THE RELATIONSHIP BETWEEN GREEN SUPPLY CHAIN INTEGRATION AND SUSTAINABLE PERFORMANCE

By

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DECLARATION

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ABSTRACT

Green supply chain management (GSCM) has recently emerged to comply with regulations for environmental protection as a result of increasing environmental concerns over the past decades. Since manufacturing companies have often been charged for the environmental liabilities of their suppliers, there has been urgency for integration of environmental initiatives, not only within the walls of the company, but across the entire supply chain in order to ensure the company's sustainable performance. Consequently, Green Supply Chain Integration (GSCI) was introduced to integrate the environmental management practices within manufacturing companies, with the suppliers and the customers. However, there is lack of discoveries in terms of GSCI conceptualization. Therefore, this study was conducted to identify the relationship between Green Supply Chain Integration and sustainable performance. Specifically, the objective of this study is to examine the relationship between supplier integration, customer integration, internal integration, logistic integration, technology integration, and dimensions of sustainable performance namely economic, environmental, and social. A survey was conducted on ISO14001 Environmental Management System (EMS) certified manufacturing firms in Malaysia. A total of 107 questionnaires was completed by the respondents and considered to be appropriate for data analysis. The data was analyzed using Pearson's correlation analysis and multiple regression analysis. It was found that each variable in the GSCI is positively correlated with sustainable performance. Further investigation using multiple regression has shown that internal integration and technology integration to be the strongest predictors of sustainable performance. Apart from contribution to theoretical knowledge, the results would also be valuable in providing new insights to management in their environmental goals and sustaining successful performance within the pressures of stakeholders, customers, and environmental regulations.

Keywords: Green supply chain management, green supply chain integration, ISO 14001 Environmental Management System, supplier integration, customer integration, internal integration, logistic integration, technology integration, sustainable performance.

ABSTRAK

Pengurusan rantaian bekalan hijau kini adalah satu inisiatif terhadap perlindungan alam sekitar akibat daripada peningkatan masalah membabitkan alam sekitar sejak beberapa dekad yang lalu. Oleh kerana firma pembuatan sering dikenakan denda di atas liabiliti alam sekitar yang dilakukan pembekal mereka, wujudnya tekanan terhadap proses integrasi dalam pengurusan alam sekitar. Proses integrasi ini bukan sahaja melibatkan integrasi dalaman, malah turut membabitkan penglibatan secara menyeluruh dalam rantaian bekalan bagi memastikan prestasi mampan firma pembuatan. Sehubungan itu, integrasi rantaian bekalan hijau telah diperkenalkan untuk mengintegrasikan amalan pengurusan alam sekitar di dalam firma pembuatan, juga bersama dengan pihak pembekal dan pihak pelanggan. Walau bagaimanapun, masih terdapat kekurangan dari segi penemuan terhadap integrasi bekalan rantaian hijau secara konseptual. Lantaran itu, kajian ini dijalankan untuk mengenal pasti hubungan di antara integrasi rantaian bekalan hijau dan prestasi mampan. Secara khususnya, objektif kajian ini bertujuan untuk mengkaji hubungan di antara integrasi pembekal, integrasi pelanggan, integrasi dalaman, integrasi logistik, integrasi teknologi, dengan dimensi-dimensi prestasi mampan iaitu ekonomi, alam sekitar, dan sosial. Satu kaji selidik telah dijalankan terhadap firma pembuatan yang mempunyai pengiktirafan Sistem Pengurusan Alam Sekitar ISO14001 di Malaysia. Sebanyak 107 soal selidik telah dilengkapkan oleh responden dan dianggap sesuai untuk penganalisaan data. Data yang diperoleh dianalisis menggunakan analisis korelasi Pearson dan analisis regresi berbilang. Keputusan kajian mendapati bahawa setiap pemboleh ubah dalam integrasi rantaian bekalan hijau mempunyai hubungan yang positif dengan prestasi mampan. Siasatan lanjut menggunakan kaedah regresi berbilang menunjukkan bahawa integrasi dalaman dan integrasi teknologi menjadi peramal terkuat bagi prestasi mampan. Selain daripada sumbangan kepada pengetahuan teori, keputusan yang diperoleh juga amat penting dalam mencapai matlamat pengurusan alam sekitar dan mengekalkan prestasi organisasi yang baik, berikutan daripada tekanan daripada pihak berkepentingan, pelanggan, dan peraturan alam sekitar.

Kata Kunci: Pengurusan rantaian bekalan hijau, integrasi rantaian bekalan hijau, Sistem Pengurusan Alam Sekitar ISO 14001, integrasi pembekal, integrasi pelanggan, integrasi dalaman, integrasi logistik, integrasi teknologi, prestasi mampan.

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MODEL

LIST OF ABBREVIATIONS

Abbreviation		Meaning
μ	=	Error term
B	=	Unstandardized beta coefficient
CI	=	Customer Integration
CO2	=	Carbon Dioxide
e.g.	=	that is
Eco	=	Economic
EMS	=	Environmental Management System
EnSP	=	Environmental Sustainable Performance
Env	=	Environmental
ESP	=	Economic Sustainable Performance
FMM	=	Federation of Malaysian Manufacturers
GEMI	=	Global Environmental Management Initiative
GLC	=	Government-Linked Company
GSCI	=	Green Supply Chain Integration
GSCM	=	Green Supply Chain Management
i	=	respondent 1 2 …… 107
IEA	=	International Energy Annual Report
II	=	Internal Integration
ISO	=	International Organization for Standardization
JV	=	Joint Venture
KeTTHA	=	Ministry of Energy, Green Technology, and Water
KMO	=	Kaiser-Meyer-Olkin Measure of Sampling Adequacy
LI	=	Logistic Integration
MNC	=	Multinational Company
MS	=	Malaysian Standard

