, 2009). Non-normal data are relatively treated well in PLS, thus the usage of PLS in this study is appropriate to help in treating issues related to non-normality of data during the analysis.

Fourthly, the use of PLS-SEM has been demonstrated by past researchers as having an ability to test moderation effect (Kadir, Said & Singh, 2012; Henseler & Fassott, 2010; Goodhue *et al*., 2007; Chin *et al.*, 2003). Bolen (1989) showed that the result of PLS are more meaningful and valid while the conclusion of the results of the other analytical method are less clear which requires several other separate methods of analysis. In order to understand the complex relationship associated with social science research, the use of PLS-SEM is necessary in the application of more sophisticated multivariate data analysis method (Hair *et al.*, 2013). As such, it is regarded as a powerful tool with the ability to simultaneously test several relationships.

This study employed smartPLS path modelling in establishing the measurement and the structural models. The measurement model provided an explanation on the assessment of the reliability and the validity of the constructs of the study, while the structural model was used to establish the correlation and the relationship effect among the constructs regression analysis. In addition, using the bootstrapping and PLS algorithm helped in analyzing the hypotheses of this study and the moderating effects of perceived benefits and environmental regulation (moderators) on the relationship between sustainable environmental manufacturing practices (SEMP) and firm performance.

### 4.10 Summary

The methodology employed in this study is presented in this chapter. The focus of the chapter is solely on the descriptive and the hypotheses testing. An elaborate discussion was provided on the sampling design and the determination of the sample size. This chapter further highlighted the use of stratified random sampling procedure and the method of data collection. Measurement of the instrument in the study and the development of the data collection instrument was also discussed. It was also presented in this study that the collected data for this study was analyzed using PLS-SEM technique. However, the analysis and the findings of the main data collected for this study is presented in the following chapter.

# CHAPTER FIVE

# DATA ANALYSIS AND FINDINGS

## 5.1 Introduction

This chapter begins with the discussion of the response rate of the survey, followed by the discussion of the procedures taken in screening the data prior to the main data analysis. Next is the descriptive analysis of the respondents and the constructs. Finally, the results of the statistical analysis for testing the proposed hypotheses were presented. This study used the Partial Least Square (PLS) technique to analyse the measurement model, or goodness of the measure through the construct validity and the reliability analysis of measures used. The structural model and the relationships among the constructs of this study (antecedents/drivers of SEMP: top management commitment, stakeholder pressure, public concern, perceived benefits and environmental regulation; SEMP; firm performance: financial performance, operational performance, environmental performance) were analyzed using the data collected from questionnaire in this survey.

### 5.1.1 Response Rate

In-line with the opinion of Cooper and Schindler (2007) and Zikmund (2005) who believed that the collected raw data in a survey should be examined for correctness, accuracy, completeness and eligibility of responses, this study examined the survey questionnaires received in this study. A total number of 790 survey questionnaires were distributed to the study population out of which 135 sample respondents were obtained to have filled and returned the distributed questionnaires. However, as represented in Table 5.1 below, a total of 103 questionnaires was finally retained for data analysis.

Precisely, 32 questionnaires were not included in the data analysis as a result of two major reasons. Firstly, some of the excluded questionnaires are incomplete as a result of the presence of pages of missing value per case. Precisely, 27 questionnaires were rejected due to this reason. Secondly, issues of non-qualified respondents are also a cause for the exclusion of some questionnaires. Exactly five responses were excluded from the analysis due to the issue relating to respondents not qualified for the analysis. It is important to exclude such questionnaires or data from the analysis as they do not represent the sample and may not reflect the concept under examination (Hair *et al.*, 1998; Cousineau & Chartier, 2010).

Table 5.1
*Distribution and Retention of Questionnaires*

| **Item** | **Frequency** | **Percentage (%)** |
|---|---|---|
| Distributed questionnaires | 790 | 100 |
| Returned | 135 | 17.09 |
| Rejected questionnaires | 32 | 4 |
| Retained questionnaires | 103 | 13.04 |

*Note*: Designed for this research

A total of 103 respondents represent the sample size of this study, which provided an effective response rate of approximately 13% that covers a broad range of medium and Large Malaysian manufacturing sector. This response rate is considered sufficient considering the suggestion of Hair *et al*., (2010) and Barlet *et al*., (2001) that a sample size should be ten times larger than the numbers of variables. Given that the numbers of variables in this study is nine, a sample size of 90 is adequate for the analysis. Also, the posthoc analyss conducted in this study using $R^2$ value of 0.25 to achieve a statistical power of 80% at 5% significance level requires a sample size of 98 respondents. Thus, a sample size of 103 is regarded as adequate for this study (Cohen, 1992). In addition, the data analysis tools employed in this study (PLS-SEM) has the capability of running responses as low as 30 (Chin, 1998).

This response rate of 13% in postal survey is a common response rate within the context of research in Malaysian manufacturing companies (Wong *et al.*, 2011; Jusoh *et al.*, 2008). A similar response rate of 12.6% was obtained by Wong *et al.*, (2011) and 11.5% was obtained by Ahmed and 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.

The data collection covered an approximately period of six months (i.e. From April, 2013 to September, 2013). Statistical package for social science (SPSS) version 20 was used for the preliminary analysis, such as the data screening, test of non-response bias, common method variance analysis and test for multicollinearity. The data were later imported into SmartPLS 2.0 M3 (Ringle *et al.*, 2005) for the reliability, validity, measurement model and the structural model analysis (including the moderation analysis) of the model.

Having confirmed that, the valid returned questionnaires were keyed into SPSS, this study went further to check for the non-response bias and the result is presented in the following section.

### 5.1.2 Test for Non-response Bias

Berg (2002) refers to non-response bias as a mistake a researcher expects to make during the estimation of sample characteristics as a result of under-estimation of some certain types of respondents due to non-response. Non-response bias occurs in different forms (such as respondent's personality, motivation and behaviour) and varying degree with the tendency of affecting results (Malhotra, *et al.*, 2006). Literature provides an explanation on non-response bias that "there is no minimum response rate below which a survey is biased and conversely, no response rate above which a survey is never biased" (Singer, 2006, p. 641). Pearl and Fairely (1985); Sheikh (1981) assert that non-response bias must be investigated irrespective of its size. Hence, there is a need to conduct non-response bias in this study.

Having expressed that non-response bias is rarely avoidable in researches, as such, this study conducted an independent t-test on the non-response bias by dividing the respondents into two independent groups based on the time they responded to survey questionnaires in relation to all of the study variables (SEMP, stakeholder pressure, top management commitment, public concern, environmental regulation, perceived benefits, financial performance, operational performance and environmental performance). This study compared the responses of those who responded early before July, 2013 with the responses of those who responded between July and September 2013. It has been proven in previous researches that non-respondents are similar to the later respondents in research (Miler & Smith, 1983). Therefore, this research, in effect, regards the late respondents (those who responded between July and September 2013) as the representative of the respondents that were influenced by the follow-up made by the researcher (Malhotra *et al.,* 2004). Table 5.2 below presents the description of the statistics for the collection of responses in this study.

Table 5.2

*Descriptive statistics for Early and late respondents*

| | Group | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| **SP** | Early response before July, 2013 | 50 | 4.3632 | .60548 | .08563 |
| | Late response after July, 2013 | 53 | 4.3358 | .58468 | .08031 |
| **SEMP** | Early response before July, 2013 | 50 | 4.4627 | .62599 | .08853 |
| | Late response after July, 2013 | 53 | 4.2870 | .52436 | .07203 |
| **TMC** | Early response before July, 2013 | 50 | 4.8197 | .65194 | .09220 |
| | Late response after July, 2013 | 53 | 4.9046 | .57334 | .07875 |
| **PC** | Early response before July, 2013 | 50 | 4.7440 | .78355 | .11081 |
| | Late response after July, 2013 | 53 | 4.5736 | .74940 | .10294 |
| **ER** | Early response before July, 2013 | 50 | 4.7297 | .60811 | .08600 |
| | Late response after July, 2013 | 53 | 4.7679 | .53200 | .07308 |
| **PB** | Early response before July, 2013 | 50 | 4.7959 | .66747 | .09439 |
| | Late response after July, 2013 | 53 | 4.7389 | .46226 | .06350 |
| **FP** | Early response before July, 2013 | 50 | 4.2089 | .71309 | .10085 |
| | Late response after July, 2013 | 53 | 3.9778 | .79806 | .10962 |
| **OP** | Early response before July, 2013 | 50 | 4.5717 | .56444 | .07982 |
| | Late response after July, 2013 | 53 | 4.5162 | .70903 | .09739 |
| **EP** | Early response before July, 2013 | 50 | 5.8741 | .72678 | .10278 |
| | Late response after July, 2013 | 53 | 5.8855 | .75125 | .10319 |

The result of the independent sample t-test for equality of mean indicates an equal variance assumed in the group mean and standard deviation for the early. As indicated in Table 5.3 below, the independent t-test conducted to compare the early respondents and the late respondent shows that there is no significant difference between the early respondents and the late respondents based on the items in stakeholder pressure ($t = 0.234$, $P < 0.815$); SEMP ($t = 1.547$, $p < 0.125$); top management commitment ($t = 0.703$, $p < 0.484$); public concern ($t = 1.128$, $p < 0.262$); environmental regulation ($t = 0.340$, $p < 0.734$); perceived benefits ($t = 0.502$, $p < 0.617$); financial performance ($t = 1.547$, $p < 0.125$); operational performance ($t = 0.440$, $p < .661$); and environmental performance ($t = -0.079$, $p < 0.938$) respectively. Thus, it is indicated in this result that the statistical differences among the items are quite small and have no significant effect on the overall result.

Table 5.3
*Independent Sample T-Test for Equality of means*

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **F** | **Sig.** | **T** | **df** | **Sig. (2-tailed)** | **Mean Difference** | **Std. Error Difference** | **95% Confidence Interval of the Difference** | |
| | | | | | | | | | **Lower** | **Upper** |
| **SP** | **EVA** | 0.265 | 0.608 | 0.234 | 101 | 0.815 | 0.02748 | 0.11728 | -0.20517 | 0.26013 |
| | **EVNA** | | | 0.234 | 100.12 | 0.815 | 0.02748 | 0.1174 | -0.20543 | 0.26039 |
| **SEMP** | **EVA** | 3.129 | 0.080 | 1.547 | 101 | 0.125 | 0.17568 | 0.11354 | -0.04955 | 0.40091 |
| | **EVNA** | | | 1.539 | 95.79 | 0.127 | 0.17568 | 0.11413 | -0.05086 | 0.40223 |
| **TMC** | **EVA** | 1.612 | 0.207 | 0.703 | 101 | 0.484 | -0.08495 | 0.1208 | -0.32458 | 0.15469 |
| | **EVNA** | | | 0.701 | 97.619 | 0.485 | -0.08495 | 0.12126 | -0.32559 | 0.15569 |
| **PC** | **EVA** | 0.804 | 0.372 | 1.128 | 101 | 0.262 | 0.17042 | 0.15105 | -0.12922 | 0.47005 |
| | **EVNA** | | | 1.127 | 99.933 | 0.263 | 0.17042 | 0.15124 | -0.12965 | 0.47048 |
| **ER** | **EVA** | 0.310 | 0.579 | -0.340 | 101 | 0.734 | -0.03825 | 0.11241 | -0.26125 | 0.18475 |
| | **EVNA** | | | -0.339 | 97.438 | 0.735 | -0.03825 | 0.11285 | -0.26222 | 0.18572 |
| **PB** | **EVA** | 5.939 | 0.017 | 0.507 | 101 | 0.613 | 0.05706 | 0.11259 | -0.16629 | 0.28041 |
| | **EVNA** | | | 0.502 | 86.657 | 0.617 | 0.05706 | 0.11376 | -0.16907 | 0.28319 |
| **FP** | **EVA** | 0.365 | 0.547 | 1.547 | 101 | 0.125 | 0.23112 | 0.14945 | -0.06534 | 0.52758 |
| | **EVNA** | | | 1.552 | 100.711 | 0.124 | 0.23112 | 0.14895 | -0.06438 | 0.52661 |
| **OP** | **EVA** | 4.692 | 0.033 | 0.437 | 101 | 0.663 | 0.05544 | 0.12676 | -0.19602 | 0.30689 |
| | **EVNA** | | | 0.44 | 98.269 | 0.661 | 0.05544 | 0.12593 | -0.19445 | 0.30533 |
| **EP** | **EVA** | 0.366 | 0.547 | -0.079 | 101 | 0.938 | -0.01145 | 0.14579 | -0.30065 | 0.27776 |
| | **EVNA** | | | -0.079 | 100.933 | 0.938 | -0.01145 | 0.14565 | -0.30037 | 0.27748 |

Note: No issue of non-response bias is detected. ***EVA*** *– Equal Variance Assumed;* ***EVNA*** *– Equal Variance Not Assumed*

### 5.1.3 Data Coding

Upon the confirmation that non-response bias is not a threat in this study, data coding was embarked upon by the author.

According to Churchill (1999), data coding can be mainly categorized in two: the first asserts that the items should conform to the constructs in a study, indicating that each construct should be assigned to a different section that asks questions about it while the second categorization provides that each item in a construct should be given a code number for easy identification and analysis. As such, this study followed the categorization provided by Churchill (1999) and arranged the questions in-line with the construct. Hence, the constructs are coded as shown in Table 5.4 below

Table 5.4

*Variable Coding*

| **Variables** | **Code** |
|---|---|
| Financial Performance | **FP** |
| Operational Performance | **OP** |
| Environmental Performance | **EP** |
| Sustainable Environmental Manufacturing Practice | **SEMP** |
| Top Management Commitment | **TMC** |
| Stakeholder Pressure | **SP** |
| Public Concern | **PC** |
| Perceived Benefit | **PB** |
| Environmental Regulation | **ER** |

***Note:*** All variables were coded as shown in this table

## 5.2 Preliminary Analysis

The importance of data screening in quantitative research cannot be underestimated as it provides an avenue for the achievement of significant result. The quality of a statistical result is a dependent on the quality of data screening conducted (Hair *et al.,* 2010). The discussion of the preliminary analysis conducted in this study using SPSS version 20 is presented in this section. These analyses include screening of data for the detection of missing data and detection of outliers. As such, this study began with the screening of the data collected for the detection of missing data.

### 5.2.1 Missing Data

Missing data poses serious issues in every aspect of research. Its impact varies on researches with respect to its occurrence and magnitude. For example, a missing data of 1% are considered as not posing any threat, below 5% is regarded as bearable and manageable while a missing data of about 15% poses a great threat and requires a sophisticated technique to resolve (Acuna & Rodrigues, 2004). Two different methods are available for treating missing data, these are pre-replacing method and the embedded method (Magnani, 2004).

Missing data are treated at the initial stage with pre-replacing method while the embedded method is employed later at the data mining stage. However, no method is regarded as the best in treating missing data, but a suitable method can be used based on the nature of data analysis methods to be employed and the related cost and time constraints available. Concerning this study, the missing data are bearable and it was therefore treated by replacement using the mean value of the k nearest neighbours. This method was employed because it is unique and able to replace data in relation to both its quantitative and the qualitative attributes of the missing data (Lin *et al.,* 2004).

### 5.2.2 Detection and Treatment of Outliers

Upon the replacement of the missing values, this study further went ahead to detect and treat outliers. Outliers represents extreme responses to a particular observation, it is undesirable because it symbolizes that an observation indicates an unusual permutation of two or more variables (Bryne, 2010; Hu *et al.,* 1990). The detection of outliers can be achieved via several statistical techniques; modification of Akaike information estimation (Ueda, 2009), using quartile or median value (Liu *et al.,* 2004), and Mahalanobi's distance (Pallant, 2011, Gerit *et al*., 2010).

This research used the Mahalanobi's distance because of its capability to detect the distance of a particular case from the centroid of the remaining cases (Pallant, 2011). In-line with the suggestion of Hair *et al*., (2010), this research created a response identification number in order to use the Chi-square statistical table to examine the empirical optimal values. The researcher ran a simple regression by using the response identification number as the dependent variable and the other items (excluding demographic variables) as the independent variables and then compares the output of the new Mahalanobi's distance with the chi-square statistical table. This study found that four among the total of 103 cases representing 3.9% are outliers because they possess new Mahalanobi's output greater than the chi-square. However, this research concurs with the argument of Iglewicz and Hoaglin (1993) which recommended that the outliers should be retained as it does not have the tendency of distorting the result. Also, SmartPLS has the ability to produce good results even in the presence of outliers (Hair *et al.*, 2013).

## 5.3 Fundamental Assumptions of Statistics

Various statistical assumptions such as normality, linearity, common method bias and homoscedasticity are usually observed in statistical analysis. However, PLS-SEM is a non-parametric statistical method that does not really require data to be normally distributed (Hair *et al.*, 2011; Henseler *et al.*, 2009). As a result, this research only tests for the common method bias and linearity assumptions.

### 5.3.1 Common Method Bias

Common method bias has often been regarded by researchers as a potential source of concern in behavioural studies. It is the variance that is attributable to the measurement procedure instead of the actual concept of the interest of the researcher (Podsakoff, Mackenzie, Lee & Podsakoff, 2003). Literatures have shown an increasing concern on how to reduce or eliminate method biases as they are one of the sources of measurement error which pose a threat to the validity of the conclusion on relationships between the constructs (Podsakoff *et al*., 2003; Meade *et al.*, 2007).