N	=	Population
OECD	=	Organisation for Economic Co-operation and Development
OHSAS	=	Occupational Health and Safety Advisory Services
PCA	=	Principal Component Analysis
SCM	=	Supply Chain Management
SI	=	Supplier Integration
SIRIM	=	Standards and Industrial Research Institute of Malaysia
SP	=	Sustainable Performance
SPSS	=	Statistical Package for Social Science
SSP	=	Social Sustainable Performance
TI	=	Technology Integration
α	=	Intercepts (constant value)

CHAPTER ONE

INTRODUCTION

1. Research Background

Supply chain management (SCM) has received increasing attention from industrialists in light of strategic planning in design, maintenance, and operation of supply chain process. Despite the improvements that have been achieved successfully with the help of SCM, some organizations overlooked the environmental issues including global energy, global warming, reverse logistic, and ecological concerns in global competition. With the increasing environmental concerns over the past decades, green supply chain management (GSCM) has recently emerged to comply with regulations for environmental protection (Cheng and Sheu, 2012; Abdullah, Hassan, and Johari, 2014). In order to fulfill environmental obligations, organizations recognize that they cannot work in isolation. Since companies have often been charged for the environmental liabilities of their suppliers (Rao, 2008), there has been an urgency to integrate environmental initiatives, not only within the walls of the company, but across the entire supply chain in order to ensure the company's sustainable performance (Cote, Lopez, Marche, Perron, and Wright, 2008).

Business sustainable performance happens when a company or firm creates ongoing value for its stakeholders and shareholders while keeping up with environmental requirement (Brent' and Labuschagne', 2004). Sustainability is a brilliant way of

performing business, and one of the essential parts of sustainability transition process is developing innovative and constructive corporate culture through integration (Chen, Okudan, and Riley, 2010). These healthy cultures would be able to create better organizational performance and make optimum use of existing assets for the good outcomes of economic, environment, and society (Dunphy, 2011). The result from having economic, environmental, and social sustainability would ensure satisfaction among the shareholders, supplier, customer, employee, and society.

Due to awareness of environmental protection on global level, Green Supply Chain Management (GSCM) has been receiving significant interest from researchers and practitioners of operation and supply chain management (Abdullah, Hassan, and Johari, 2014). The GSCM is now considered as an important management tool in improving sustainable performance particularly among manufacturing firms. The GSCM also refers to all stages of supply chain management which must comply with environmental protection requirements (Zhu and Sarkis, 2007). The manufacturers are required to employ Green Supply Chain Integration (GSCI) to integrate the environmental management practices within their companies, with the suppliers and the customers (Shi and Lin, 2003). This action will enhance inter-firm cooperation and encourage mutual GSCM as well as influence the firm's sustainable performance (Wu, 2013).

1.1 Background of Green Supply Chain Practices in Malaysia

Ministry of Energy, Green Technology, and Water (KeTTHA) has been taking a holistic approach to advocate green technology and practices in the country. Since the launching of National Green Technology Policy by the Prime Minister on 24th July 2009, the government has consistently introduced various programs and incentives. The active promotion of green initiatives and exposures is critical to ensure that the green agenda will reach all Malaysians with the expectation that Malaysians will adopt a green culture and leave a 'green' Malaysia for the generations to come. As the Prime Minister of Malaysia, Datuk Seri Najib Tun Razak has urged business organizations to adopt a green culture in their practices and operations. Despite the urge, the degree of intention to adopt green practices among local firms, specifically manufacturing firms are still ambiguous and they are still in the learning process in terms of how to employ the green practices in their daily activities (Sarkis, 2012).

1.2 Problem Statements

Each country is facing with different pressures particularly where environmental issues are concerned (Christmann and Taylor, 2001). Based on International Energy Annual Report (2007), manufacturing industries are significantly responsible for the consumption of a huge amount of resources and waste generation globally. Manufacturing sector is also responsible for emission of 36% of carbon dioxide (CO2) in the world (OECD, 2009). Therefore, a renewed focus on the impact of manufacturing industries' stakeholders such as the regulatory makers, shareholders, customers, and employees have been requiring

manufacturing organizations to be more responsible toward the environments with respect to their products and the process (Amrina and Yusof, 2011).

There are many companies yet to adopt green supply chain management concept in their business operation (Wooi and Zailani, 2010). The resistance toward integrated GSCM practices has been caused by the high cost of adopting such practices (Anbumozhi and Kanada, 2005). Due to this impediment, the establishment of KeTTHA on 9th April 2009 has encouraged business organizations to take up green cultures in their business operation as well as to promote green practices. Governmental laws and regulations as well as public consciousness of environmental effects have been the main drivers of green supply chain and corporation sustainability (Liu, Kasturiratne, and Moizer, 2012). In order to ensure efficient integration of the entire supply chain process, GSCM practices are needed to be applied simultaneously rather than independently (Kim, 2006). However, the integration practices involving the likes of supplier, manufacturer, customer, logistic, and technology across the entire green supply chain remain unclear (Yu, Chavez, Feng, and Wiengarten, 2014).

Incomplete conceptualizations have generated inconclusive results about the relationship between GSCI and firm's sustainable performance (Green, Zelbst, Meacham, and Bhadauria, 2012). Prior studies (e.g., Walton, Handfield, and Melnyk, 1998; Zailani, Jeyaraman, Vengadasan, and Premkumar, 2012) have separately investigated internal and external characteristics when investigating the supply chain and inter-organizational performance (Wong, Lai, and Cheng, 2009; Yu et al., 2014). Previous studies have also been found to be limited in term of GSCI conceptualization by leaving out two important dimensions of GSCI namely logistic integration and technology integration (Wu, 2013). There is a need to investigate on the linkage of individual dimension of the GSCI and each

dimension of firm's sustainability performance (Vachon and Klassen, 2008). These situations demand further investigation on the association between GSCI practices and sustainable performance.