A self-reported data from the respondents in manufacturing industries in Malaysia is used in this study, thereby creating a potential for the existence of common method variance. The measure of the predictors (antecedents/drivers and SEMP), and the criterion variable (firm performance) in this study were obtained from a single source and thus, may create a possibility for the existence of common method bias (Meade *et al*., 2007). In order to control the issue of common method in this study, some procedural and statistical control has been considered in this study as suggested by Podsakoff *et al.*, (2003). Some of these procedural approaches include the protection of the respondents' anonymity, reversed worded questions, elimination of ambiguity and avoidance of double barreled questions.

Statistically, Harman's single factor test has been one of the most widely used statistical techniques in addressing the issues of common method variance. In this technique, all the variables are simultaneously loaded onto the exploratory factor analysis and the un-rotated factor solution was examined to detect the factors that are necessary to provide explanation to the variables (Aulakh & Gencturk, 2000; Podsakoff *et a*l., 2003). It is assumed in this technique that, if a single factor emerged from the factor analysis or the covariance among the measures is explained by one general factor, it means there is an indication of a substantial amount of common method variance (Podsakoff *et al*., 2003). The un-rotated exploratory factor analysis in this study indicates 19 components extracted. This indicates that there is no general factor in the un-rotated factor structure. Hence, common method bias is not a problem in this study.

### 5.3.2 Test of Linearity

The relationship between the independent variables and the dependent variable in a research is expected to be linear for Type I and Type II error to be avoided. To reduce the existence of the non-linear relationship between the independent and the dependent variables, researchers should use items that have been used by previous researchers or in an established theory and which the reliability and the validity have been ascertained (Nunnally & Bernstein, 1994). Concerning this study, the issue of non-linearity has been taken care of, as items used in both the independent and the dependent variables were adapted from previous studies as discussed in chapter four. Nevertheless, this study assessed the linearity by checking if there is multicollinearity among the independent variables.

Multicolinearity indicates a high linear correlation among the independent variables (Hair *et al.,* 2010). The presence of multicolinearity does not indicate a good regression model. It complicates the interpretation of any relationship due to its difficulties in ascertaining the effects of a single variable on the other (Nawanir, Teong & Othman, 2013). High correlation ($r = 0.9$ and above) among the independent variables is an indication of multicollinearity (Pallant, 2011). Multicolinearity is assessed through the tolerance value and variance inflation factor (VIF) in a regression analysis. The tolerance value indicates how much of the variability of the independent values is not explained by the other independent variables in the model while VIF is an inverse of the tolerance value. A tolerance value of 0.2 or below and VIF value of 5 or higher indicates the presence of multicolinearity (Hair, Ringle & Sarstedt, 2011).

This study tested for multicolinearity among the independent variables (top management commitment, public concern, stakeholder pressure and SEMP). As presented in Table 5.5 below, the tolerance values for PC (public concern) is 0.657 and VIF is 1.521, SP (stakeholder pressure) has a tolerance value of .730 and VIF value of 1.370, TMC has 0.497 has its tolerance value and VIF value of 2.012, while SEMP has a tolerance value of 0.680 and VIF value of 1.470. The result as indicated in Table 5.5 indicates that all the tolerance values are higher than 0.2 and the VIF values are below 5 indicating that multicolinearity is not a threat in this study. Figure 5.1 and 5.2 diagrammatically present the multicollinearity diagnostics.

Table 5.5

*Test of Multicollinearity*

| **Model** | **Colinearity Statistics** | |
|---|---|---|
| | **Tolerance** | **VIF** |
| PC | .657 | 1.521 |
| SP | .730 | 1.370 |
| TMC | .497 | 2.012 |
| SEMP | .680 | 1.470 |

*Note: Tolerance > 0.20 and VIF < 5*

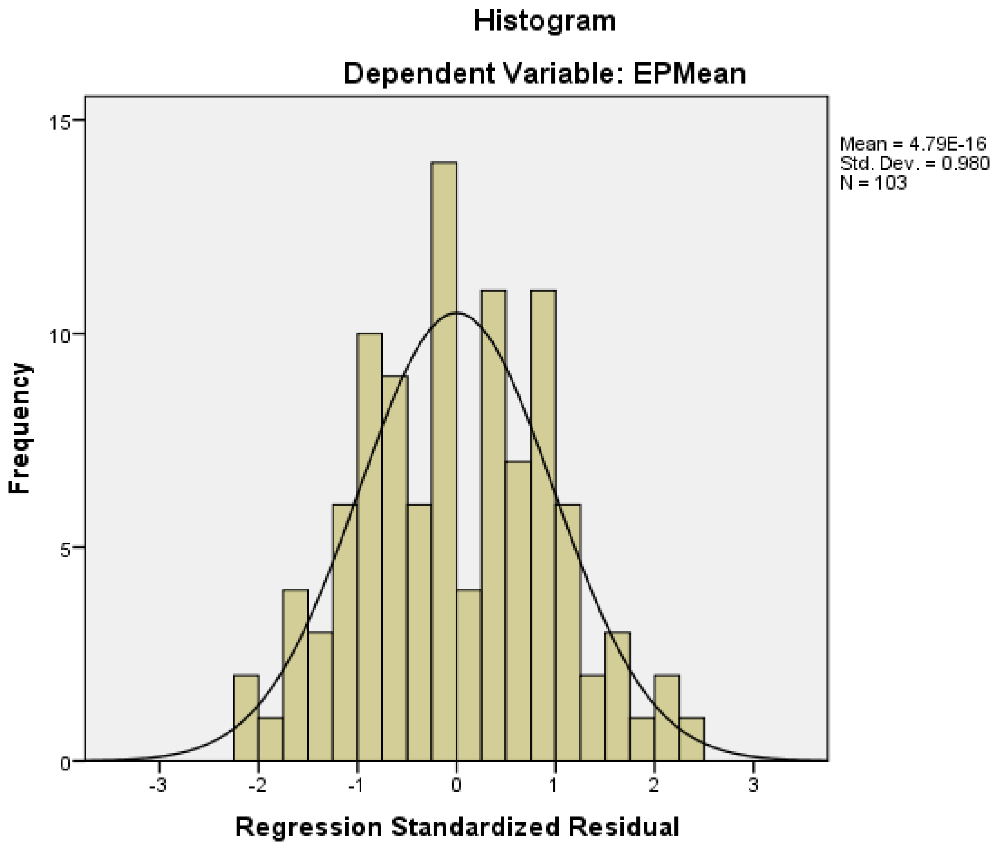


Figure 5.1

*Histogram Showing Multicollinearity Diagnostics*

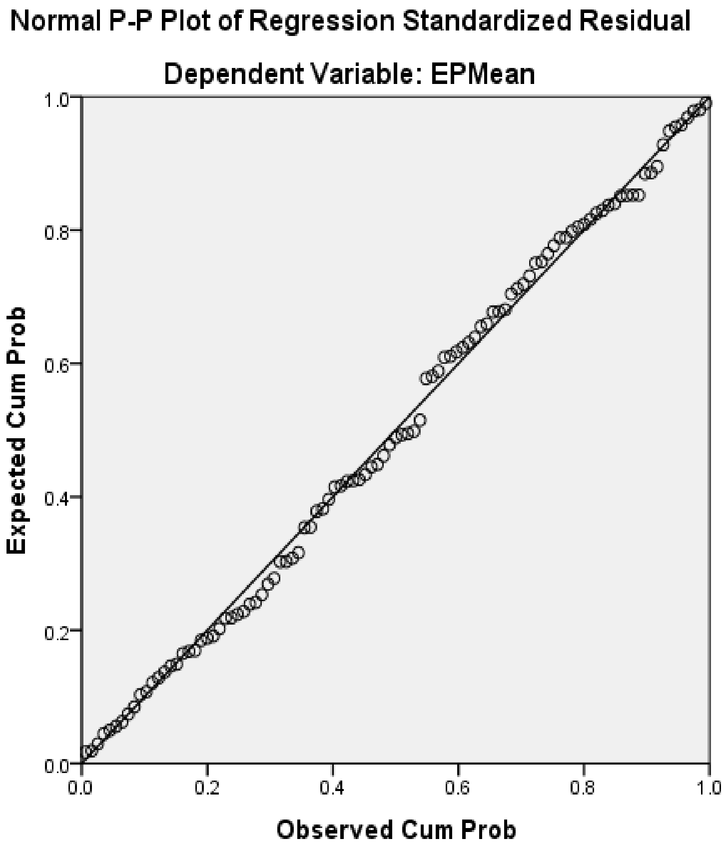


Figure 5.2
*PP plots for the Multicollinearity Diagnostics*

## 5.4 Characteristics of the Sample of Study

This section presents the description of the sample of the study to enhance an understanding of the background information of the respondents and companies that participated in this current study. The characteristics of the respondents examined in this study include the position of the respondents, duration of employment in current position and the duration of employment in current company. The company profile investigated in this study includes: company's industrial category, quality system's certification, types of ownership, size of the company (number of employees of the company). The demographic characteristics of the respondents and their companies were measured on nominal and ordinal scales. Table 5.6 and Table 5.7 present the result of the characteristics of this study sample.

Majority of the respondents are in the position of environmental, health & safety manager/executive (50.5%), followed by other position representing 19.4% of the respondents. Those respondents that fall in the category of production/ manufacturing manager/executive represent 17.5%, while operation manager/executive position has the least representation (12.6%). The positions in the other category range between technical executives, quality control executive, material management, manager, general manager, corporate social responsibility manager, quality assurance manager, ISO manager and facility manager. The indication of this result is that the respondents have required knowledge to provide answers relating to sustainable environmental manufacturing practices in their companies.

Also, inquiry into the working experience of the respondents in their current position revealed that the majority of the respondents have between 1-5 years experience of their current position which indicate an adequate working experience to answer questions related to environmental manufacturing practices in their companies. 24.3% of the respondents have 6-10 year working experience of their current position, 19.4% have more than 10 years working experience while 8.7% possess less than 1 year working experience of their current position. This indicates that quite a large number of the respondents have at least 1-5 years working experience of their positions; thus, they are regarded as well versed, knowledgeable and suitable for this study.

Similar to the above, Table 5.6 presents that 45% of the respondents have between 1-5 years total working experiences with their company, 29.1% have more than 10 years experience, 18.4% are between 6-10 years working experience while 6.8% have less than 1 year working experience in their company. As such, it is noted that a large proportion of the respondents have an acceptable year of experience of environmental practices in their various companies. Table 5.6 presents the demographic characteristics of the study respondents.

Table 5.6
*Demographic characteristics of the respondents of the study*

| S/N. | Variable | Frequency | Percent (%) |
|---|---|---|---|
| **1.** | **Position** | | |
| | Operation | 13 | 12.6 |
| | Production/manufacturing | 18 | 17.5 |
| | Environmental/ Health and safety | 52 | 50.5 |
| | Others | 20 | 19.4 |
| **2** | **Working experience (based on current position)** | | |
| | Less than 1 year | 9 | 8.7 |
| | 1-5 years | 49 | 47.6 |
| | 6-10 years | 25 | 24.3 |
| | More than 10 years | 20 | 19.4 |
| **3** | **Work Experience (based on current company)** | | |
| | Less than 1 year | 7 | 6.8 |
| | 1-5 years | 47 | 45.6 |
| | 6-10 years | 19 | 18.4 |
| | More than 10 years | 30 | 29.1 |

Characteristics of the companies investigated in this study are presented in Table 5.7. It reveals that the majority of the respondents are from the electrical, electronic and computing & machinery parts (30.1%). This was followed by chemicals and allied products category with 16.5%, next is the company that falls within the other category with 14.6%. Rubber and plastic industry has 12.6 %, followed by companies from food and beverage industry having 10.7%. Basic metal & allied components category and transport equipment sector have 5.8% and 4.9 % respectively. Paper and allied products has 2.9%, while textile, wearing apparels and dying of fur category represents the minority percentage (1.9%). The companies that fall in the category of others are within the range of software manufacturing, fabrication of overhead traveling crane, heat exchanger, manufacturer of cutting tools, metal stamping and assembly, pharmaceutical, packaging and concrete products. The indication of this result is that the respondents' companies are a good representation of their industrial sectors in Malaysia. This is shown in the percentage of electrical, electronics and computing machinery having the highest representation and revealing that Malaysia is well known for its popularity in electrical and electronics production. The result also revealed that majority of the companies is certified in ISO 14001 (55.3%) indicating the awareness of environmental manufacturing practices in the companies.

As shown in Table 5.7 below, respondents from multinational companies dominated the study with 45.6%, followed by the private enterprise which has 35%. The foreign invested enterprises is the next having 10.7% of the sample while the joint venture and state owned enterprise have 4.9% and 3.9% respectively.

In term of the size of the companies which is represented by the number of full-time employees of the companies. It revealed that 46.6% of the companies have above 251 full-time employees which represents that the majority of the respondents are large manufacturing companies (It should be noted that a lot of manufacturing companies in Malaysia employ low class workers from the neighbouring countries such because of their low wage demands,which results into companies having more than 250 full-time employees (Al-Khalifa & Aspinwall, 2000) . This is followed by 28.2%, which represents companies with number full-time employees ranging between 151-250, while 25.2% of the respondent companies have between 51 and 150 full-time employees. This indicates that the respondent companies are large enough, knowledgeable and feasible for this study.

Table 5.7
*Demographic characteristics of company*

| **S/N.** | **Variable** | **Frequency** | **Percent (%)** |
|---|---|---|---|
| 1 | **Category of industry** | | |
| | Food products and beverages | 11 | 10.7 |
| | Textile, wearing apparel | 2 | 1.9 |
| | Paper and allied products | 3 | 2.9 |
| | Chemical and allied products | 17 | 16.5 |
| | Rubber and plastics | 13 | 12.6 |
| | Basic metallic parts | 6 | 5.8 |
| | Electrical, electronic & computing | 31 | 30.1 |
| | Transport equipment | 5 | 4.9 |
| | Others | 15 | 14.6 |
| ***2*** | **Certification** | | |
| | ISO 9001 | 19 | 18.4 |
| | ISO/TS 16949 | 4 | 3.9 |
| | QS 9000 | 2 | 1.9 |
| | ISO 14001 | 57 | 55.3 |
| | Other | 21 | 20.4 |
| **3** | **Ownership** | | |
| | Stated Owned Enterprise | 4 | 3.9 |
| | Joint Venture | 5 | 4.9 |
| | Private Enterprise | 36 | 35 |
| | Multinational Company | 47 | 45.6 |

| | | | |
|---|---|---|---|
| | Foreign | 11 | 10.7 |
| **4** | **Company size (based on number of employees)** | | |
| | Small (51 – 150) | 26 | 25.2 |
| | Medium (151 – 250) | 29 | 28.2 |
| | Large (more than 251) | 48 | 46.6 |

As mentioned earlier in chapter 4 of this study, random sampling technique was used in this study to ensure that the homogeneity within each stratum and the heterogeneity among the study population is achieved. This has been proven by the characteristic distribution of the respondents.

## 5.5 Descriptive Analysis of the Constructs

The statistical description of the constructs in this study was analyzed descriptively, by determining the statistical values of mean, standard deviation, minimum and maximum values for all the constructs. The measurement of all the constructs was done using a six-point Likert scale.

The descriptive analysis result in this study for the variable stakeholder pressure reveal a mean value of 4.35 with standard deviation of 0.592 indicating that the respondents slightly agreed that there is stakeholder pressure in their company. SEMP has a mean score of 4.37 and standard deviation of 0.580 which indicates a slight practice of sustainable environmental manufacturing among the sample population. The mean score of 4.86 and standard deviation value of 0.611 reveal that the top management of the sample population is committed to the implementation of SEMP among the sample population. Public concern has a mean value of 4.66 and a standard deviation score of 0.767 indicating that the public are concern about the implementation of SEMP among the sample population. Environmental regulation has a mean score of 4.75 and standard deviation value of 0.568 indicating the implementation of environmental regulation among the sample population. The mean score of 4.77 and standard deviation value of 0.569 for perceived benefits indicates that the respondents agreed to perceive SEMP as benefit. The descriptive analysis of financial performance, with mean value of 4.09 and standard deviation of 0.763 shows that the study sample slightly agrees to financial performance as the outcome of SEMP. The mean value of 4.54 and standard deviation of 0.640 indicate that the study sample agree to operational performance as an outcome of SEMP while a mean value of 4.90 and standard deviation of 0.608 shows that the respondents strongly agree to environmental practices has an outcome of SEMP. Table 5.8 below presents the results of the descriptive statistical analysis of this study.

Table 5.8
*Descriptive Analysis of Constructs*

| **Construct** | **N** | **Mean** | **Std. Dev** |
|---|---|---|---|
| Stakeholder pressure | 103 | 4.35 | .592 |
| SEMP | 103 | 4.37 | .580 |
| Top management commitment | 103 | 4.86 | .611 |
| Public concern | 103 | 4.66 | .767 |
| Environmental regulation | 103 | 4.75 | .568 |
| Perceived benefits | 103 | 4.77 | .569 |
| Financial performance | 103 | 4.09 | .763 |
| Operational performance | 103 | 4.54 | .640 |
| Environmental performance | 103 | 4.90 | .608 |

## 5.6 Confirmatory Factor Analysis (CFA)

This section of the study presents the confirmatory factor analysis result by using the principal component analysis (PCA) of PLS-SEM. The measurement items used in the conduct of this study were adapted from a previous related study; hence, the need for exploratory data analysis is not required (Hair *et al.*, 2010). The initial 77 items from the total of the 9 constructs used in this study were reduced to 52 items after the confirmatory factor analysis through which items with low loading were deleted. Table 5.9 presents the summary of the items retained after the confirmatory factor analysis.