In Malaysian context, within the implementation of the GSCM, further study on the integrated GSCM practices are required (Abdullah, Hassan, and Johari, 2014). Most researchers conducted studies on the GSCI in countries like Taiwan and China (Rao, 2002; Zhu and Cote, 2004) which may share similar social-cultural situation as Malaysia. However, earlier works and reviews have a narrow perspective and limited focus as they did not cover adequately all the aspects of the GSCI practices and their relationship with sustainable performance (Abdullah, Hassan, and Johari, 2014).

Responding to this need, this study is deemed necessary to bridge the gap on the GSCM particularly on the relationship between GSCI practices and their impact on sustainable performance. Therefore, the current study also aims to explore the conceptualization of the GSCI by enriching with new variables of logistic integration and technology integration and their relationships with sustainable performance.

1.3 Research Questions

The study aims to examine the relationship between Green Supply Chain Integration (GSCI) and Sustainable Performance. Therefore, the study attempts to answer the following questions:

1. Is there any relationship between supplier integration, customer integration, internal integration, logistic integration, technology integration and sustainable

performance (economic sustainable performance, environmental sustainable performance, social sustainable performance)?

2. Which of the GSCI practices (supplier integration, customer integration, internal integration, logistic integration, and technology integration) has the most impact on sustainable performance?

1.4 Research Objectives

This research intends to accomplish the following objectives:

1. To determine the relationship between supplier integration, customer integration, internal integration, logistic integration, technology integration and sustainable performance (economic sustainable performance, environmental sustainable performance, social sustainable performance).

2. To determine which practice of GSCI (supplier integration, customer integration, internal integration, logistic integration, and technology integration) has the most impact on sustainable performance.

1.5 Research Scope

The study focused on Malaysian Standard (MS) ISO (International Organization for Standardization) 14001 certified manufacturing firms in Malaysia in order to answer the research questions and to accomplish the research objectives. This particular type of

companies have been chosen because they were expected to adopt green practices and initiatives within their operations (Darnall, Jolley, and Handfield, 2006; Zhu, Sarkis, Cordeiro, and Lai, 2008). Manufacturing firms have been identified as the main contributor of environmental deterioration in Malaysia (Rusli, Rahman, and Ho, 2012). Apart from that, manufacturing sector has also been selected as it represents the largest sector in terms of sales, employment, and contribution to the nation's economy (Abdullah et al., 2014).

According to Standards and Industrial Research Institute of Malaysia (SIRIM) and Federation of Malaysian Manufacturers (FMM) directory in August 2014, there were 722 ISO 14001 certified manufacturing companies in Malaysia. Each company selected as sample would be represented by a personnel from management level who has been appointed as in dealing or taking care of Environmental Management System (EMS) or ISO documentations in the company. Therefore the unit of analysis applied in the study is organization.

1.6 Significance of the Research

This study contributes to GSCM knowledge in several ways. The green supply chain management continues building up interest among researchers. In Malaysia, green practices are still developing and there is a need to investigate GSCI practices in bigger scope as well as its implementation in the country (Abdullah et al., 2014). The current study provides empirical evidence and develops a more comprehensive research framework of the GSCI and its relationship with sustainable performance. Apart from that, the study is expected to highlight the importance of green supply chain integration practices by providing thorough reviews and insights related to the research area.

Many firms in developing countries like Malaysia are still learning on how to incorporate green practices through their daily operations (Rao, 2002; Sarkis, 2012). Constant study is required for managerial and practical contribution. The findings of the study could provide beneficial information in helping manufacturing companies to identify effective approaches towards successful green supply chain practices as well as ensuring their sustainable performance. Furthermore, it is hoped that the empirical results obtained from the study are able to provide valuable insights not only for manufacturers in Malaysia, but also for manufacturing firms in other industrial nations, where the industry has been internationally integrated and might be more culturally or politically sensitive to environmental issues (Sarkis, Torre, and Diaz, 2010). Through the investigation on the integration of green supply chain, the results from the study are believed to be valuable for management in their environmental goals and to sustain a successful performance within the pressures of stakeholders, customers, and environmental regulations.

1.7 Organization of the Thesis

This report is divided into five chapters. Chapter 1 discusses introduction of the study which describes the direction of this study by presenting problem statements, research objectives, research questions, research scope, and significance of the study. This chapter is important to provide an understanding to the reader about the purpose of the study.

Chapter 2 discusses in-length about literatures and existing studies related to sustainable performance among manufacturing firms and the GSCI. Chapter 3 explains about research methodology for the study. Theoretical framework, research hypotheses, research design, operational definition, research sample and population, data collection

method, and data analysis involved are described further in Chapter 3 to achieve the objective of the study.

The analysis and findings of the study are discussed in Chapter 4. This chapter presents results from the analyses to the reader with related explanations and discussions. Lastly, the findings' implication, the limitation of the study, and the future research' direction are explained in Chapter 5.

CHAPTER TWO

LITERATURE REVIEW

2 Introduction

The main objective of this chapter is to provide a review on the literatures relevant to the key constructs of the study. It includes reviews of relevant articles related to overview of manufacturing firms and environmental issues, sustainable performance and its dimensions, the approach of GSCI toward green supply chain management, the dimensions of GSCI (supplier integration, customer integration, internal integration, logistic integration, technology integration), and lastly the coordination theory. Based on these literatures from past studies, the hypotheses were then developed in the form of correlations to achieve the objectives of the study.

2.1 Manufacturing Firms and Environmental Issues

Liu et al. (2012) defined manufacturing firms as "business firms that uses components, parts or raw materials to make a finished good, where these finished goods can be sold directly to consumers or to other manufacturing businesses that use them for making a different product".