Table 5.9

*Confirmatory factor analysis results*

| **Constructs** | **No. of Items used** | **No of Items Deleted** | **Items Retained** | **No. of items retained** |
|---|---|---|---|---|
| **Stakeholder pressure** | 6 | 3 | SP1 | 3 |
| | | | SP2 | |
| | | | SP3 | |
| **Top Mgt. Commitment** | 8 | - | TMC1 | 8 |
| | | | TMC2 | |
| | | | TMC3 | |
| | | | TMC4 | |
| | | | TMC5 | |
| | | | TMC6 | |
| | | | TMC7 | |
| | | | TMC8 | |
| **Public Concern** | 5 | - | PC1 | 5 |
| | | | PC2 | |
| | | | PC3 | |
| | | | PC4 | |
| | | | PC5 | |
| **Perceived Benefits** | 12 | 5 | PB3 | 7 |
| | | | PB4 | |
| | | | PB7 | |
| | | | PB10 | |
| | | | PB11 | |
| | | | PB12 | |
| | | | PB13 | |
| **Environmental Regulation** | 9 | 5 | ER6 | 4 |
| | | | ER7 | |

| Constructs | No. of Items used | No of Items Deleted | Items Retained | No. of items retained |
|---|---|---|---|---|
| | | | ER8 | |
| | | | ER9 | |
| **SEMP** | 20 | 12 | SEMP4 | 8 |
| | | | SEMP5 | |
| | | | SEMP6 | |
| | | | SEMP7 | |
| | | | SEMP11 | |
| | | | SEMP12 | |
| | | | SEMP13 | |
| | | | SEMP16 | |
| **Firm Performance** | 5 | - | FP1 | 5 |
| | | | FP2 | |
| | | | FP3 | |
| | | | FP4 | |
| | | | FP5 | |
| **Operating Performance** | 6 | - | OP1 | 6 |
| | | | OP2 | |
| | | | OP3 | |
| | | | OP4 | |
| | | | OP5 | |
| | | | OP6 | |
| **Environmental Performance** | 5 | - | EP1 | 5 |
| | | | EP2 | |
| | | | EP3 | |
| | | | EP4 | |
| | | | EP5 | |

Having presented the result of the confirmatory factor analysis, the next section presents the discussion of the evaluation of the model of this study.

## 5.7 Model Evaluation

This section presents the evaluation of both the measurement and the structural model of the study. The measurement model is presented in section 5.7.1 below.

### 5.7.1 The Measurement Model using PLS-SEM

This study employed the use of partial least squares - structural equation modelling (PLS-SEM) by using the smartPLS M3 software application to estimate the measurement model of this study (Ringle *et al*., 2005). The first step in using the PLS analysis technique is the assessment of the measurement model in the PLS analysis, through the assessment of the validity and reliability measures (Ramayah, Lee & In, 2011).

The reliability measure determines the consistency of the measurement instrument in measuring the concept of the study under investigation, while validity measures how a particular concept of a study is truly represented by the measurement instrument designed for the study (Sekaran & Bougie, 2009). The individual item reliability, construct internal consistency and construct validity are considered in assessing the outer model in PLS. An approach was developed by Fornell and Larcker (1981) for PLS to evaluate the reliability, convergent validity and the discriminant validity of the instrument and this approach was used in this study for the analysis.

The predictive power of a particular model or construct and the determination of the standard path coefficient of each relationship between exogenous and endogenous variable in PLS analysis is assessed using the R squared ($R^2$) values of the endogenous variables. The interpretation of the values of $R^2$ in PLS is similar to those obtained from multiple regression analysis. According to Chin

(1998) and Barclay *et al*., (1995), the value of the $R^2$ indicates the amount of variance in the construct explained by the model.

PLS is a nonparametric statistical method for testing significant relationship (Hair *et al*., 2013). Even though, the distributional normality assumption of observation is not usually required in the procedures of estimating parameters in PLS (Chin, 2010), the distribution of the observation should not be too far from normal (Hair *et al*., 2013). Two techniques are used to assess statistical significance: the bootstrapping and jacknife techniques. The jackknife technique is a briefer algorithm and test hypothesis by assessing the statistical significance of the path coefficients. It is used to reduce the time of execution and save resources for a large data set (Chin, 2010). However, Mooney (1996) affirm that the bootstrapping technique provides a better calculation of measures. As such, this study employed bootstrapping technique in testing for the significance of the path models as it is the only technique available to examine the significance of path coefficients in PLS.

PLS relies on a nonparametric bootstrap procedure to evaluate the coefficients for their significance (Efron & Tibshirani, 1986) and test for the standard error (Chin, 1998). In bootstrapping technique, a large number of subsamples are drawn with replacement from the original sample (Efron & Tibshirani, 1986). It is a superior resampling method as it returns to the population each time an observation is drawn from the sampling population (Good, 2000). The numbers of bootstrap retrials in PLS is usually determined by the user, as no standardized procedure is specified. This may affect the standard error, t-values, confidence intervals and the conclusion of the hypotheses in case the researchers chose an insufficient number of retrials. However, a guideline provided by Hair *et al.*, (2013) suggests that the number of bootstrap sample be high, but must at least not be lesser than the number of the valid samples in the data set. As a result, a retrial time of 5,000 was used in this study as recommended by Hair *et al.*, (2013)

### 5.7.2 Constructs' Validity

Construct validity examines how well the results obtained from the use of a measure fit the theories upon which the test is designed (Sekaran & Bougie, 2009). As such, it provides answers whether the instrument used in the test tap the actual concept theorized in the study. In order to achieve validity analysis, two kinds of validity tests were performed on the measurement scales namely: convergent validity and discriminant validity (Sekaran & Bougie, 2009; Tore, 2005).

### 5.7.3 Convergent Validity

Convergent validity is the extent to which a measure correlates positively with an alternative measure of the same construct. In examining the convergent validity of a measure in PLS, the average variance extracted (AVE), composite reliability and item loadings are assessed (Hair *et a*l., 2013). Convergent validity is established if all the measures purported to indicate a particular construct are indeed related.

#### 5.7.3.1 Average Variance Extracted

The convergent validity of this study was evaluated by assessing the measure of the average variance extracted (AVE) as depicted in Table 5.10 below. AVE is the average variance shared between a construct and its measures. It is defined as the grand mean value of the squared loadings of the indicators associated with a particular construct (the sum of the squared loadings divided by the numbers of indicators) (Hair *et al*., 2013) The average variance shared between a construct and its measures should be greater than that shared with the other constructs in the same model (Couchman & Fulop, 2006).

In PLS, the calculation of AVE is inbuilt into the analysis software. AVE value equal or higher than 0.50 indicates that on the average, the construct explained more than half of the variance of its indicators. Conversely, an AVE of lesser value than 0.50 indicates that more error remains in the items than the average variance explained by the constructs. As such, the rule of thumb is that an AVE value greater or equal to 0.50 is acceptable (Hair *et al*., 2013; Barclays *et al.*, 1995). The result of AVE in this study is presented in Table 5.10 below. It is shown that the average variances extracted in this study are all above 0.50. This indicated that the establishment of convergent validity has been achieved in this study.

#### 5.7.3.2 Composite Reliability

Reliability is a quality criterion of a construct; it requires a high level of correlation among the indicators of a particular construct (Bagozzi & Baumgartner, 1994; Kraft, 2005). There are two common measures of construct's reliability: Cronbach alpha and composite reliability. Unlike Cronbach alpha, which is usually used by non-PLS model, composite reliability does not assume an equivalency among the measure with the assumption that indicators are equally weighted (Chin *et al.*, 1992). As a result, Cronbach alpha tends to be a lower bound of reliability. Due to the above reason, this study used composite reliability. Table 5.10 presents the result of the AVE and composite reliability of this study.

Table 5.10

*The Convergence and Reliability Analysis*

| Constructs | Items | Loadings | AVE | CR |
|---|---|---|---|---|
| **Environmental Performance** | EP1 | 0.783 | 0.668 | 0.909 |
| | EP2 | 0.862 | | |
| | EP3 | 0.821 | | |
| | EP4 | 0.842 | | |
| | EP5 | 0.775 | | |
| **Environmental Regulation** | ER6 | 0.804 | 0.602 | 0.856 |
| | ER7 | 0.873 | | |
| | ER8 | 0.772 | | |
| | ER9 | 0.633 | | |
| **Financial Performance** | FP1 | 0.862 | 0.708 | 0.924 |
| | FP2 | 0.805 | | |
| | FP3 | 0.857 | | |
| | FP4_1 | 0.804 | | |
| | FP5 | 0.878 | | |
| **Operational Performance** | OP1 | 0.788 | 0.635 | 0.913 |
| | OP2 | 0.759 | | |
| | OP3 | 0.845 | | |
| | OP4 | 0.786 | | |
| | OP5 | 0.795 | | |
| | OP6 | 0.806 | | |
| **Perceived Benefits** | PB10 | 0.729 | 0.548 | 0.906 |
| | PB11 | 0.787 | | |
| | PB12 | 0.741 | | |

| Constructs | Items | Loadings | AVE | CR |
|---|---|---|---|---|
| | PB13_1 | 0.674 | | |
| | PB3 | 0.759 | | |
| | PB4 | 0.681 | | |
| | PB7 | 0.756 | | |
| | PB9 | 0.785 | | |
| **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 | | |

***Note***: Composite reliability (CR) = Square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the error variances)}. Average variances extracted (AVE) = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}

A convergent validity is also achieved if a particular measurement scale indicator/items have a high factor loading on their associated constructs (i.e., > 0.5) and the loading of the indicators/items measuring the other constructs is/are lesser than that it intends to measure (Hair *et al.,* 2013). In this present study, all the fifty two (52) items loaded on their respective constructs and exceeded the recommended threshold value of 0.5 (Hair *et al.,* 2013). Twenty five (25) items were deleted for low loading and significant cross loading. As shown in Table 5.10 above, all the items loaded with a minimum value of 0.633 and a maximum value of 0.927 on their respective constructs.

It is further shown that all the indicators/items loaded highly on their respective construct than any other construct as shown in Table 5.10 above. As such, it is shown and concluded that all indicators/items loaded on their respective constructs are adequate for the assessment of convergent validity. In PLS analysis, the loadings and the cross loading of each indicator are assessed to determine if there is a problem and as criteria for the achievement of convergent validity. The result of the loading and cross loading of indicators is presented in Table 5.11 below.

Table 5.11

*Item Loading and Cross Loading*

| **Indicators** | **EP** | **ER** | **FP** | **OP** | **PB** | **PC** | **SEMP** | **SP** | **TMC** |
|---|---|---|---|---|---|---|---|---|---|
| **EP1** | **0.783** | 0.179 | 0.275 | 0.420 | 0.289 | 0.379 | 0.269 | 0.361 | 0.430 |
| **EP2** | **0.862** | 0.251 | 0.319 | 0.408 | 0.257 | 0.378 | 0.332 | 0.342 | 0.560 |
| **EP3** | **0.821** | 0.292 | 0.395 | 0.449 | 0.207 | 0.375 | 0.280 | 0.334 | 0.500 |
| **EP4** | **0.842** | 0.290 | 0.297 | 0.437 | 0.384 | 0.455 | 0.402 | 0.521 | 0.591 |
| **EP5** | **0.775** | 0.351 | 0.218 | 0.383 | 0.382 | 0.318 | 0.388 | 0.436 | 0.463 |
| **ER6** | 0.300 | **0.804** | 0.186 | 0.360 | 0.377 | 0.191 | 0.412 | 0.276 | 0.429 |
| **ER7** | 0.321 | **0.873** | 0.227 | 0.392 | 0.428 | 0.321 | 0.388 | 0.226 | 0.386 |
| **ER8** | 0.238 | **0.772** | 0.338 | 0.357 | 0.411 | 0.323 | 0.413 | 0.079 | 0.428 |
| **ER9** | 0.170 | **0.633** | 0.093 | 0.125 | 0.457 | 0.278 | 0.521 | 0.145 | 0.458 |

| Indicators | EP | ER | FP | OP | PB | PC | SEMP | SP | TMC |
|---|---|---|---|---|---|---|---|---|---|
| **FP1** | 0.300 | 0.216 | **0.862** | 0.552 | 0.272 | 0.075 | 0.215 | 0.159 | 0.156 |
| **FP2** | 0.357 | 0.184 | **0.805** | 0.530 | 0.174 | 0.107 | 0.235 | 0.110 | 0.276 |
| **FP3** | 0.267 | 0.291 | **0.857** | 0.593 | 0.228 | 0.188 | 0.268 | 0.144 | 0.254 |
| **FP4_1** | 0.327 | 0.243 | **0.804** | 0.532 | 0.326 | 0.284 | 0.207 | 0.175 | 0.296 |
| **FP5** | 0.288 | 0.272 | **0.878** | 0.592 | 0.397 | 0.224 | 0.264 | 0.139 | 0.279 |
| **OP1** | 0.427 | 0.404 | 0.577 | **0.788** | 0.379 | 0.267 | 0.345 | 0.278 | 0.415 |
| **OP2** | 0.292 | 0.277 | 0.523 | **0.759** | 0.403 | 0.162 | 0.196 | 0.168 | 0.230 |
| **OP3** | 0.364 | 0.274 | 0.567 | **0.845** | 0.445 | 0.210 | 0.281 | 0.282 | 0.286 |
| **OP4** | 0.507 | 0.324 | 0.555 | **0.786** | 0.395 | 0.324 | 0.223 | 0.282 | 0.402 |
| **OP5** | 0.441 | 0.434 | 0.510 | **0.795** | 0.431 | 0.318 | 0.328 | 0.185 | 0.294 |
| **OP6** | 0.406 | 0.318 | 0.465 | **0.806** | 0.474 | 0.281 | 0.329 | 0.294 | 0.366 |
| **PB10** | 0.211 | 0.429 | 0.206 | 0.281 | **0.729** | 0.411 | 0.439 | 0.326 | 0.442 |
| **PB11** | 0.376 | 0.315 | 0.239 | 0.381 | **0.787** | 0.451 | 0.375 | 0.328 | 0.410 |
| **PB12** | 0.262 | 0.432 | 0.271 | 0.384 | **0.741** | 0.467 | 0.421 | 0.285 | 0.458 |
| **PB13_1** | 0.171 | 0.328 | 0.410 | 0.550 | **0.674** | 0.313 | 0.375 | 0.068 | 0.182 |
| **PB3** | 0.373 | 0.251 | 0.265 | 0.488 | **0.759** | 0.412 | 0.277 | 0.325 | 0.290 |
| **PB4** | 0.226 | 0.423 | 0.170 | 0.261 | **0.681** | 0.353 | 0.419 | 0.213 | 0.361 |
| **PB7** | 0.361 | 0.557 | 0.212 | 0.388 | **0.756** | 0.420 | 0.463 | 0.374 | 0.443 |
| **PB9** | 0.250 | 0.405 | 0.177 | 0.224 | **0.785** | 0.433 | 0.451 | 0.212 | 0.417 |
| **PC1** | 0.378 | 0.216 | 0.218 | 0.260 | 0.470 | **0.823** | 0.374 | 0.433 | 0.492 |
| **PC2** | 0.405 | 0.318 | 0.106 | 0.252 | 0.492 | **0.826** | 0.404 | 0.431 | 0.528 |
| **PC3** | 0.275 | 0.357 | 0.141 | 0.249 | 0.418 | **0.737** | 0.331 | 0.203 | 0.360 |
| **PC4** | 0.426 | 0.292 | 0.216 | 0.332 | 0.436 | **0.858** | 0.312 | 0.273 | 0.441 |
| **PC5** | 0.429 | 0.267 | 0.229 | 0.265 | 0.422 | **0.857** | 0.329 | 0.317 | 0.495 |
| **SEMP11** | 0.319 | 0.414 | 0.284 | 0.270 | 0.484 | 0.285 | **0.725** | 0.316 | 0.442 |
| **SEMP12** | 0.351 | 0.348 | 0.323 | 0.285 | 0.474 | 0.392 | **0.767** | 0.378 | 0.516 |
| **SEMP13** | 0.289 | 0.389 | 0.224 | 0.258 | 0.422 | 0.359 | **0.761** | 0.360 | 0.457 |
| **SEMP16** | 0.346 | 0.475 | 0.264 | 0.328 | 0.389 | 0.409 | **0.707** | 0.264 | 0.476 |
| **SEMP4** | 0.304 | 0.421 | 0.153 | 0.289 | 0.342 | 0.271 | **0.809** | 0.402 | 0.456 |
| **SEMP5** | 0.255 | 0.316 | 0.118 | 0.186 | 0.264 | 0.185 | **0.705** | 0.262 | 0.364 |
| **SEMP6** | 0.291 | 0.376 | 0.049 | 0.183 | 0.382 | 0.358 | **0.733** | 0.286 | 0.378 |
| **SEMP7** | 0.312 | 0.354 | 0.175 | 0.292 | 0.351 | 0.237 | **0.710** | 0.300 | 0.305 |
| **SP1** | 0.368 | 0.221 | 0.139 | 0.202 | 0.263 | 0.330 | 0.307 | **0.781** | 0.462 |
| **SP2** | 0.451 | 0.268 | 0.123 | 0.311 | 0.367 | 0.383 | 0.424 | **0.927** | 0.481 |
| **SP3** | 0.475 | 0.122 | 0.192 | 0.282 | 0.292 | 0.356 | 0.393 | **0.878** | 0.452 |
| **TMC1** | 0.469 | 0.381 | 0.140 | 0.312 | 0.283 | 0.492 | 0.362 | 0.377 | **0.745** |
| **TMC2** | 0.474 | 0.392 | 0.233 | 0.291 | 0.250 | 0.428 | 0.400 | 0.480 | **0.807** |
| **TMC3** | 0.511 | 0.411 | 0.233 | 0.364 | 0.382 | 0.480 | 0.485 | 0.510 | **0.827** |

| Indicators | EP | ER | FP | OP | PB | PC | SEMP | SP | TMC |
|---|---|---|---|---|---|---|---|---|---|
| **TMC4** | 0.511 | 0.488 | 0.299 | 0.262 | 0.438 | 0.416 | 0.570 | 0.438 | **0.843** |
| **TMC5** | 0.638 | 0.406 | 0.327 | 0.494 | 0.452 | 0.480 | 0.497 | 0.503 | **0.868** |
| **TMC6** | 0.468 | 0.423 | 0.248 | 0.353 | 0.342 | 0.479 | 0.388 | 0.405 | **0.767** |
| **TMC7** | 0.584 | 0.450 | 0.239 | 0.343 | 0.458 | 0.484 | 0.472 | 0.402 | **0.851** |
| **TMC8** | 0.440 | 0.469 | 0.217 | 0.316 | 0.532 | 0.482 | 0.556 | 0.383 | **0.809** |

***Note:*** *The bold highlighted items represent the items that belong to the column's construct*

### 5.7.4 Discriminant Validity

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). The result of the discriminant analysis for this study is presented in Table 5.12 below.

Table 5.12
*Discriminant Validity*

| Constructs | EP | ER | FP | OP | PB | PC | SEMP | SP | TMC |
|---|---|---|---|---|---|---|---|---|---|
| **EP** | **0.817** | | | | | | | | |
| **ER** | 0.342 | **0.776** | | | | | | | |
| **FP** | 0.361 | 0.292 | **0.842** | | | | | | |
| **OP** | 0.511 | 0.428 | 0.666 | **0.797** | | | | | |
| **PB** | 0.386 | 0.519 | 0.347 | 0.530 | **0.740** | | | | |
| **PC** | 0.467 | 0.353 | 0.219 | 0.329 | 0.549 | **0.821** | | | |
| **SEMP** | 0.421 | 0.526 | 0.283 | 0.360 | 0.534 | 0.431 | **0.740** | | |
| **SP** | 0.502 | 0.234 | 0.174 | 0.312 | 0.359 | 0.413 | 0.438 | **0.864** | |
| **TMC** | 0.628 | 0.527 | 0.301 | 0.417 | 0.493 | 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.*

As depicted by Table 5.12, the result of the discriminant validity revealed that the square root of AVE for all the constructs presented in the diagonal indicate the highest value (SP – 0.864) and the lowest value (PB and SEMP – 0.740). All the values of the square root of AVE for all the constructs are greater than the off-diagonal coefficient values or the elements in the corresponding rows and/or columns. Thus, it is evidenced in this study that discriminant validity is achieved.

In summary, it is demonstrated in the results presented in Table 5.10, 5.11 and 5.12 that the measures for all the nine constructs including (stakeholder pressure (SP), public concern (PC), top management commitment (TMC), sustainable environmental manufacturing practices (SEMP), environmental regulation (ER), perceived benefits (PB), financial performance (FP), operational performance (OP) and environmental performance (EP) validly measured their respective constructs based on their parameter estimates and statistical significance (Chow & Chan, 2008). As a result of the achievement of a satisfactory measurement model with acceptable reliability and valid measure of constructs, it is hereby important to assess the structural model of this study.

Having shown in the result of the measurement model that the constructs reliability and validity of the developed model is achieved, it is hereby noteworthy to present next, the result of the structural model. However, prior to the presentation of the structural model in this study, the revised model is first presented to enhance the understanding of the proposed model which might have been modified as a result of the deletion undertaken during the confirmatory factor analysis. Though, some of the items that initially constituted the constructs of the study were deleted, but none of the constructs were dropped because at least, two items were left in each construct as measurement indicators (Hair *et al*., 2012). Figure 5.3 presents the revised model of the study.

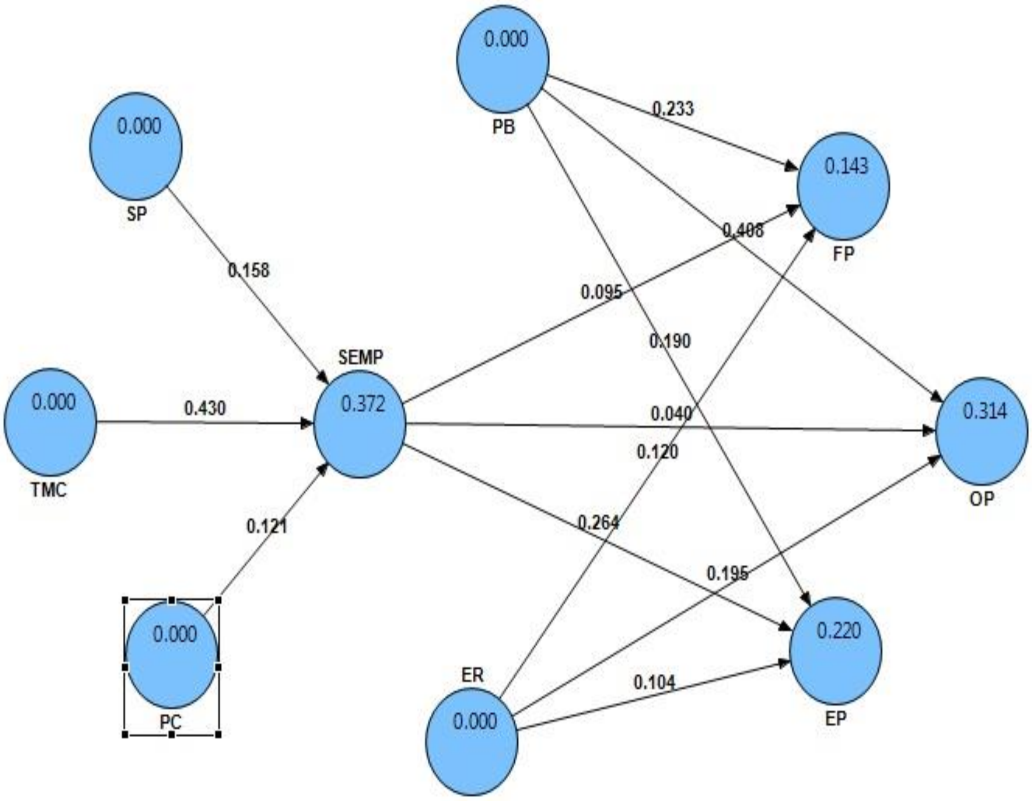


Figure 5.3
*Revised Model of the study*

### 5.7.5 Structural Model

In this section of the report, the structural model and the result of the test of hypotheses are presented. The main concern of this section tends towards the testing of the hypotheses related to both the main and the moderating effects. In achieving this, PLS path modeling multiple regression approach was used to test the main effects and the moderating effects were tested using the bootstrapping technique in PLS. The path modelling in this study was conducted using PLS bootstrapping techniques (Chin, Marcolin & Newsted, 1996), using 103 cases and 5000 bootstrapped samples in testing the hypotheses of the current study.

The 5000 bootstrapped samples was used to ensure that all the model parameter has empirical sampling distribution and standard error was obtained.

By using the same method stated above, the path coefficients were estimated using t-statistics. The significance level of the t-value was assessed by a one-tailed distribution (Chin *et al.*, 1996; Churchill, 1979; Sharma, 2000). According to Churchill (1979) and Sharma (2000), in a situation where a one-tailed statistical test is conducted, the significance level of t-value of 1% is greater than or equal to 2.326, at 5% is greater or equal to 1.645 while at 10% is greater or equal to 1.282, any t-value lesser than the stated are regarded as not significant.

## 5.8 Analysis of Direct Effects

This section presents the results of the direct effect between the antecedents of SEMP, sustainable environmental manufacturing practices (SEMP) and firm performance. This result is presented in two sections: the first section presents the relationship between the antecedent factors (TMC, SP and PC) and SEMP while the second section presents between SEMP and firm performance (financial, operational and environmental performance). The results of the standard beta values represent the relationships in this study while the choice of the significance level at $P < 0.10$ was used to test the structural model relationship (Hair *et al.*, 2010).

### 5.8.1 Testing the hypotheses between the antecedents and SEMP

***H1a****: Top management commitment (TMC) will positively influence sustainable environmental manufacturing practices (SEMP).*

***H1b**: Stakeholder pressure (SP) will positively influence sustainable environmental manufacturing practices (SEMP).*

***H1c:** Public concern (PC) will positively influence sustainable environmental manufacturing practices (SEMP).*

The hypotheses between the antecedents and SEMP as hypothesized earlier in this study are presented in this section. Table 5.13 presents the results of the standard path coefficients (β), standard error, t-value and the decision taken in this study. In the same vein, the graphical presentation of the standard path coefficients (β) and the t-value of the hypothesized relationships are presented in Figure 5.4. As indicated in this Figure 5.4 and Table 5.13, two (2) of the three stated relationship between the antecedents and SEMP constructs demonstrated an evidence of a significant positive effect. The two 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 effect.

### 5.8.2 Testing the hypotheses between SEMP and Firm Performance

***H2a**: Sustainable environmental manufacturing practices (SEMP) will positively influence the financial performance (FP) of firms.*

***H2b**: Sustainable environmental manufacturing practices (SEMP) will positively influence the operating performance (OP) of firms.*

***H2c**: Sustainable environmental manufacturing practices (SEMP) will positively influence the environmental performance (EP) of firms.*

The result of the earlier stated research hypotheses between sustainable environmental manufacturing practices (SEMP) and firm performance (financial performance (FP), operational performance (OP) and environmental performance (EP) are presented in this section. The result of this research as indicated in Table 5.13 and Figure 5.4 demonstrates that only one of the three stated hypothesized relationships shows an evidence of a significant positive relationship, SEMP and environmental performance (EP) ($\beta = 0.264$, $t = 2.336$, $P < 0.10$). While the remaining two relationships: SEMP and financial performance (FP) ($\beta = 0.95$, $t = 0.715$, $P < 0.10$); and (2) SEMP and operational performance (OP) ($\beta = 0.040$, $t = 0.346$, $P < 0.10$) do not show any evidence of a significant relationship.

Table 5.13
*Results for the direct hypotheses*

| Hypotheses | Path coefficient | Beta | Std. Error | T-Value | Decision |
|---|---|---|---|---|---|
| **H1a** | **TMC -> SEMP** | 0.430* | 0.132 | 3.255 | **Supported** |
| **H1b** | **SP -> SEMP** | 0.158* | 0.097 | 1.634 | **Supported** |
| **H1c** | **PC -> SEMP** | 0.121 | 0.143 | 0.844 | Not Supported |
| **H2a** | **SEMP -> FP** | 0.095 | 0.133 | 0.715 | Not Supported |
| **H2b** | **SEMP -> OP** | 0.040 | 0.115 | 0.346 | Not Supported |
| **H2c** | **SEMP -> EP** | 0.264* | 0.113 | 2.336 | **Supported** |

***Note**: * P<0.10, Indicates the item is significant at 10% significant level. Three (3) hypotheses were supported based on their t-values.*

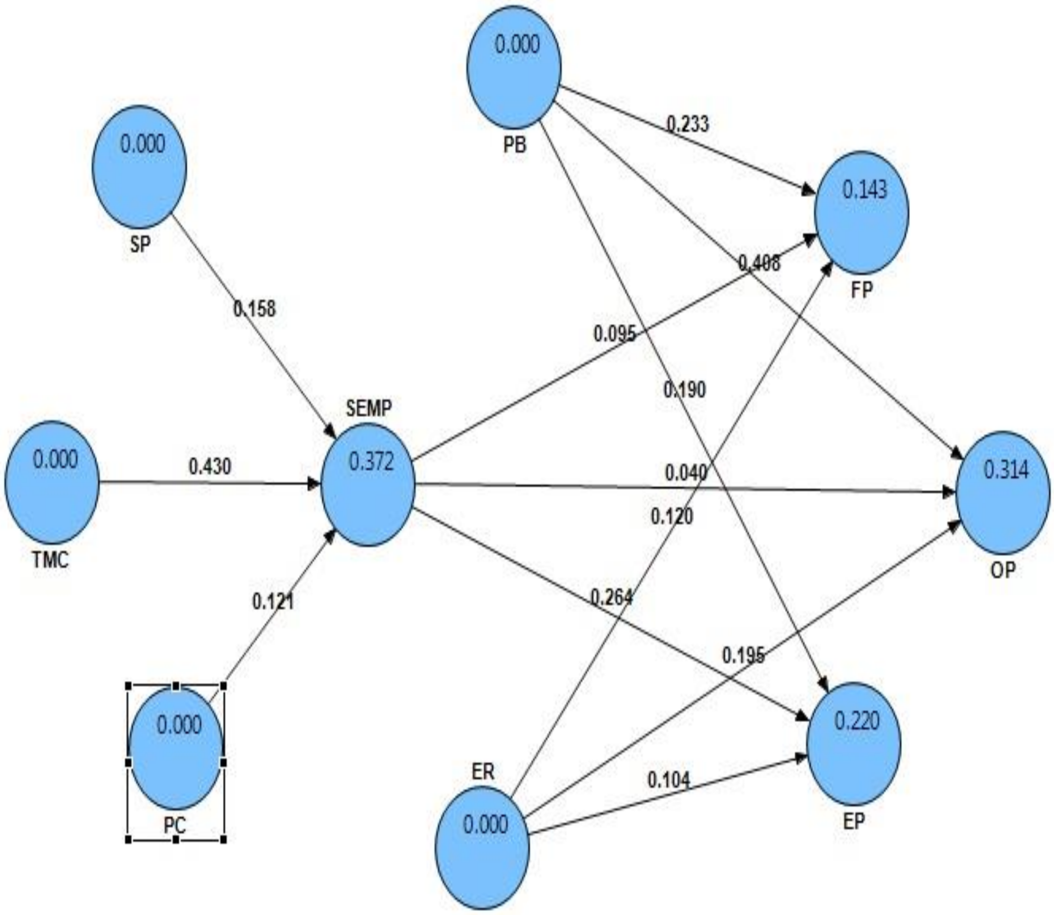


Figure 5.4
*Algorithm model for the direct effect*

In summary, the result of the hypotheses testing of the direct relationship as shown in Table 5.13 revealed that all the accepted hypotheses possess a t-value above the critical value of 1.282 (10% significance level, one-tail test) while the hypothesis that were not supported poses a t-value lesser than 1.282. Therefore, evidences were found in this study to support hypotheses H1a, H1b and H2c, hence accepted, while the study did not find evidence to support hypothesis H1c, H2a and H2b.

## 5.9 The Quality Indexes - Goodness of Fit Measure (GoF)

Upon the presentation of the structural model that presents the main and the moderating effect in this study, preliminary analysis was conducted concerning the goodness of fit measure (GoF) of this study. The result of the GoF helps this study in providing a validating judgment concerning the overall fit of the structural model and also provides a positive judgment towards the overall application of the model.

A well-defined global optimization criteria is a lacking measure in PLS path modeling analysis, that is, there is no global fitting function to be used to evaluate how good the model. The reason given to this is because PLS is a variance-based model which performs better at prediction than the co-variance-based (Chin, 2010). However, Amato, Vinzi & Tenenhaus (2004) recommended a validation of the measurement and the structural model as a means of determining the goodness of fit of the model. An overall model that has all its latent and manifest variable to be valid is regarded as satisfying the criteria of Goodness of Fit (Chow & Chan, 2008). As such, it can be affirmed from the previous section above (Validity analysis: the result of AVE, composite reliability and the discriminant validity) that the structural model of this study is fit and represents the intended measures of the author.

## 5.10 Determining the Effect size ($F^2$)

It is important to determine the relevance and the extent to which the examined path changes the explaining power of the endogenous construct (Cohen, 1988). As the path coefficient cannot provide any information about the effect size of the exogenous latent variables on the endogenous construct. In determining the effect size, Cohen $F^2$ value was used and calculated with the formula provided below by Cohen (1988):

$$F^2 = \frac{R^2_{included} - R^2_{excluded}}{1 - R^2_{included}}$$

Based on the guidelines provided by Cohen (1988), $f^2$ values of 0.02, 0.15 and 0.35 respectively represent small, medium and large effect of the exogenous constructs on the endogenous constructs. The effect of the significant path coefficient is shown in Table 5.14.