According to IEA (2007), manufacturing industries are significantly responsible for the consumption of a huge amount of resources and waste generation throughout the world. From 1972 to 2004, there was an increase of 61% in the consumption of energy by manufacturing industries which consists of a third of the global usage of energy. Apart from being the main cause of environmental issues like increasing levels of pollution, overflowing waste sites, and diminishing raw material resources, manufacturing sector is also responsible for emission of 36% of carbon dioxide (CO2) in the world (OECD, 2009). Therefore, a renewed focus on the impact of manufacturing industries' stakeholders such as the regulatory makers, shareholders, customers and employees have been shifted to seeking from the manufacturing organizations to be more responsible to their environments with respect to their products and the process (Amrina and Yusof, 2011). The concept of sustainable manufacturing practices relates toward the procedures, policies, and the techniques used by firms in monitoring and controlling the effects of their production processes and operations on the natural environment (Montabon, Sroufe, and Narasimhan, 2007).

2.2 Sustainable Performance

Business sustainable performance happens when a company or firm creates ongoing value for its stakeholders and shareholders while keeping up with environmental requirement (Brent' and Labuschagne', 2004). There are few essential aspects of firm's sustainable value which are; doing well for the environment and society, and more importantly by keeping the customer and shareholders happy. According to Dunphy (2011), "sustainability consists of actions that extend socially useful life of the organization,

enhance the ability to maintain and renew viability of the biosphere and protect all living species, enhance ability of society to maintain itself and to solve its major problem and to maintain a decent of welfare, participation and personal freedom for present and future generations of humanity".

Sustainability is a brilliant way of performing business, and transitions toward sustainable enterprises can be made by developing innovative and constructive corporate culture. These healthy cultures would be able to create high performance and make optimum use of existing assets in ways that have good outcomes for the economic, environment, and society (Dunphy, 2011).

Chen et al. (2010) pointed out three criteria of sustainable performance; economic sustainable performance, environmental sustainable performance, and social sustainable performance. In 2001, the European Commission published a sustainable development strategy by emphasizing the importance of social cohesion, environmental protection, and economic growth to go hand in hand (Pei, Amekudzi, Meyer, Barrella, and Ross, 2010). Guan, Cheng, and Ye (2010) addressed sustainable supply chain management as "a modern management pattern emphasizing on the integration of the economy, environment, and society through all the processes including procurement, producing, packaging, transportation, storage, consumption and disposal of the end-life product, supported by supply chain management technology, and its final goal is to achieve the sustainable development of economy, environment and society".

The proposed framework applied in this study to assess the sustainability performances can be divided into three main sustainability dimensions as proposed by Brent' and Labuschagne' (2004). These dimensions are economic sustainability,

environmental sustainability and social sustainability. Therefore, in embracing the whole concept of sustainability, these three pillars of sustainability is crucial to run a successful business not just for now but for the future (Eweje, 2011).

2.2.1 Economic Sustainable Performance

Economic sustainability is continuing to be one of major goals for business firms. According to Green et al. (2012) and Liu et al. (2012), economic sustainable performance is **"**evaluation of organizational cost reduction, promotes market shares, return on assets, improve income, and profits regarding the economic goals of performance". The implementation of GSCM practices among manufacturing firms has resulted better economic performance (Green et al., 2012). The positive result from economic aspect can be achieved through multiple direct pathways of sustainable supply chain management (Liu et al., 2012). Previous research from Eltayeb, Zailani, and Ramayah (2011) investigated on green supply chain initiative among Malaysian certified companies and the result has confirmed the positive relationship between economic performance and green supply chain initiatives. Consumers are the main driver of green practices implementation and playing huge role by demonstrating their influence and environmental conscious in choosing companies, increasing competitiveness, and economic performance (Andic, Yurt, and Baltacıoğlu, 2012).

Companies with practices to achieve sustainable performance are able to improve economic performance in term of income, profit, tax, as well as taking care of employee's welfare financially (Zhu, Sarkis, and Lai, 2012). The importance of economic sustainability performance has also been highlighted by Chien and Shih (2007) where they discovered

that integrated GSCM is beneficial in reducing costs, promoting market shares, and increasing enterprises profits. Chan, He, and Wang (2012) through their study on environmental and corporate performance have also proved significant relationship of GSCM on firms' earning growth, market share, sales growth, and tax returns on investment.

2.2.2 Environmental Sustainable Performance

Environmental concerns and conscious are driving business firms to look onto their operational impacts. Referring to Junquera, Brío, and Fernández (2012), environmental sustainable performance is defined as **"**the evaluation of organizational reduction for emissions, decrease of consumption for hazardous or harmful materials, and efficient energy or resources use". Environmental sustainable performance is 'achievements in reducing the resource usage, pollution emitted, and waste generated resulting from the undertaken efforts (Brent' and Labuschagne', 2004). Environmental sustainable performance is also strongly related to environmental goals of organization including the decrease of frequency for environmental accidents and solutions to improve an enterprise's environmental situation (Chien and Shih, 2007). The environmental performance can also be a useful indicator in decreasing environmental risks, as well as supporting external communication and policy-making for both public and private sectors (Mazzi, Mason, Mason, and Scipioni, 2012).

2.2.3 Social Sustainable Performance

The business firms have a huge responsibility socially where they need to take care of their employees and societies. Teraji (2009) defined social sustainable performance as "evaluation of organization on healthy work environment, social commitment and participation, education and training, and human resources development". He added that as awareness among consumers on corporate social performance increases, management increasingly recognizes their responsibility for implementing ethical programs to enhance social welfare. There are several domains namely human resources, corporate governance, human rights, and environment that should be properly assessed (Bessire and Onnee, 2010).

Brent' and Labuschagne' (2004) referred social sustainable performance as 'achievements in creating social welfare (for various stakeholders including supplier, employee, customer and society) resulting from the undertaken operational efforts. In detail, the management have full responsibility in the implementation of social commitment and participation, social administrative policies, human resource management, and healthy working environment. Apart from that, United Microelectronics Corporation (2012) quoted that the responsibility also includes employee benefits, staff relations, talent development, working conditions, public welfare support, social concerns, and response. Exposure on social sustainable performance would ensure organization in achieving its mission and vision as well as to stay competitive in the market.

2.3 Green Supply Chain Management (GSCM) and Green Supply Chain Integration (GSCI)

Green supply chain management is “delivering products and services from suppliers, manufacturers to end customers through material flow, information flow and cash flow in the context of environment” (Zhu et al., 2008). Srivastava (2007) referred the GSCM as “integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life”. Due to the regulatory requirements and customers pressures, the scope of GSCM ranges from reactive monitoring of the general environmental management to more proactive practices implemented through various reverse activities such as recycle, refurbish, re-use, remanufacture, and rework.

The GSCM has gained increasing interest among researchers and practitioners of operations and supply chain management. The growing importance of GSCM is driven mainly by the escalating deterioration of the environment, such as increasing levels of pollution, overflowing waste sites, and diminishing raw material resources. However, it is not just about being environmentally friendly; it is about good business sense and higher profits. In fact, it is a business value driver and not a cost center (Wilkerson, 2005). Since manufacturing companies have often been charged for the environmental liabilities of their suppliers (Rao, 2008), there has been an urgency to integrate environmental initiatives, not only within the walls of the company, but across the entire supply chain involving all supply chain partners to ensure the company’s sustainable performance (Cote et al., 2008).

The requirement toward involvement of green supply chain partners leads to introduction of GSCI, an approach to green supply chain management. It is defined as "strategic collaboration of partner firms in a supply chain to manage the operational and environmental impacts of supply chain activities by coordinating the intra- and inter-organizational processes" (Economic and Social Resource Council, 2015). The GSCI explains on how and why green integration leads to better performance, and what and who are supposed to be integrated (Wong, Wong, and Boon-itt, 2015).

Coordination of environmental management among supply chain partners is also called as environmental collaboration (Economic and Social Resource Council, 2015). This collaboration within supply chain partners can be impaired by the lack of supply chain integration. The integration within a supply chain can be expected to positively influence cooperative activities related to environmental (Canning and Hanmer-Lloyd, 2001). Therefore, the GSCI can be considered as "a novel concept when firms develop an approach to strategically integrate with suppliers, customers, internal, logistic, and technology to reduce environmental impacts" (Zhu et al., 2010; Economic and Social Resource Council, 2015). Successful GSCI practices would contribute to reduction of environmental impacts of the supply chain (Zhu et al., 2010).

2.3.1 Supplier Integration

Supplier refers to a party that provides materials, parts, services, and goods directly to a manufacturer (Russell and Taylor, 2009; Slack, Chambers, and Johnston, 2010). The definition of supplier integration is "environmental collaboration between a firm and its suppliers in implementing environmental management practices" (Vachon and Klassen,

2008). It is a phase where upstream segment of company's supply chain and product are focused (Zhu and Cote, 2004). Suppliers should be involved in the implementation of environmental practices in terms of material management procedures and purchasing processes (Rao and Holt, 2005). The supplier's environmental performance is increasingly monitored by manufacturing organizations to ensure that the equipment or materials supplied have gone through environmental-friendly processes (Rao and Holt, 2005). According to GEMI (2001), the main players in automobile industries like Toyota and Ford have required their suppliers to obtain ISO 14001 certifications in supporting the environmental initiatives. This is due to the reason that suppliers are important partners as they can be in a position to provide assistance to improve environmental performance of the supply chain (Seuring and Muller, 2008).

2.3.2 Relationship of Supplier Integration and Sustainable Performance

Previous studies (e.g., Vachon and Klasson, 2006; Vachon, 2007; Zhu et al., 2010) have proved that supplier integration is positively related to organizational sustainable performance. Vachon and Klassen (2006) have found that collaboration with suppliers could improve sustainable performance of one organization economically and environmentally. Developing collaborative relationship with suppliers is also favorable for an effective adoption, development, and implementation of the GSCM toward social contributions (Geffen and Rothenberg, 2000; Vachon, 2007). Zhu et al. (2010) emphasized the significance of supplier integration and sustainable performance by stating that the lack of supplier collaboration would weaken sustainable performance improvements among

manufacturing firms. Based on the literature reviews, these hypotheses have been proposed:

H1 There is a positive relationship between supplier integration and sustainable performance.

2.3.3 Customer Integration

Customer is a party that receives or consumes products (goods or services) and has the ability to choose between different products and suppliers (Slack, Chambers, and Johnston, 2010). The customer in supply chain scope includes merchandiser, retailer, wholesaler, online retailer, and consumers (Russell and Taylor, 2009). Integrating customer from GSCM perspective can be defined as "environmental collaboration between a focal firm and its customers that aims to fulfil customer environmental requirements" (Vachon and Klassen, 2008). It focuses on the downstream side of the supply chain. Customer integration covers the level of integration in adopting green supply chain management practices for environmental management, planning purposes, and to find solutions of environmental problems (Wu, 2013).

Zhu et al. (2010) managed to identify opportunities for firms in conducting environmental integration with their customers. One of these opportunities is by building great long term relationship with customers as it is a key to a successful implementation of environmental practices (Zhu et al., 2010; Green et al., 2012). Previous study by Christmann and Taylor (2001) has shown that the main driver for manufacturers to improve their environmental practices and image is customer pressure. Apart from that,

understanding the needs of customer is an important aspect in creating value. Due to pressures from the customers, it is critical for firms to conduct environmental collaboration with them to develop joint environmental planning and achieve environmental goals collectively (Vachon and Klassen, 2008).

2.3.4 Relationship of Customer Integration and Sustainable Performance

Previous study by Green Brand Survey (2010) indicated that customers in developed countries like Australia, United States of America, and United Kingdom are willing to cooperate with manufacturers to achieve environmental goals and they prefer to purchase from environmentally responsible company (Chen et al., 2012). Findings from the study also shows positive correlation between customer integration and sustainable performance where these green-oriented customers assess green attributes of a service or product via their purchases. This situation affects organizational sustainable performance in term of economic, environmental, and social (Chen et al., 2012).