Table 5.14
*Effect size of the relationship between the antecedents and SEMP*

| **Relationship** | **$R^2$ Included** | **$R^2$ Excluded** | **Effect Size ($F^2$)** | **Rating** |
|---|---|---|---|---|
| **TMC -> SEMP** | 0.372 | 0.268 | 0.166 | Medium |
| **SP -> SEMP** | 0.372 | 0.355 | 0.027 | Small |
| **PC ->SEMP** | 0.372 | 0.362 | 0.016 | None |
| **SEMP -> FP** | 0.143 | 0.139 | 0.005 | None |
| **SEMP -> OP** | 0.314 | 0.313 | 0.001 | None |
| **SEMP-> EP** | 0.220 | 0.178 | 0.054 | Small |

As can be deduced from Table 5.14 which presents the value of the effect size of each relationship and their respective ratings. It is shown that top management commitment (TMC) has medium effect size ($F^2$) on sustainable environmental manufacturing practices (SEMP). However, it should be noted that those relationships with small effect sizes are as well important statistically with the other medium effect size. This was argued by Chen *et al.,* (2003) who affirmed that all effect sizes have their own peculiarity in influencing the dependent variable and therefore, it should be considered.

### 5.11 Determining the predictive Relevance ($Q^2$) of the Model

Upon the determination of the effect size ($F^2$) in this study, next is the predictive relevance ($Q^2$) of the model which was conducted to assess the predictive capacity of the model. According to Hair *et al.,* (2012), $Q^2$ assesses not only the built around of values of the model but also the parameter estimates of the model. The calculation of $Q^2$ in this study was conducted by using the blindfolding procedures of PLS through which the estimated results were obtained from the variable score from which the cross validated redundancy score was obtained. The extracted cross validated result determines the predictability of the endogenous constructs and thus, reveals the model quality. Hair *et al.,* (2013) affirmed that $Q^2 > 0$ in a reflective endogenous variable indicates the model predictive relevance while a value of $Q^2 < 0$ indicates the lack of predictive capability of the model. Table 5.15 shows the construct's cross validated redundancy value.

Table 5.15
*Construct Crossvalidated redundancy value*

| **Total** | **SSO** | **SSE** | **1-SSE/SSO** |
|---|---|---|---|
| **EP** | 515 | 447.491 | 0.131 |
| **FP** | 515 | 467.247 | 0.093 |
| **OP** | 618 | 499.383 | 0.192 |
| **SEMP** | 824 | 665.709 | 0.192 |

***Note****: SSO-Sum of square of Observations; SSE – Sum of Squares of Prediction Errors; while* $Q^2$ *value = 1-SSE/SSO*

As indicated in column 4 of Table 5.15, it is shown that the model has a predictive relevance of 0.131 for environmental performance (EP), 0.093 for financial performance (FP), 0.192 for operational performance (OP) and 0.192 for sustainable environmental manufacturing practices (SEMP). Therefore, it can be concluded that the model has a good predictive relevance.

## 5.12 Testing the Moderating Effects

Moderation or interaction effect implies that a variable M known as a moderator influences the strength and/or the direction of the relationship between the independent variable X and the dependent variable Y. The test of a moderating effect warrants a statistical measure of the relationship between the independent variable and the dependent variable under the influence of the moderator (Baron & Kenny, 1976). Three different approaches are available for statistical evaluation of the moderating effect (Joreskog, 1998), these are: multi-group approach, product indicator approach and two-step constructs score approach.

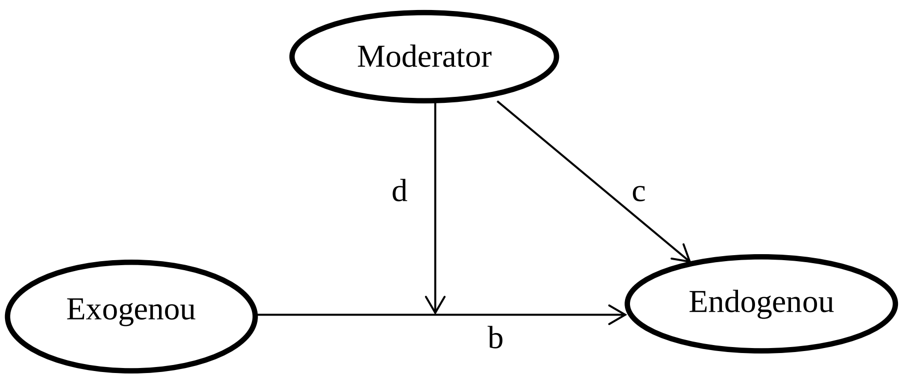


Figure 5.5
*Simple model with a moderating effect (Source: Henseler and Fassott, 2010)*

The multi-group approach is used when the moderator variable is categorical; it involves dividing the variable into categories depending on the available category of the variable. For example, variable category can be gender (male or female), age groups (young and adult). This approach is not recommended for this study because grouping the data may emanate some problems as there may be too few cases to produce reasonable results.

The product indicator approach can be used to assess moderation when the moderator variable is a continuous variable and measured reflectively (Baron & Kenny, 1986; Henseler & Fassott, 2010; Hair *et al.,* 2013). While the two-step construct score approach is employed for evaluating interaction of a formatively measured continuous moderator. As regarding this study, the moderator variables (perceived benefits (PB) and environmental regulation (ER)) are reflectively measured; therefore, the product indicator approach is considered appropriate and used in evaluating the interactive effects.

The product indicator approach in PLS involves that the latent variables that are created through the multiplication of each items from the independent variable by each items from the moderator variable are added as shown by Figure 5.6 below (Chien *et al*., 2003).

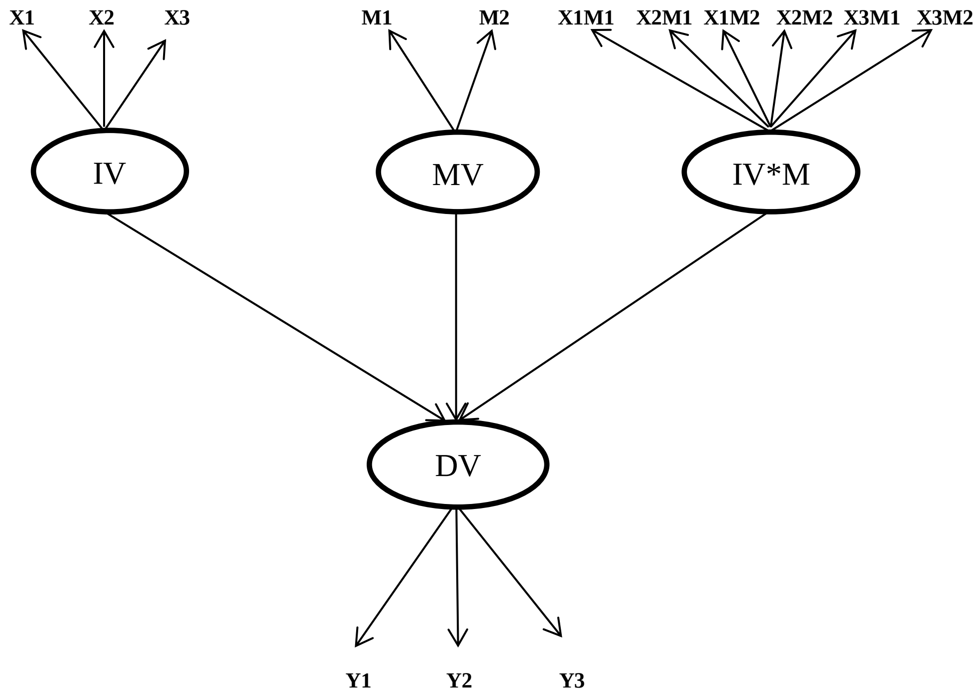


Figure 5.6
*PLS Product Indicator Approach (Source: Helm et al., 2010)*

This study used 2000 bootstrapping samples to assess the significant path of the simple and interactive effect and further examined the strength of the interaction by using the Cohen (1988) effect size $F^2$ which was calculated as follows:

$$F^2 = \frac{R^2_{\text{model with Moderator}} - R^2_{\text{model without Moderator}}}{1 - R^2_{\text{model without moderator}}}$$

The next section presents the moderating effect of perceived benefits and environmental regulation between sustainable environmental manufacturing practices and firm performance. This presentation of the result is divided into different sections based on the stated moderating hypotheses on this study.

### 5.12.1 Test for the moderating effect of Perceived benefits (PB) on the relationship between SEMP and FP

This section investigates the moderation effect hypothesis (H3a) which posits that perceived benefits (PB) will moderate the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP). The result of the simple effect and the interaction effect model as shown in Table 5.16 and Figure 5.7 provides a standardized beta (β) value of 0.062 from SEMP to FP, 0.160 from PB to FP and the interaction effect of -0.108 with $R^2$ value of 0.197. The simple effect model results in a slightly lower standardized beta (β) value for SEMP -> FP and a slightly higher standardized beta (β) value for PB -> FP with a $R^2$ value changed from 0.143 before interaction to 0.197 after interaction. The interaction upon the change in $R^2$ value produced a small effect size ($f^2$) of 0.067 by using Cohen (1988) effect size ($f^2$). The significance of the interaction assessed by using 2000 bootstrapped sample size provided an evidence of a non-significant path coefficient with t-value of 0.467 ($P < 0.10$). The result was used to evaluate hypothesis H3a and found no support that perceived benefit will moderate the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP).

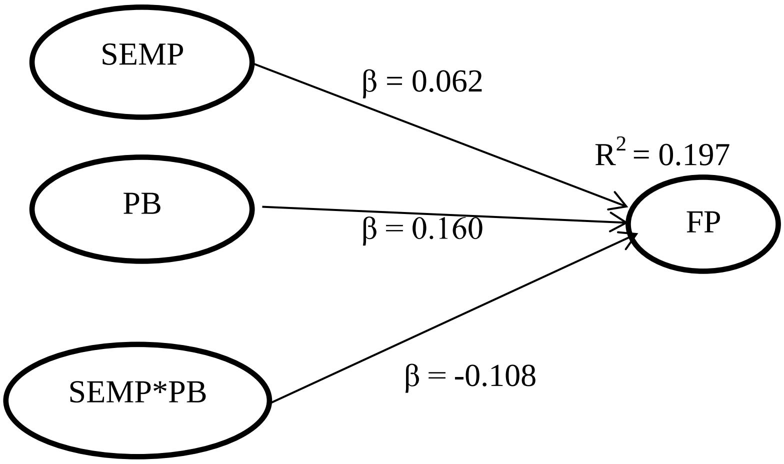


Figure 5.7
*Moderating effect of PB on SEMP and FP*

### 5.12.2 Test for moderating effect of perceived benefit (PB) on the relationship between SEMP and OP.

Hypotheses H3b which posits that Perceived benefits (PB) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and operational performance (OP) was investigated in this section. Table 5.16 and Figure 5.8 below present the results of the standardized beta (β) value for the simple and the interaction effect. The result found a standardized beta (β) value of 0.011 from SEMP to OP, 0.294 from PB to OP and the interaction effect of 0.296 with the model producing a $R^2$ value of 0.399. The simple effect model shows a lower standardized beta (β) value for SEMP -> OP and a higher standardized beta (β) value for PB -> OP with a change in $R^2$ from 0.314 to 0.399. The interaction upon the change in the value of $R^2$ value produced a small effect size ($f^2$) of 0.141.

This study further investigates the significant level of the interaction by using a bootstrapped sample size of 2000 and the result found an evidence of a significant path co-efficient with a t-value of 1.290 at $P < 0.10$. The result was used to further evaluate hypothesis H3b and found a support that perceived benefit (PB) moderates the relationship between sustainable environmental manufacturing practices (SEMP) and operational performance (OP). The interpretation of the finding of this hypothesis was further enhanced by plotting a 2-way interaction graph between sustainable environmental practices and operational performance for average, low (one standard deviation below the mean value) and high (one standard deviation above the mean value) of perceived benefits as shown in Figure 5.9 below. The graph confirmed that the stronger the perceived benefits, the stronger the relationship between sustainable environmental manufacturing practices and firm performance.

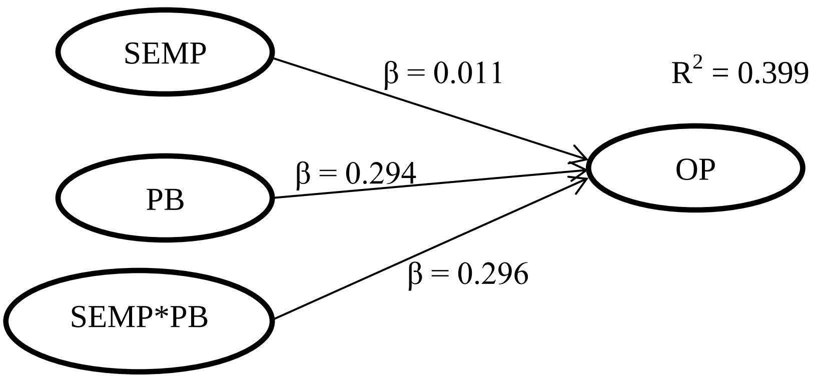


Figure 5.8
*Moderating effect of PB on SEMP and OP*

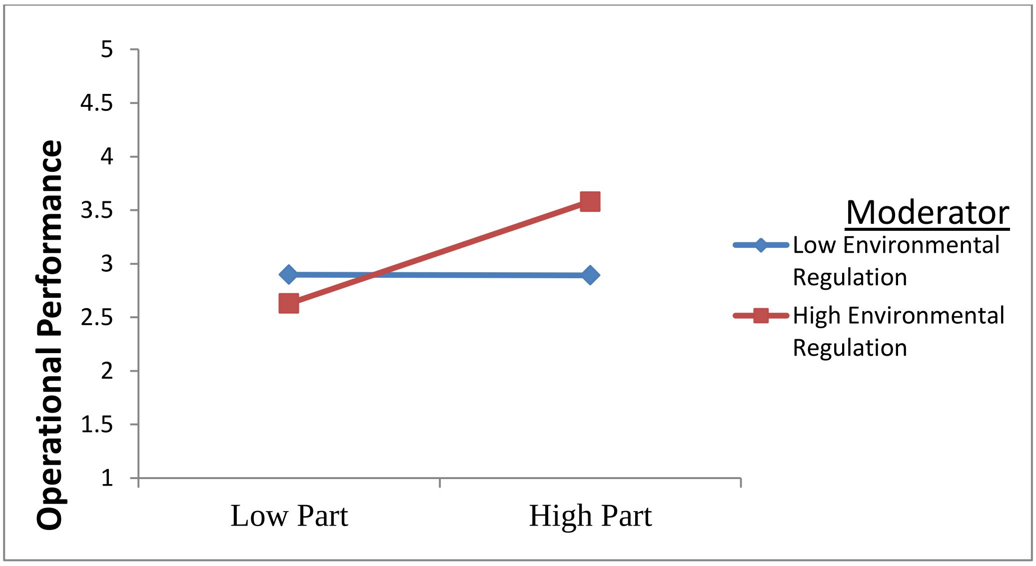


Figure 5.9
*Moderating effect of perceived benefit on the relationship between SEMP and operational performance*

### 5.12.3 Test for moderating effect of perceived benefit (PB) between SEMP and environmental performance (EP)

The moderating hypothesis H3c which posits that perceived benefit (PB) would moderate the relationship between SEMP and environmental performance (EP) was evaluated by using the product indicator approach of PLS. The result of the simple effect and the moderating effect as presented in Figure 5.10 and Table 5.16 provided a standardized beta (β) value of 0.236 from SEMP to EP, 0.194 from PB to EP and the moderating effect has a standardized beta (β) value of 0.102 with $R^2$ value of 0.285. The interaction caused a change in $R^2$ value from 0.220 before interaction to 0.285 after interaction and using Cohen ($f^2$) effect size, the result showed a small effect size ($f^2$) of 0.091 on environmental performance. The significance of the interaction effect was evaluated by using bootstrap sample size of 2000 and the result showed a t-value of 0.579 at $P < 0.10$. This result does not provide a support for hypothesis H3c that perceived benefit (PB) will moderate the relationship between SEMP and environmental performance (EP).