It is also found that customer collaboration determines economic performance and competitive advantage of one business organization (Andic et al., 2012). Research by Eltayeb et al. (2011) has proved a significant relationship between customer integration and environmental sustainable performance. Whenever a new product is introduced, customer involvement is always crucial as the product features related to green concept need to be presented and clearly defined by manufacturers (Chan et al., 2012).

Yeung, Lo, Yeung, and Cheng (2008) and Ellram, Tate, and Carter (2008) also emphasized that interaction between manufacturers and customers can improve

organizational sustainable performance. Similarly, the literature about 'lean and green' from Simpson, Power and Samson (2007) stated that the level of customer's collaboration is positively related to environmental and social sustainable performance of firms. Thus, these hypotheses were further proposed:

H2 There is a positive relationship between customer integration and sustainable performance.

2.3.5 Internal Integration

Internal integration is referred to "environmental management practices conducted within a company" (Rao and Holt, 2005). Wu (2013) classified internal integration as "level of integration in combining and improving information and internal resources in the company to generate knowledge sharing beyond the boundaries of individual functions or departments in reducing and preventing pollutions". Communication and cooperation are crucial to successful environmental practices as GSCM involves all departmental boundaries between and within organizations (Aspan, 2000). Zhu et al. (2008) also stressed about the influence of coordination across functional department within the entire supply chain to improve environmental management.

Most of the time the implementation and adoption toward environmental practices internally seem to be the main issue (Zhu, Geng, and Lai, 2010). However, the GSCM practices like minimizing wastes and attracting customer cooperation for eco-design of product for instance, would require internal coordination mechanisms (Zhu et al., 2010). There are many firms going toward environmental direction these days with their

environmental management systems, environmental auditing of departments, internal evaluation of environmental reports, and certification of ISO 14001 (Klassen and Johnson, 2004; Zhu et al., 2010). Therefore, cooperation from within the organization is essential to ensure sustainable performance, economically and socially as well as achieving environmental objectives.

2.3.6 Relationship of Internal Integration and Sustainable Performance

Past study by Green et al. (2012) investigating GSCM among firms has shown that collaboration and cooperation from organization internally leads to a better overall sustainable performance. Eltayeb et al. (2011) added that the economic aspect could be gradually increased through efficient internal integration from the adoption of GSCM. Many companies which integrate with the GSCM are able to create competitive market shares and increase the profits (Chien and Shih, 2007). According to Zhu et al. (2010), lack of internal resource and managerial support lead to economic failure.

Eltayeb et al. (2011) have also found positive relationship between internal integration and environmental sustainable performance. Previously, Sroufe (2003) found that an environmental management system (EMS) adopted in organization positively affects operational performance measure such as production waste reduction.

The integration within manufacturer via sustainable design practice also improves income, employee's welfare, and profit (Zhu et al., 2012). The internal coordination mechanisms like exposure of cross-functional cooperation and having specialized staff on environmental issues are correlated to social sustainable performance, including the likes

of safer working environment, increased happiness, motivation, involvement, social commitment, and high participation among the staffs (Zhu et al., 2010). Referring to previous studies, these hypotheses were proposed:

H3 There is a positive relationship between internal integration and sustainable performance.

2.3.7 Logistic Integration

Logistics integration is "environmental management practices of the planning, implementing, and controlling of goods or service to the point the consumer or customer is served" (Oy and Kamthunzi, 2014). Vachon (2003) defined logistic integration in GSCM scope as integration in adopting green supply chain management practices that relates to the supplier and the customer in terms of managing information and material flow along supply chain management.

Logistic can be further understood as a movement process of material or people from point a to point b but taking into account the flow of information too, an example of a water bottle putting in mind that water is life, the whole process from the point the water is drawn from its source till it reaches the consumer is critical. There are many things to be taken care of as it needs to be transported at the right time, to the right place, and in the right condition. Under the scope of green practices, every process of material and information movements needs to be carried within environmental requirements.

The adoption of sustainable performance management requires a good flow of information in the supply chain to ensure great decisions made by the managers (Lee and

Saen, 2012). Traditionally, supply chain performance and logistics focus on time, cost, and accuracy (Shaw, Grant, and Mangan, 2010). In other words, the logistic integration involving the supplier and the customer lead to time efficiency, cost reduction, and accuracy of information exchange (Lee and Saen, 2012). Unfortunately, one of the main causes that may hinder the organizational sustainable performance goals is logistical and technological integration (Hervani, Helms, and Sarkis, 2005). For many manufacturers, achieving sustainable performance goal through logistics is a tough challenge to overcome without strong collaboration or cooperation among green supply chain partners (Weinhofer and Busch, 2012).

2.3.8 Relationship of Logistic Integration and Sustainable Performance

Logistics management and environmental sustainable performance linkage is still a new phenomenon (Lee and Wu, 2014). Recent study from Lai and Wong (2012) has found that green logistics management improves operational efficiencies, reduces waste, conserves resources, and satisfies social expectation for environmental protection. Similarly, Pazirandeh and Jafari (2013) characterize green logistics as that "which is designed not to only be environmentally friendly, but also economically functional". In addition, Lee (2011) has also found that selection of optimized transportation channels can simultaneously reduce environmental impacts and achieve cost. This notion proves that environmental practice via logistics increase the sustainable performance of business firms. These literatures also have a common key message that green logistic is reducing organization's environmental impact while improving the efficiency of operation including better resource utilization and cost savings.

The main role played by logistic integration involving manufacturers, suppliers, and customers is important in determining effective green logistics management (Hervani, Helms, and Sarkis, 2005). The collaboration among the supply chain partners mainly on material and information flow may be able to predict organizational sustainable performance. Based on the importance of logistic integration from the conceptual of GSCI (Wu, 2013), the relationship between logistic integration and sustainable performance was investigated through development of these hypotheses:

H4 There is a positive relationship between logistic integration and sustainable performance.