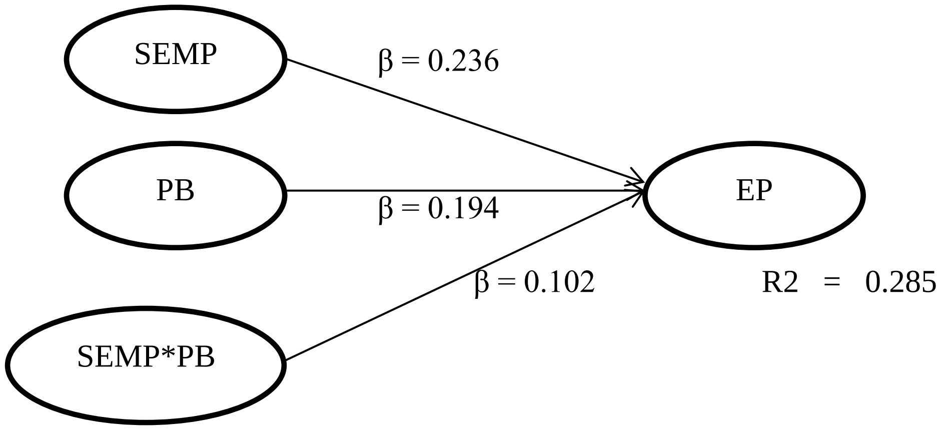


Figure 5.10
*Moderating effect of PB on SEMP and EP*

Table 5.16
*Summary of hypotheses testing for the moderating effects*

| Relationship | Std. Beta | Std. Error | T-Value | Decision |
|---|---|---|---|---|
| SEMP * PB -> FP | -0.108 | 0.231 | 0.467 | Not-Supported |
| SEMP * PB -> OP | 0.296* | 0.229 | 1.290 | **Supported** |
| SEMP * PB -> EP | 0.102 | 0.175 | 0.579 | Not Supported |
| SEMP * ER -> FP | -0.317 | 0.347 | 0.912 | Not Supported |
| SEMP * ER -> OP | 0.259 | 0.266 | 0.972 | Not supported |
| SEMP * ER -> EP | 0.239* | 0.106 | 2.253 | **Supported** |

Note: * P < 0.10 (*Indicates the item is significant at 10%)*

### 5.12.4 Test for moderating effect of environmental regulation (ER) between SEMP and financial performance (FP)

This section presents the moderation effect hypothesis (H4a) which posits that environmental regulation (ER) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP). As shown in Table 5.16 above and Figure 5.11, the simple effect (SEMP -> FP) has a standardized beta (β) value of 0.062, the standardized beta (β) value for ER -> FP is 0.128 while the -0.176 represents the standardized beta (β) value for the moderation effect path and the model has a $R^2$ value of 0.270. The effect size of the interaction path model using Cohen (1988) effect size ($f^2$) was assessed, the result revealed a small effect size ($f^2$) of 0.10 on financial performance. The significance of the interaction model was further assessed by using a bootstrapped sample size of 2000 and the result presented a t-value of 0.467 at $P < 0.10$ significant level. This result does not find a support that environmental regulation (ER) moderates the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP). Hence, hypothesis H4a is not supported.

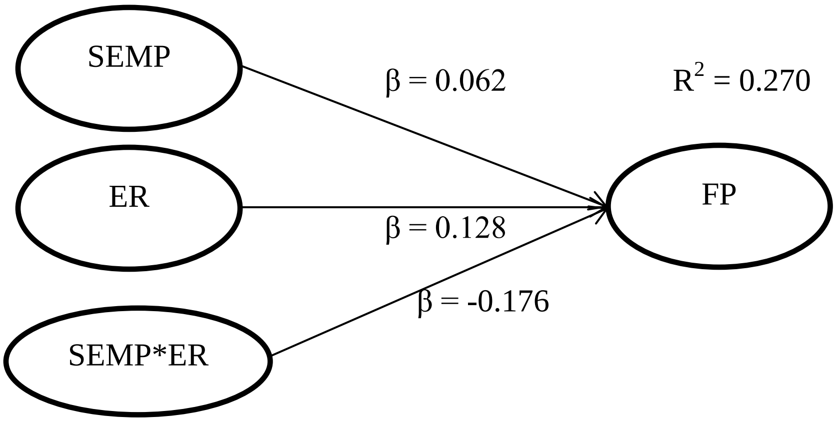


Figure 5.11
*Moderating effect of ER on SEMP and FP*

### 5.12.5 Test for moderating effect of environmental regulation (ER) on the relationship between SEMP and (OP)

This section presents the result of hypothesis H4b which posits that environmental regulation (ER) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and operational performance (OP). As shown in Table 5.16 and Figure 5.12, the result revealed a standardized beta (β) value of 0.010 from SEMP to OP, 0.158 from ER to OP and the standardized beta (β) value for the interaction effect is 0.259 with $R^2$ value of 0.467. The effect size of the interaction was further assessed upon the change in $R^2$ from 0.399 to 0.467 and it was revealed that the interaction has a small effect size ($f^2$) of 0.128 on operational performance. This study further investigated the significance of the interaction by using a bootstrapped sample size of 2000 and the result reveals a t-value of 0.972 indicating that this study does not find an evidence to support that environmental regulation (ER) moderates the relationship between sustainable environmental manufacturing practices (SEMP) and operational performance (OP). Therefore, hypothesis H4b is not supported.

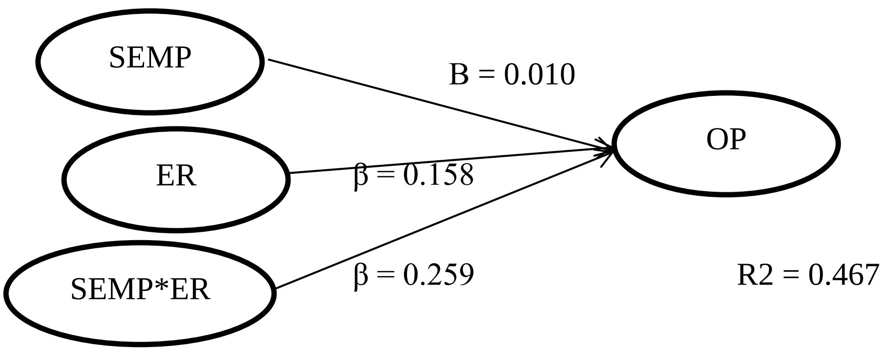


Figure 5.12
*Moderating Effect of ER on SEMP and OP*

### 5.12.6 Test for moderating effect of environmental regulation (ER) on the relationship between SEMP and (EP)

The result of hypothesis H4c which posits that environmental regulation (ER) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and environmental performance (EP) is presented in this section of the study. The result, as shown in Table 5.16 and Figure 5.13 revealed that the standardized beta Value (β) for the simple effect (SEMP -> EP) is 0.236, standardized beta (β) value of 0.105 was found for the path linking environmental regulation to environmental performance (ER -> EP) while the interaction effect (SEMP * ER -> EP) has a standardized beta (β) value of 0.239 and the $R^2$ value was found to be 0.311. The study further investigated the effect size of the interaction upon the change in the $R^2$ value from 0.285 before interaction and 0.311 after interaction and the result revealed a small effect size of 0.038 of the interaction on environmental performance (EP).

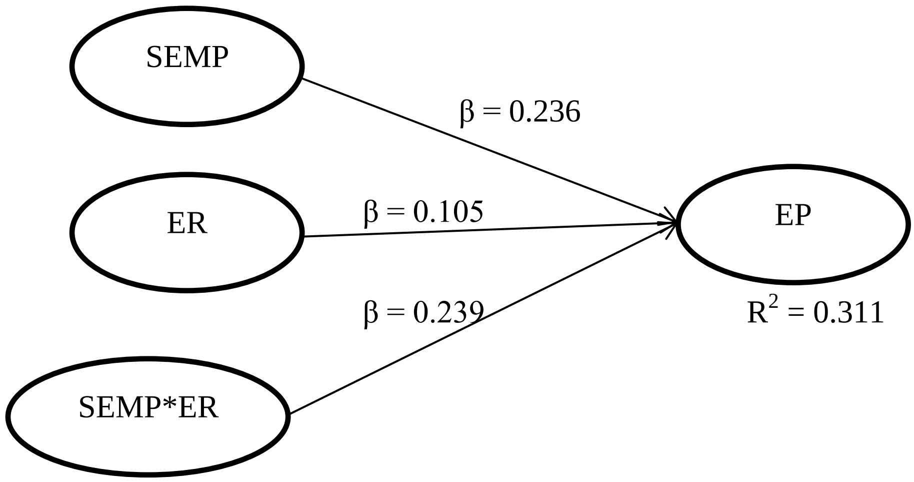


Figure 5.13
*Moderating effect of ER on SEMP and EP*

Furthermore, the significance of the interaction was assessed by using a bootstrapped sample of 2000, the t-value was found to be 2.253 at $P < 0.10$ which provide an evidence to support hypothesis H4c that environmental regulation (ER) moderates the relationship between SEMP and environmental performance. To further help in interpreting this interaction, a two-way interaction graph on the relationship between sustainable environmental manufacturing practices (SEMP) and environmental performance (EP) was plotted for average, low (one standard deviation below the mean value) and high (one standard deviation above the mean value) of environmental regulation as shown in Figure 5.14. The graph confirmed that the more stringent environmental regulation is, the stronger the relationship between sustainable environmental manufacturing practices and environmental performance.

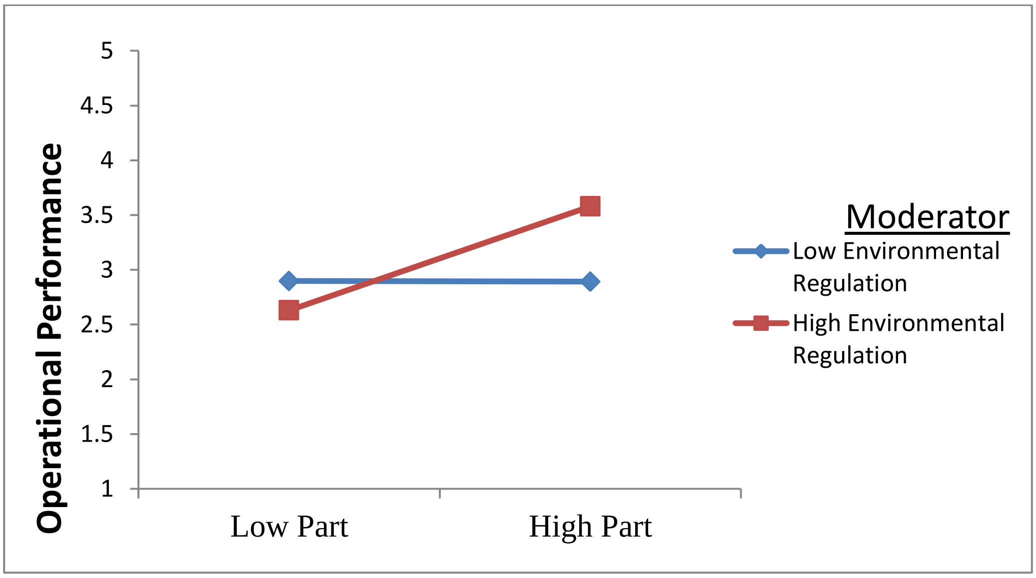


Figure 5.14
*Moderating effect of environmental regulation on the relationship between SEMP and operational performance*

The moderating effect of perceived benefits and environmental regulations is presented in Figure 5.15.

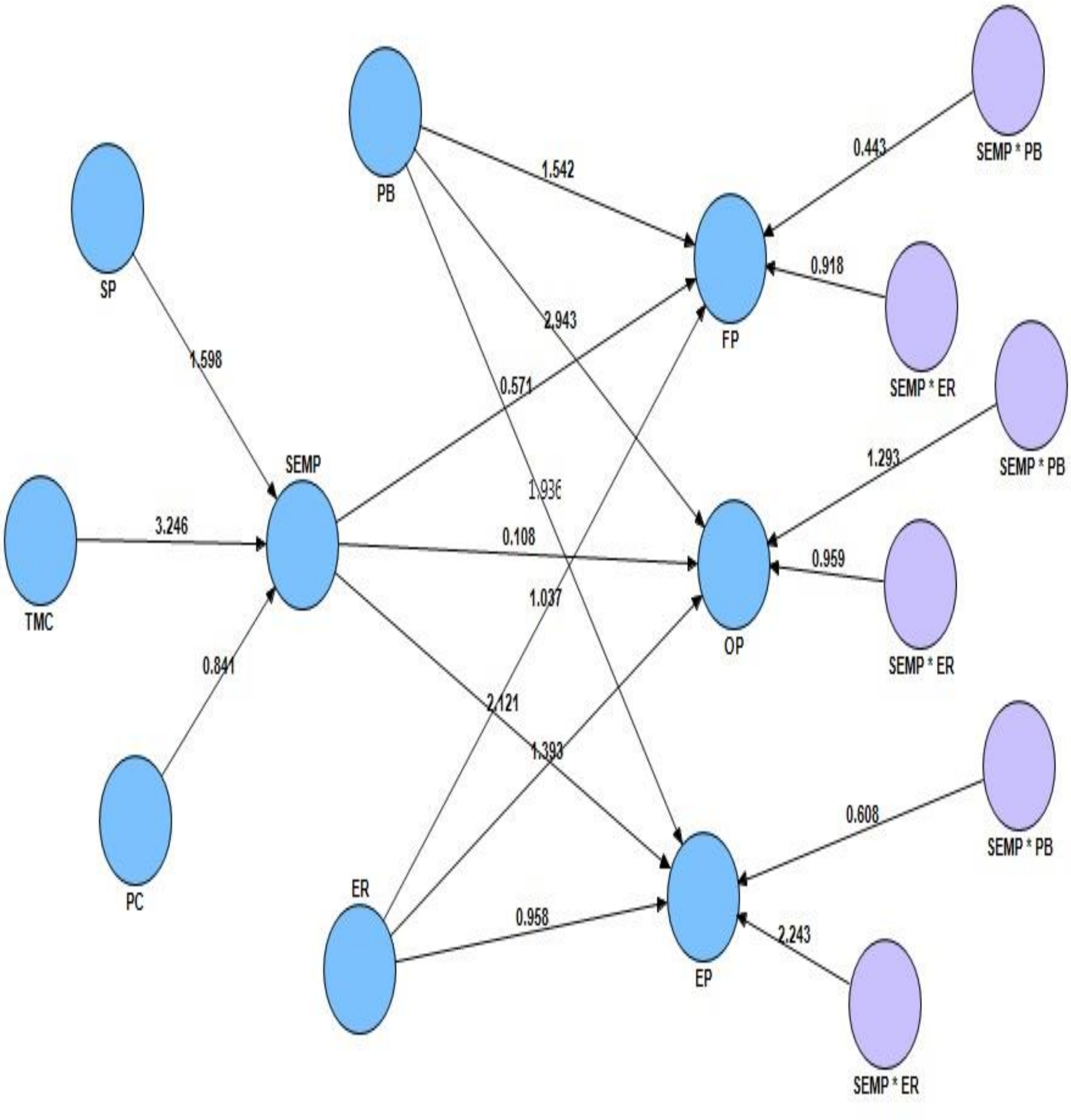


Figure 5.15
*Model showing the moderating effect of perceived benefits and environmental regulation*

Summing up the above findings, three out of the six direct relationship hypotheses were supported and two among the moderating hypotheses are supported. Table 5.17 presents the summary of the hypotheses testing conducted in this study.

Table 5.17
*Summary of the research hypotheses test*

| Hypotheses | Statement of Hypotheses | Findings | Decision |
|---|---|---|---|
| **H1a** | TMC has positive effect on SEMP | β =0.430<br>t-value = 3.255 | **Supported** |
| **H1b** | SP positively influence SEMP | β = 0.158<br>t-value = 1.634 | **Supported** |
| **H1c** | Public Concern positively influence SEMP | β = 0.121<br>t-value = 0.844 | Not Supported |
| **H2a** | SEMP positively influence FP | β = 0.095<br>t-value = 0.715 | Not Supported |
| **H2b** | SEMP positively influence OP | β = 0.040<br>t-value = 0.346 | Not Supported |
| **H2c** | SEMP positively influence EP | β = 0.264<br>t-value = 2.336 | **Supported** |
| **H3a** | PB moderates between SEMP and FP | β = -0.108<br>t-value = 0.467 | Not Supported |
| **H3b** | PB moderates between SEMP and OP | β = 0.296<br>t-value = 1.290 | **Supported** |
| **H3c** | PB moderates between SEMP and EP | β = 0.102<br>t-value = 0.579 | Not Supported |
| **H4a** | ER moderates between SEMP and FP | β = -0.317<br>t-value = 0.912 | Not Supported |
| **H4b** | ER moderates between SEMP and | β = 0.259 | Not supported |

| Hypotheses | Statement of Hypotheses | Findings | Decision |
|---|---|---|---|
| | OP | t-value = 0.972 | |
| **H4c** | ER moderates between SEMP and EP | β = 0.239<br>t-value = 2.253 | **Supported** |

### 5.13 Summary

The detailed description of the results of the data collected in this study was presented in this chapter. Following the series of analysis techniques taken in this study, a convergent validity was confirmed through the loading and the cross loading of the data set. Discriminant validity test was also conducted by using the Fornel and Larcker criterion and it was confirmed that discriminant validity was achieved. This study further evaluated both the measurement and the structural model by using smartPLS 2.0 M3 (Ringle *et al.*, 2005) to test the stated hypotheses of the direct and the indirect relationships, the result found that three out of the stated direct relationships are supported and two among the six indirect hypotheses were supported at 10% significance level.

# CHAPTER SIX

# DISCUSSION AND CONCLUSION

## 6.1 Introduction

Sustainable environmental manufacturing practices, its antecedent factors and firm performance were investigated in this study. The findings of the statistical analysis of this study were presented in chapter five. This chapter aims at discussing the result of the study within the context of the research questions, hypotheses and literature review. This chapter is divided into five sections, section one began by providing the research overview with the key objectives as well as the methodological approaches employed in the conduct of the study. Section two summarizes the result of the analysis in regards to the tested hypotheses and literature review. Next is the discussion regarding the implications of the findings of the current study and the directions for future research. The limitation of this study is presented in the fourth section while the conclusion of the study is discussed in the fifth section.

## 6.2 Overview of the research

This study investigated sustainable environmental manufacturing practices, its antecedents and firm performance. Chapter one of this study provided the rationale for the conduct of this research and particularly pointed out that the hypothesized relationships have been previously researched in isolation and were conducted basically in developed countries. Based on the review of literatures and the discussion of the problem statement of the research, it was revealed that the results of the previously conducted researches were not consistent and therefore calls for an investigation into this domain. In detail, the study investigated the effect of the antecedents on SEMP and the influence of SEMP on firm performance via the moderating effects of perceived benefits and environmental regulation.