2.3.9 Technology Integration

Technology integration can be defined as "environmental practices of the use of technology tools taking place between a buying and supplying organization regarding activities such as product development, process reengineering, and technical training" (Wu, 2013). The term technological is defined broadly to include not only structural aspects such as product and process related changes, it also includes managerial techniques and expertise (Vachon, 2003).

The technology integration in green supply chain activities is becoming a necessity in most industries due to rapid movement in green technology (Nidumolu, Prahalad, and Rangaswami, 2009). Innovation of green technology is the key driver to achieve sustainable development and aims to decrease the bad impact of product lifecycle toward environment (Dangelico and Pujari, 2010). Although technology integration is an

important part of the GSCI, it is always hard to obtain the latest green manufacturing technologies (Wu, 2013). Furthermore, apart from being costly affair, integration of technology is also challenging and need to be carried with exhaustive pre-analysis (Nidumolu et al., 2009). Due to this situation, manufacturers are more likely to lack the knowledge of green technology. Therefore, the manufacturer should make an effort to acquire information across the supply chain internally and externally through assistance and training as a result of inadequate professional knowledge about processes or new products (Koufteros, Vonderembse, and Jayaram, 2005).

2.3.10 Relationship of Technology Integration and Sustainable Performance

Previous study by Huber, Michael and McCathie (2007) shows that the use of technology in supply chain contributes to effective communication, unique product identification, and real time information. A plethora of technologies having customer centric features and information-intensive provide enormous benefits like reduced costs, increased flexibility, and enhanced coordination (Andic et al., 2012). The technology integration in green supply chain management should be able to help tracking the progress of green initiatives practiced in an organization, which automatically increases the possibility to achieve environmental goals (Bushar, Zanwar, Jain, and Rao, 2014). However, the technology integration still requires involvement from supplier and customers in term of product design, training, and assistance to improve company's economy, environmental, and social performance (Vachon, 2003).

The relationship of technology integration and performance are interconnected as shown by several empirical studies (Huber, Michael, and McCathie, 2007; Gunasekaran,

Lai, and Cheng, 2008; Andic et al., 2012; Bushar et al., 2014). However, to the best knowledge of the author, to date, there is still no investigation linking the technology integration from GSCM scope and organizational sustainable performance via three dimensions of economy, environmental, and social. There are still limitations on GSCI conceptualization by leaving out technology integration (Wu, 2013). This requires further investigation on the association between technology integration and sustainable performance. Therefore, four hypotheses have been proposed:

H5 There is a positive relationship between technology integration and sustainable performance.

2.4 Coordination Theory

The underpinnings theory used in this study is coordination-theoretic perspective in supply chain management. Coordination theory was initially developed by Malone and Crowston (1994), explaining about dependencies between the tasks the different group members are carrying out and the coordination mechanisms the group use to coordinate their work by considering alternative mechanisms. The theory has been widely used to analyze inter-organizational dependencies and alternative mechanism's influence in the supply chain activities through prior studies by Gosain, Malhotra, and El Sawy (2004), Legner and Schemm (2008), and Lai, Wong, and Cheng (2010).

Zhu, Sarkis, and Lai (2010) made a revision toward the theory with an aim to fit the integration approach of green supply chain management. It consists the combination of external (supplier and customer) and internal (manufacturer) integration of GSCM

practices. The coordination theory is a strong fundamental in explaining collaboration or integration in GSCM as it covers both inter- and intra- organizational practices (Zhu et al., 2010). According to Malone and Crowston (1994), coordination theory suggests that organizations should integrate activities along their supply chain. Referring to the theory, it is stated that dependency exists in activities and needs to be managed appropriately. GSCM practices are coordinated through the relationship and communications that occur among supply chain partners, and the strength of these integration predicts superior performance (Shah, Goldstein, Unger, and Henry, 2008). The importance of strategic supply chain management has been mentioned since 1990's where improved collaborations, relationship, and information exchange are crucially required (Gunasekaran et al., 2008). Both internal and external organizational changes are needed for successful GSCM with the aim to operate as cooperative value chains (Lai and Cheng, 2009). Greater coordination, both inter- and intra-organizational lead to greater organizational performance (Lai, Cheng, and Yeung, 2005).

Coordination mechanism is served by external and internal practices and the implementation of the GSCM itself to extend activities across the supply chain, manage the task dependency between supply chain processes, and improve balance of economic, environmental, and social performance (Zhu et al., 2010). In order for organizations to perform well, external and internal practices need to be aligned and coordinated mainly through collaboration of supply chain partners. Therefore, based on the theory used, the study extends theoretical contributions of the GSCI through addition of logistic and technology integration.

2.5 Conclusion

The literature review has presented the topics that are related to this research. They include definitions and overviews on sustainable performance, supplier integration, customer integration, internal integration, logistic integration, and technology integration. Although there are existing studies on the correlation of the GSCI and sustainable performance, they were studied separately for both external (supplier and customer) and internal (manufacturer) variables (Yu et al., 2014). Furthermore, the linkage of logistic and technology integration under the GSCI construct and dimensions of sustainable performance are still inconclusive. Due to the regulation and pressures on environmental protection, the manufacturers are obligated toward integration with their supply chain partners. Within the fundamental of Coordination Theory, hypotheses were then developed for investigation referring to the past studies. The next chapter would explain about the method used in the study to answer the research questions and research objectives.

CHAPTER THREE

RESEARCH METHODOLOGY

3. Introduction

The main purpose of the chapter is to discuss the method and to provide a better understanding of the direction of the study. In conducting this study, several studies were reviewed in designing the most appropriate methodology. Research methodology is an important factor in ensuring the reliability, validity, and accuracy of results. The approach used for data analysis and sampling method should be identified to ensure they meet and associate with the research objectives.