The important theoretical aspects of this study were reviewed in the chapter two, followed by the establishment of the model that was tested. As depicted by the research model in chapter three, literatures that are important to this area of study such as sustainable environmental manufacturing practices, its antecedents (top management commitment, stakeholder pressure and public concern) and firm performance (financial performance, operational performance and environmental performance) were examined. Natural resources based view of firms was also reviewed as the underpinning theory used in this study.

Chapter three of this study presented the framework for the research and which was subsequently followed by the development of various constructs and the proposed structural models (hypothesized relationships). Twelve relationships were hypothesized in this study. The underlying research philosophy and the various method employed in this research were presented in chapter four. In order to achieve the earlier stated objectives of the study, quantitative research approach was employed. Based on the relevant literatures reviewed in this study, the author developed measurement scales for the relevant constructs of the study and which was subjected to face validity and pilot study. The developed questionnaire was later used as the main research instrument for data collection, which was subsequently gathered by using a self-administered mail technique.

Next was the presentation of the result of the data analysis which was conducted using PLS-SEM. Firstly, the description of the data was presented, followed by the summary of the result of the measurement model. In this stage, confirmatory factor analysis was conducted which resulted into the deletion of the items that loaded poorly. This was followed by a conventional assessment of the average variance extracted (AVE) and composite reliability to ensure the achievement of reliability, validity of the measurement model. Upon the development of the proper measurement model, the results of the latent variables were saved and later used for the assessment of the structural model. The test of the posited hypotheses (direct and moderating hypotheses) was also conducted in the previous chapter and the result revealed a significant positive relationship among the direct relationships except for public concern and SEMP. The result also provided a significant moderation effect of perceived benefits on the relationship between SEMP and operational performance and significant moderation effect of environmental regulation on the relationship between SEMP and environmental performance.

Conclusively, the essence of this section of the study (chapter six) is to present the discussion of the result. The findings were assessed from the perspective of the past literatures and provided a support for the recent debate emerging from the latest research. Various contributions of this study, theoretical, methodological and practical contributions were highlighted. As such, a distinct contribution was achieved by bringing together and investigating the antecedents, SEMP and firm performance in a single research framework and further using PLS technique to investigate the moderating effect of perceived benefits and environmental regulation on the relationship between SEMP and firm performance. Future theoretical issues were subsequently highlighted and the relevant limitations of the study were presented.

## 6.3 Recapitulations of the Findings

This study aimed at assessing the influence of top management commitment (TMC), stakeholder pressure (SP), and public concern (PC) on sustainable environmental manufacturing practices (SEMP), and the influence of SEMP on financial performance (FP), operational performance (OP) and environmental performance (EP)) via the moderating effects of perceived benefits (PB) and environmental regulation (ER). From this, 12 hypotheses (both the direct and moderating hypotheses) were developed to represent the constructs dimensional relationships. The result of the analysis found that five hypotheses representing the main and the moderating effects were supported.

Precisely, six direct hypotheses were formulated out of which three are related to the antecedents of SEMP, and the remaining three relate to the outcomes of SEMP. Two of the hypothesized relationships relating to the antecedent factors are supported and one of the three direct hypotheses relating to the outcomes of SEMP is supported. Also, the findings only found evidence to support two among moderating hypotheses. The discussion of the findings in-line with the previous literatures and theories is presented in the next section.

### 6.4 Discussion of the findings

This section is divided into two parts; the first part discusses the results concerning the direct relationship between: (1) antecedents of SEMP as exogenous variables and SEMP as an endogenous variable; (2) SEMP as exogenous variable and firm performance as endogenous variables. The second part of the section also discusses the moderating effect in two parts: (1) moderating effects of perceived benefits on the relationship between SEMP and firm performance and (2) the moderating effect of environmental regulation (ER) on the relationship between SEMP and firm performance. Section 6.4.1 discussed the first objective of the study

#### 6.4.1 Discussion of the effects of antecedents of SEMP on SEMP

The first objective of this study aims at investigating the influence of the antecedent factors of SEMP on sustainable environmental manufacturing practices (SEMP). Sustainable environmental manufacturing practice (SEMP) refers to the implementation of technical and organizational initiatives of manufacturing firms towards minimizing the impact of its manufacturing activities on the natural environment (Cramer, 1998; Omar & Samuel, 2011).

In pursuing the achievement of this objective, three hypotheses were developed and tested in relation to the influence of antecedent factors on SEMP. The study found that two antecedent factors, including top management commitment (TMC) and stakeholder pressure (SP) have significant positive influence on SEMP. The third antecedent (public concern) does not significantly influence sustainable environmental manufacturing practices. However, there are evidences to support the claim of the insignificant relationship between public concern and SEMP in

Malaysia. The following section discusses the relationship between top management commitment (TMC) and SEMP

#### 6.4.1.1 Influence of top management commitment (TMC) on SEMP

Top management commitment (TMC) is defined as 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; Starick & Rands, 1995). Top management commitment is a critical and vital factor of proactive environmental practice (Wee & Quazi, 2005; Huang & Wu 2010). Top management is responsible for 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).

Hypothesis H1a of this study posited that top management commitment would 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). The implication of the positive significant relationship between top management commitment and SEMP is that increase in the commitment of top management of firms will result in 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 and Yen (2012); Carter et al., (2009); Al-shourah and Ibrahim, (2007). Given by the finding of this study, top management commitment has a positive influence on the implementation of sustainable environmental practices. The next discussion relates to the relationship between stakeholder pressure and SEMP.

#### 6.4.1.2 Influence of stakeholder pressure on SEMP

Stakeholder pressure is defined as the influence exerted by individuals or groups on the company's objectives (Henrique & Sadorsky, 1999). Hypothesis H1b in this study posited a positive influence of stakeholder pressure on sustainable environmental manufacturing practices. As expected, the findings of this study found an evidence to support the hypothesis. The implication of this finding as emphasized by Henrique and Sadorsky (1999) is that stakeholders can express an 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 will be directed towards the awareness of stakeholders of the risk borne by their manufacturing activities (Al-Tuwajiri *et al.,* 2004). Owing to the result of the finding of stakeholder pressure in influencing sustainable environmental manufacturing practices in this study which corroborates the previous studies of Buysse & Verbeke (2003); Delmas & Toffel (2008); Gonzalez-Benito & Gonzalez-Benito (2006); Henriques & Sadorsky (1999); Murillo-Luna et al., (2008); Springel & Busch (2010), stakeholder pressure is positively influential on the implementation of sustainable environmental manufacturing practice in Malaysia. The following section provides the discussion of the relationship between public concern and SEMP.

### 6.4.1.3 Influence of public concern on SEMP

Public concern in this study is referred as the sensitivity of individuals towards environmental issues (Berkiroglu, 2011). Hypothesis H1c of this study posited that public concern (PC) would positively influence sustainable environmental manufacturing practices (SEMP). However, 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, which belongs 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 (Hofstede, 2009). As such, one of the ways to avoid losing face is to stay calm and saying no through a non-verbal communication mode (Hofstede, 2009; Rogers, 2005). It is obvious that the cultural orientation of the respondents of the previous studies is far away different from this study's. The previous studies such as Carter et al., (2009) and Banerjee et al., (2003) were conducted in the U.S and other western countries where the public tends to appreciate brutal honest whenever they are discontented with certain issues such as environmental issues, but the opposite holds true in Asia, especially the Southeast Asia where Malaysia is located (Rogers, 2005). In Malaysia, the public will prefer not to react as loss of face to parties involved in issues can be disastrous to business success (Katz, 2008). Therefore, it is noteworthy that the insignificant influence of public concern on sustainable environmental manufacturing practices within the context of Malaysia is considered as reasonable. The discussion of the second objective of this study is presented in the following section.

### 6.4.2 Discussion of the effects of SEMP on firm performance

Objective number two of this study aimed at investigating the effect of sustainable environmental manufacturing practices on firm performance. Firm performance in this study refers to the firms' activities that focus on the achievements of its objectives. It entails the financial performance, operational and environmental performance. Financial performance is the financial objective attained through organization's manufacturing activities (Zhu & Sarkis, 2003). The operational performance refers to a certain level of performance attained in the operational activities of manufacturing firms (Sharma & Vrendenburg, 1998; Sarkis, 2003). While environmental performance refers to the achievement of a certain level of environmental objectives by manufacturing firms in its environmental practices (Sharma & Vrendenburg, 1998; Sarkis, 2003).

In pursuance of the second objective of this study, three hypotheses were developed and tested in relation to sustainable environmental manufacturing practices (SEMP) and financial, operational and environmental performance in the Malaysian manufacturing sector. The result only found a support for the relationship between sustainable environmental manufacturing practices and environmental performance while evidences were not found to support the other two relationships. The following section discusses in together the relationship between SEMP; and financial and operational performance.

#### 6.4.2.1 Effects of SEMP on financial and operational performance

Hypothesis 2a and 2b of this study, which posited that sustainable environmental, manufacturing practices would positively influence financial performance and operational performance were not supported. The study found insignificant positive relationships between SEMP with financial performance and operational performance. Though the findings are in-line with Ullman, (1985) and Artiach et al., (2010) who suggests that there is no association between environmental practices and performance of firms. However, it is in contrary to the study of Lopez-Gamero *et al.* (2009); Ameer and Othman (2011), and Lai and Wong (2012) and Ravi Abdekhodaee & Nagarajah (2013) respectively.

One plausible explanation for these insignificant relationships is the stage of the implementation of sustainable environmental manufacturing practices (SEMP) in Malaysia. As revealed in the study of Omar and Samuel (2011) on the extent of the implementation of SEMP in Malaysia, they assert that implementation of environmental initiatives in Malaysia regardless of the type of ownership is in the third stage where environmental practices are only seen as ethical. At this stage, Malaysian manufacturing firms only perceive sustainable environmental practices as ethical; necessary things were only put in place as a reaction to pressure from high environmental regulation without giving consideration to SEMP as a strategic factor in achieving better financial and operational performance (Molina-Azorin *et al*., 2009). Jabbour and Santos (2006) assert that this stage of implementation only witnesses the incorporation of certain objectives of the company by the environmental management. Although the environmental variables might have been utilized by the firms in some certain aspects of production and process, but it is yet to be considered as relevant as a strategic factor of the entire division of the firms (Molina-Azorin *et al*., 2009).

In addition,the insignificant relationship between SEMP and financial performance is supported by the findings of Nishitani *et al.* (2013) who affirmed that only firms that voluntarily implement environmental practices will be significant in its financial performance. It was explained that when firm implement environmental practices as a result of mandatory pressure, especially from environmental regulation, they only reduce GHG emission (environmental performance), however, pollution reduction is experienced in a voluntary environmental initiative and thus, enhance financial performance.

The insignificant relationship between sustainable environmental manufacturing practices and firm performance in this study is an indication that other factors apart from the impacts on financial performance is the reason why firms implement sustainable environmental manufacturing practices. According to Nyirenda *et al.*, (2013), firms are spurred by moral obligation to mitigate negative impacts of their operation on the climate and by their aspiration to meet the growing environmental regulations. Thus, this indicates that firms are not at all time motivated by financial motives, but their ethical obligation to reduce the detrimental environmental impact and respect the environment (Nyirenda et al., 2013). Owing to these findings, sustainable environmental manufacturing practice does not have significant influence on the financial and operational performance. The next section presents the discussion of the relationship between SEMP and environmental performance.

#### 6.4.2.2 Effect of SEMP on environmental performance

Environmental performance refers to the achievement of a certain level of environmental objectives by manufacturing firms in its environmental practices (Sharma & Vrendenburg, 1998; Sarkis, 2003). Hypothesis 2c which posited that sustainable environmental manufacturing practices would positively influence environmental performance was supported by the findings of this study. This is similar to the previous study of Zhu and Sarkis (2004); Lai and Wong (2012); Sezen and Cankaya, (2013), and Ravi *et al.* (2013) who all found that environmental practices in manufacturing is significant to environmental performance of the manufacturing firms. The implication of this finding reveals that improvement in sustainable environmental manufacturing practices in firms enables the achievement of the firms' environmental objectives like reduction of energy consumption in firms, reduced carbon emission and environmental degradation caused by the manufacturing activities of the firms. As such, the more firms are committed to sustainable environmental manufacturing practices, the better their achievement of environmental performance. Thus, this study has found that sustainable environmental manufacturing practice has positive influence on environmental performance of manufacturing firms. The next section discussed the third objective of this study.

### 6.4.3 Discussion on moderating effect of perceived benefits

The third objective is to investigate the moderating effect of perceived benefits on the relationship between SEMP and financial, operational and environmental performance. The discussion of the result of the moderating effect hypothesized in this study will be divided into two parts based on the significance of the hypothesized relationships: (1) discussion of the significant hypothesized moderating relationships and (2) the discussion of the insignificant hypothesized moderation relationships. Only one of the three moderating hypotheses, (H3b) was found in this study to be significant. Specifically, the significant moderation relationship was found between perceived benefit as a moderator on the relationship between SEMP and operational performance. The discussion of the significant relationship is presented in the following section.

#### 6.4.3.1 Significant moderation effects of perceived benefits

In order to pursue the achievement of the third objective of this study, hypothesis H3b which posited that perceived benefits would moderate the relationship between SEMP and operational performance was tested. The result upon using a bootstrapped sample size 2000 found evidence to support the hypothesis. In order to provide a better explanation of the finding of this hypothesis, a 2-way interaction graph was plotted between SEMP and OP for average, low (one standard deviation below the mean value) and high (one standard deviation above the mean value) of perceived benefits as shown in Figure 5.9 of chapter five. The graph confirmed that perceived benefit moderates on the relationship between sustainable environmental manufacturing practices and operational performance.

The implication of the result is that one standard deviation increase in perceived benefit would not only impact sustainable environmental manufacturing practices by 0.029 but would also increase the impact on the relationship between SEMP and OP from 0.029 to 0.307 (0.011 + 0.296). This means that when sustainable environmental manufacturing practices is perceived as benefits, the resultant effect will be an increase in the operational performance of firms. This also goes otherwise when sustainable environmental manufacturing practice is perceived by firms as a threat. This result is supported by Sharma *et al*., (1999) who reiterated that the implementation of environmental practices should be seen as benefits to achieve better performance. In addition, Al-shourah and Ibrahim (2007) reiterated that perceived benefit moderates the relationship between environmental management practices and hotel performance. The discussion of the insignificant moderating effect of perceived benefit on the relationship between SEMP and firm performance is presented as follows.

#### *6.4.3.2 Insignificant moderation effects of perceived benefits*

Two of the hypothesized moderating effects of perceived benefits (H3a and H3c) were found not to be significant. Specifically, these are the moderating effect of perceived benefit on the relationship between SEMP and financial performance, and the relationship between SEMP and environmental performance. The below section discussed the insignificant relationships.

Hypothesis (H3a) which posited that perceived benefits (PB) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance was tested and no significant evidence was found to support that perceived benefit moderates the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP). The result is not surprising as environmental practices are usually perceived as either a benefit or a threat (Sharma et al. 1999). According to Sharma *et al.,* (2009), it was affirmed that the financial status of firms will be influenced if environmental practices are perceived as benefits. However, the result as indicated by the findings (negative sign of the standardized beta value) of this relationship showed that environmental practices is still perceived as a threat (i.e. adding to the cost of manufacturing) among the respondents and as such, it is not considered as a strategic factor of the manufacturing companies. The perception of the traditional economist about environmental practices in firms posit that environmental improvement can cause reduction in the profitability of firm (Molina-Azorin *et al.,* 2009). A significant s incurred due to the firms compliance with environmental regulation and which reduce the ability of the firm to compete (Molina-Azorin *et al*., 2009). Thus, the traditional view is of the opinion that, though simple prevention measures of environmental practices may enhance cost savings, but the ambitious practices of environmental sustainability may exceed the cost that can be derived from them (Walley & Whitehead, 1994). The following section discussed the insignificant moderating effect of perceived benefit between SEMP and environmental performance.

Hypothesis H3c which posited that perceived benefits (PB) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and environmental performance (EP) was evaluated in this study and the result does not provide an evidence to support the hypothesis. Surprisingly, the result was expected to support the hypothesized relationship as can be seen that it is positively correlated, but one plausible explanation for this finding relates to the stage of implementation of SEMP in Malaysia. Environmental manufacturing practice in Malaysia is still regarded as only ethical behaviour (Omar & Samuel 2011). As such, many firms have not considered it to be strategic factors that can be used to achieve better performance. Omar and Samuel (2011) assert that implementation of environmental initiatives in Malaysia regardless is in a stage where environmental practices are mainly implemented based on ethical obligation to satisfy the requirement of the regulations. At this stage, necessary things were put in place as a reaction to pressure from high environmental regulation, but it has not been considered to be a strategic factor in achieving better operational performance (Molina-Azorin *et al.*, 2009). Jabbour and Santos (2006) assert that this stage of implementation only witnesses the incorporation of certain objectives of the company by the environmental management. Although the environmental variables might have been utilized by the firms in some certain aspects of production and process, but it is yet to be considered as relevant as a strategic factor of the entire division of the firms. Relating this to the natural resource base view theory of firms (NRBV), it is posited that the natural environment of firms should be included in the strategic resources that firms can use to achieve better performance (Hart, 1995; 1996). Discussion on the moderating effect of environmental regulation is presented in the next section.

### 6.4.4 Discussion on moderating effect of environmental regulation

The fourth objective of this study aimed at examining the moderating effect of environmental regulation on the relationship between SEMP and financial, operational and environmental performance of manufacturing firms. In achieving this objective, three hypotheses were formulated and tested. The result found evidence to support only the effect of environmental regulation on the relationship between SEMP and environmental performance. Evidence was not found to support the other two relationships. The discussion of the moderation effect of environmental regulation will be discussed in two parts based on the significance of the hypotheses. The following section discusses the significant moderating effect of environmental regulation.

#### 6.4.4.1 Significant moderating effect of environmental regulation

Hypothesis H4c which posited that environmental regulation (ER) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and environmental performance (EP) provided an evidence to support that environmental regulation (ER) moderates the relationship between SEMP and EP. To further help in interpreting this interaction, a two-way interaction graph on the relationship between sustainable environmental manufacturing practices (SEMP) and environmental performance (EP) was plotted for average, low (one standard deviation below the mean value) and high (one standard deviation above the mean value) of environmental regulation as shown in Figure 5.14 of chapter 5.

The Figure 5.14 explained that stringent environmental regulation moderates the relationship between sustainable environmental manufacturing practices and environmental performance. This result implies that one standard deviation increase in environmental regulation will not only impact sustainable environmental manufacturing performance by 0.236, but will also increase the impact of SEMP on environmental performance from 0.236 to 0.475 (0.236 +.239) indicating that sustainable environmental manufacturing practices will result in a better environmental performance upon the increase in the stringency of environmental regulation. However, environmental performance will drop when environmental regulation is relaxed. This result is consistent and supports the finding of Lai & Wong (2012) who asserted that high environmental regulation moderates the relationship between green logistics management and environmental performance in China. The following section presents the discussion of the insignificant moderating effect of environmental regulation.

#### 6.4.4.1 Insignificant moderation effects of environmental regulation

In this section, the discussion of the two insignificant hypothesized moderating relationships (H4a and H4b) is presented. Specifically, the insignificant hypothesized relationships are: moderating effects of environmental regulation on the relationship between (1) SEMP and financial performance and (2) SEMP and operational performance. The result elaborates that the sample respondents are indifferent on the role of environmental regulation on the relationship between SEMP; and financial and operational performance. Thus, plausible explanations regarding the outcomes of these results are provided in the following section.

Hypothesis (H4a) which posited that environmental regulation (ER) would moderate the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP) does not find evidence to support that environmental regulation (ER) moderates the relationship between sustainable environmental manufacturing practices (SEMP) and financial performance (FP). This result is not really a surprise as it is emphasized by Gray and Shadbegian (2010) that environmental abatement effort is associated with productivity reduction. Also, Rassier and Earnhart (2010) asserted that tighter regulation meaningfully lower firms' profitability. Furthermore, it was reiterated by the traditional economic literatures that stringent environmental regulation, such as environmental taxes, technological standards and trade permits are regarded by the traditional economists as eroding firms of their benefits (Ambec *et al.,* 2013). The next section presents the discussion of the insignificant moderating effect of environmental regulation on SEMP and operational performance

The test for Hypothesis H4b which posited that environmental regulation (ER) would moderate the relationship between (SEMP) and operational performance (OP) revealed that environmental regulation does not moderate the relationship between SEMP and operational performance (OP). One plausible explanation for this finding relates to the view of the traditional economists and managers who regards environmental regulation as eroding firms of their profit (Ambec *et al.*, 2013). This implies that firms spend more time and resources in meeting up with the technological and operational standards which reflectively reduces operational performance of firms.

Another plausible reason for the insignificant moderating effect of stringent environmental regulation of the relationship between sustainable environmental manufacturing practices with financial and operational performance relates to the perspective of the uncertainty hypothesis (Zhang et al., 2014). Environmental regulation variable has a possibility of an open unsatisfactory measure, as such, it becomes irrelevant to firm's productivity (Zhang et al., 2014),. In addition, Xie (2008) affirmed that there is no significant effect of environmental regulation on the productivity of firms because increasing investment on environmental practices improves environmental performance. As such, environmental regulation may not significantly moderates financial and operational performance of firms.

## 6.5 Implication and Future Research Directions

The findings of this study have provided important implications to the environmental regulatory policy makers, academics and practitioners. These findings have also contributed to the body of knowledge. The research implications of this study are discussed in the following sections in the form of theory and practice.

### 6.5.1 Theoretical Implications

This study has theoretically been able to contribute to knowledge by conducting its investigation in a manufacturing industry in a developing country. This is so due to the fact that many previous studies were usually conducted in the developed nations such as UK and USA. Also, the expansion of literatures, conceptualization and the empirical investigation of sustainable environmental manufacturing practices on firm performance, its antecedent factors and the moderating effects of perceived benefits and environmental regulation between SEMP and performance form part of the theoretical contribution of this study. This study has been able to investigate SEMP, its antecedent factors, financial, operational, environmental performance, perceived benefits and environmental regulation in a single framework.

A distinct contribution to knowledge was achieved in this study by providing a model that enhances the understanding of the effect of sustainable environmental manufacturing practices on firm performance. The environmental management field lacks a comprehensive framework (Lucas, 2010) that explains the relationship between environmental practices and the performance of firms. As such, bringing together and investigating the relationship between top management commitment, stakeholder pressure, public concern, sustainable environmental manufacturing practices and firm performance (financial, operational and environmental performance) via the moderating influence of environmental regulation and perceived benefit in a single and comprehensive framework has provided that sustainable environmental manufacturing practices does not positively influence the financial and operational performance of firms unless it is regarded as a strategic factors with which firms can achieve a better financial and operational performance. Thus, this study provided a model in Figure 6.1 to enhance the understanding of the scenario of sustainable environmental practices on the performance of firms in Malaysian manufacturing.

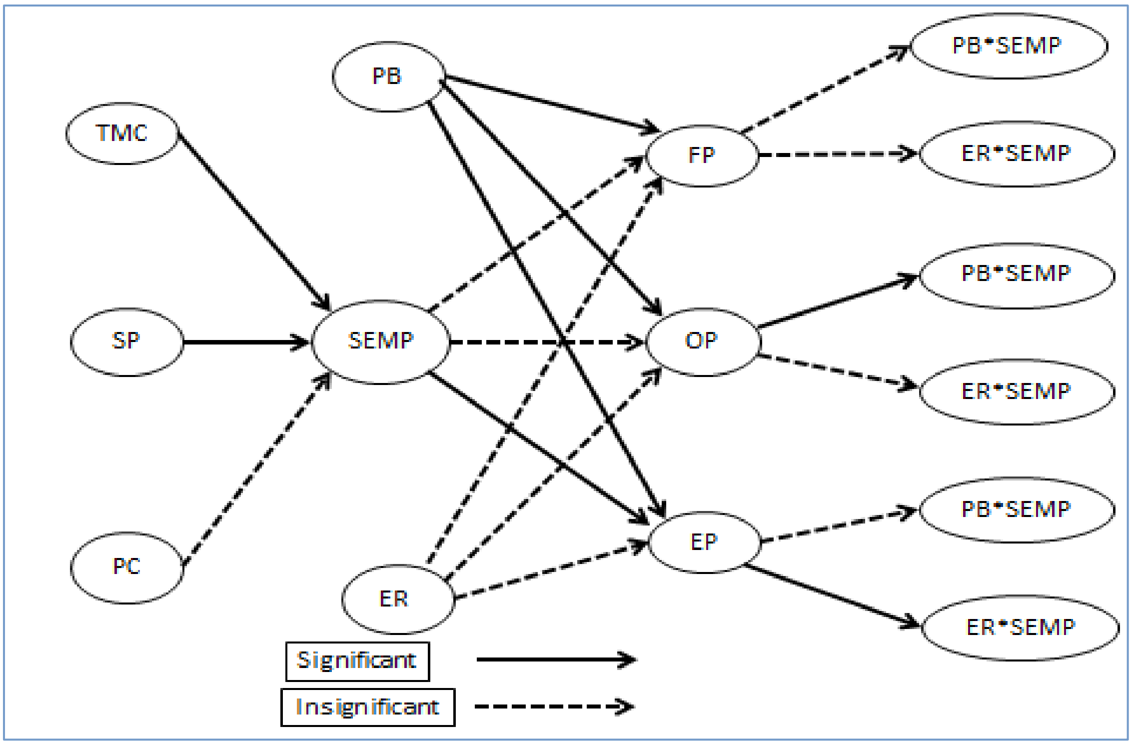


Figure 6.1
*Model of SEMP on firm performance*

The findings of the study provided a mixed result between SEMP and firm performance (financial, operational and environmental performance). The reason given is found in this study that sustainable environmental, manufacturing practices are yet to be considered as a strategic factor in the context of Malaysia. This result should not have come at any other time better than now that manufacturing companies in Malaysia are striving to go green and environmentally sustainable. As such, the current study has contributed theoretically by pointing out the reason why SEMP should be seen beyond ethical behaviour and as a strategic resource for achieving better performance. It is explained by the natural resource based view (NRBV) theory of firm that the natural environment of a firm should be considered as strategic resources that can be employed by firm to achieve competitive advantage and thus, better firm performance.

Again, empirical evidence was found in this study to support the stakeholder theory which posits that firms should successfully manage the pressure from its stakeholder to achieve competitive advantage and hence better firm performance. This study found stakeholder pressure as significantly influential on sustainable environmental practices in manufacturing company. Among other factors, this study also found evidence that commitment of top management is another significant driving factor of environmental sustainability in manufacturing practices. It further adds that the role of top management in the implementation of sustainable environmental manufacturing practices is highly important.

Previous studies have made only few, if not no attempt to investigate the role of environmental regulation on the relationship between sustainable environmental manufacturing practices and firm performances in manufacturing industry. This study has contributed to knowledge through its findings which show that environmental regulation moderates on the relationship between SEMP and environmental performance. It was deduced from the findings that environmental performance in firm increases when firms experience a high environmental regulation. The indication of this in another word is that high environmental regulation should not be seen as a deterrent to achieving better performance, but should be regarded as a drive towards implementing sustainable environmental manufacturing practices. This provides support to Porter (1995) who asserts that a well-designed environmental regulation yields better performance.

Similarly, this study further contributes to knowledge by attempting the link to access the moderating effect of perceived benefits in manufacturing industry.

Although, this study is new in identifying the moderating role of perceived benefits, however, it is clear that perceived benefits moderates between SEMP and operational performance. In other words, this study found that operational performance in manufacturing firms can be achieved when environmental initiatives are perceived as benefits rather than as threats. As emphasized by Sharma *et al.,* (2009) that environmental initiatives should be perceived as benefits, but not as a threat to firm performance. Therefore, these findings are substantial in contributing to the domain of knowledge,

In addition, this current study has added to existing literatures in the aspect of sustainable environmental manufacturing practices, especially in developing countries. Sustainable environmental manufacturing practices are still considered as a new concept in developing countries as most studies on it were conducted in the developed countries (Arafat, *et al.* 2012; Rose *et al.*, 2011) considering the period it began and the amount of  available empirical studies conducted on the concept. Therefore, much more about the theoretical relationship between SEMP and firm performance requires more explanation, especially in Malaysia (Arafat *et al*., 2012) where only few or no similar studies have been conducted. The context of the current study (i.e. Malaysia) is relatively growing in the implementation of SEMP. As such, there is no doubt that literature concerning SEMP from this context is bound to be enriched.

### 6.5.2 Practical Implications

This study has revealed the current situation of sustainable environmental manufacturing practices in Malaysia. Hence, it has enhanced the understanding of the scenario and current level of implementation of SEMP in Malaysian Manufacturing firms, as SEMP is yet to be considered as strategic resources that can enhance the achievement of competitive advantages and better performance. The study, therefore, suggested that the environmental policy makers should create more awareness to enlighten the manufacturing practitioners not only to perceive sustainable environmental practices as ethical but also as a strategic factor in achieving better firm performance.

Porter and Vander Linde (1995; 1998) argued that if environmental regulation is well designed and properly channeled, it has a tendency to offset the cost of compliance and strive innovation which results in environmental and business performance. Hence, this study is beneficial to the environmental policy makers and the concerned authorities on environmental issues such as the Department of Environment (DOE) by suggesting a revisit of the blueprint about environmental regulation on SEMP to provide supportive environmental policies that will enhance a better firm performance in the Malaysian manufacturing industry. The next section presents the limitation of the study.

## 6.6 Limitation and Recommendation for Future Studies

This section presents the limitations encountered in the course of conducting this study. It also presents the directions for future studies; the basis of the directions for future studies is derived from the identified limitations.

It is usually assumed in the data collection phase of all survey research that respondents had adequate knowledge to answer the questionnaire and that the answers given by the respondents are truthful. Even though the questionnaire had been validly and reliably pre-tested and affirmed to have passed the validity and reliability test. The responses from the respondents may be differed from the intended. This study was conducted in a cross-sectional approach in which data were gathered at a point in time. However, some studies stated that the benefits of sustainable environmental manufacturing practices can be realized in a long term rather than short term. Therefore, studying the phenomena of sustainable environmental manufacturing practices in more than one point in time (longitudinal study) is required. Therefore, this research recommends that interested future researchers on sustainable environmental manufacturing practices should consider using longitudinal approach.

Furthermore, in the interpretation of the result, it is important to note that this study selected its sample from the manufacturing companies (i.e., food products and beverages, textile, wearing apparel, paper and allied products, chemical and allied products, rubber and plastics, basic metallic parts, electrical, electronic, computing machinery parts, transport equipment and others in a developing country (Malaysia). Although, these industries have been selected and used by many past studies, however, it is possible that the generalization of the result may not be applicable in a developed country or another developing country with different economic and political situation different from the context of this study. Therefore, the need for further studies is recommended to future researchers for comparison of results across different countries.

In addition, the data in this study were collected about the predictive and criterion variables from a single respondent of each selected manufacturing company. The data represent a self-reporting by the respondents. This creates a possibility for common method variance which might have been introduced using a self-report approach for data collection (Ramayah, 2010; Yang *et al.*, 2011). As a result of this, future researchers are advised to consider the collection of data from a multiple individuals in a particular manufacturing company to avoid issues related to common method bias.

## 6.7 Conclusion

This study has empirically revealed the established linkage and relationships among the variables and it has tested both the direct and the moderating relationships in order to provide answers to the aforementioned research questions in relation to the corresponding research objectives stated in the introductory chapter of the study. Upon the validation of the research instrument used in this study, data were collected from the operations, production and environmental/health and safety managers of manufacturing firms in Malaysia. These collected data were initially subjected to series of analytical procedures and finally analysed using smartPLS 2.0 M3 by Ringle *et al.*, (2005). The evaluation of both the measurement and the structural model was done and evidences were found to support the result of the analysis.

Precisely, three direct relationships were supported among the six hypothesized direct relationships. These supported relationships were evidenced in relation to their respective t-values. In addition, virtually all the six hypothesized moderating relationships showed evidences of moderating effects, but evidence was found in this study to support only two moderating relationships. The supported relationships in this study were evidenced at 10% significance level at one tail. It is revealed in this result that sustainable environmental manufacturing practices do not yield financial and operational performance, unless it is included as a strategic factor of the manufacturing firms. Therefore, it is suggested that Malaysian manufacturing firms should not only see SEMP as an ethical behaviour but incorporate it as a strategic factor towards achieving better financial and operational performance. Therefore, it is concluded that the research questions are answered and the objectives of this study as highlighted in chapter one are achieved.

Specifically, the number one objective of this study aimed at investigating the effects of the antecedent factors/drivers on sustainable environmental manufacturing practices in Malaysia. The result of this finding by using SmartPLS 2.0 M3 (Ringle *et al.,* 2005) found that top management commitment and stakeholder pressure influence the SEMP but public concern does not. As such, the first objective has been achieved in this study.

The second objective of this study, which aimed at investigating the effects of sustainable environmental manufacturing practices on firm performance found through the statistical analysis of this study that sustainable environmental manufacturing practices only directly influence environmental performance but does not have influence on financial and operational performance. However, this research views that for SEMP to gain influence on financial and operational performance, it must be included as the strategic factor of the firm.

The third objective of this study, which is to investigate the moderating effect of perceived benefits on the relationship between SEMP and firm performance was achieved. The result found that even though SEMP has tendency to improve performance, perceived benefit moderates the relationship between SEMP and operational performance. The relationship between SEMP; and financial and environmental performance were not significantly moderated by perceived benefit.

The fourth objective of this study aimed at investigating the moderating effect of environmental regulation between SEMP and firm performance was attained in this study. The result of the empirical investigation found that environmental regulation only moderates the relationship between SEMP and environmental performance. The relationship between SEMP; and financial and operational performance were not moderated by environmental regulation.

The study provided a model that explained the scenario of sustainable environmental practices in Malaysian manufacturing by investigating the antecedent factors, sustainable environmental manufacturing practices and firm performance via the moderating role of environmental regulation and perceived benefits. Thus, the fifth objective of this study, which aimed at developing a framework that provides a better understanding of the scenario of sustainable environmental manufacturing practices in the Malaysian manufacturing industry was achieved.

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