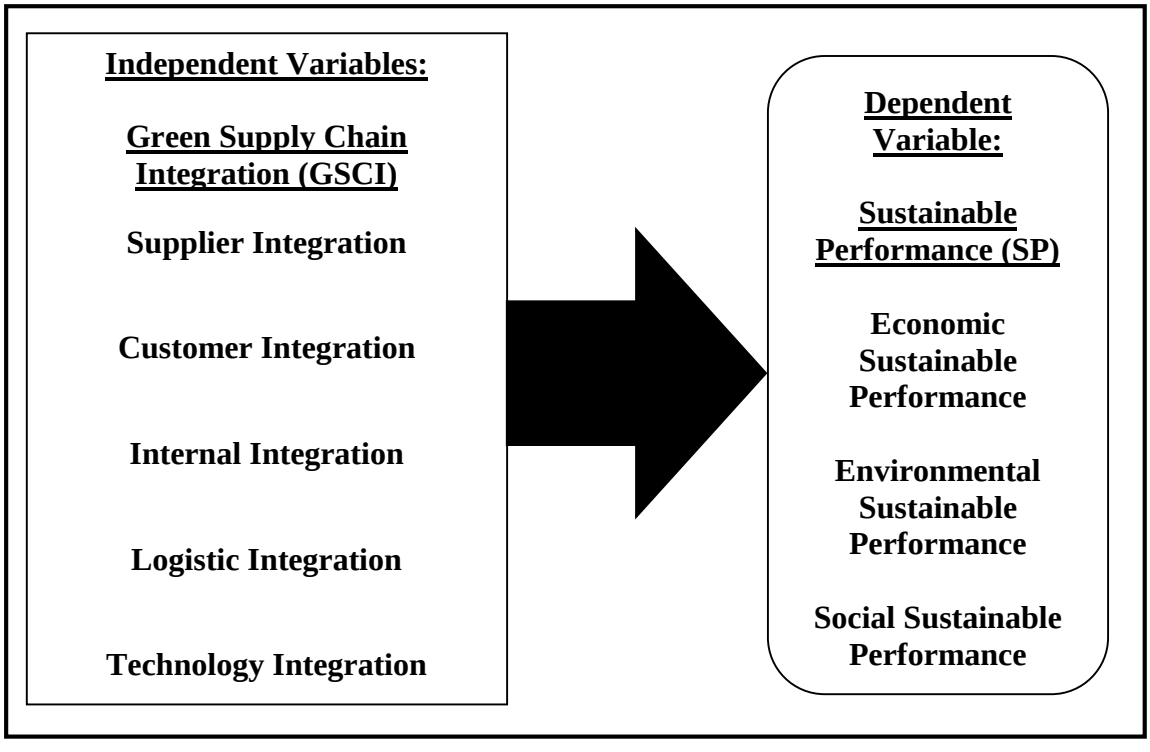
In depth, this chapter explains about methods used to measure and analyze data including theoretical framework, research hypotheses, research design, operational definition, research sample and population, instrumentation method, variables measurements, data collection procedures, and data analysis techniques.

3.1 Theoretical Framework

The study focuses on the relationship between Green Supply Chain Integration (GSCI) consisting of supplier integration, customer integration, internal integration, logistic integration, technology integration and Sustainable Performance (SP) of ISO 14001

certified manufacturing firms in Malaysia. The theoretical framework of the study is shown in Figure 3.1.

Figure 3.1
Theoretical Framework



3.2 Research Hypotheses

Based on the theoretical framework, the following hypotheses are formulated:

H1 There is a positive relationship between supplier integration and sustainable performance.

H1a There is a positive relationship between supplier integration and economic sustainable performance.

H1b There is a positive relationship between supplier integration and environmental sustainable performance.

H1c There is a positive relationship between supplier integration and social sustainable performance.

H2 There is a positive relationship between customer integration and sustainable performance.

H2a There is a positive relationship between customer integration and economic sustainable performance.

H2b There is a positive relationship between customer integration and environmental sustainable performance.

H2c There is a positive relationship between customer integration and social sustainable performance.

H3 There is a positive relationship between internal integration and sustainable performance.

H3a There is a positive relationship between internal integration and economic sustainable performance.

H3b There is a positive relationship between internal integration and environmental sustainable performance.

H3c There is a positive relationship between internal integration and social sustainable performance.

H4 There is a positive relationship between logistic integration and sustainable performance.

H4a There is a positive relationship between logistic integration and economic sustainable performance.

H4b There is a positive relationship between logistic integration and environmental sustainable performance.

H4c There is a positive relationship between logistic integration and social sustainable performance.

H5 There is a positive relationship between technology integration and sustainable performance.

H5a There is a positive relationship between technology integration and economic sustainable performance.

H5b There is a positive relationship between technology integration and environmental sustainable performance.

H5c There is a positive relationship between technology integration and social sustainable performance.

3.3 Operational Definitions

Supplier: "Company that provides parts, materials, goods, and services directly to a manufacturer" (Russell and Taylor, 2009; Slack, Chambers, and Johnston, 2010).

Customer: "A first tier party includes merchandiser, retailer, wholesaler, and online retailer that receives products (goods or services) and has the ability to choose between different products and suppliers" (Russell and Taylor, 2009; Slack, Chambers, and Johnston, 2010).

Manufacturing Firms: "Business firms that uses components, parts or raw materials to make a finished good, where these finished goods can be sold directly to consumers or to other manufacturing businesses that use them for making a different product" (Liu et al., 2012).

ISO 14001 Environmental Management System (EMS): "Tool for managing the impact of an organization's activities on the environment" (Abdullah and Fuong, 2010).

Sustainable Performance: "The evaluation of modern management pattern emphasizing on the integration of economy, environment, and society through all the processes including procurement, producing, packaging, transportation, storage, consumption and disposal of the end-life product, supported by supply chain management technology, and its final goal is to achieve the sustainable development of economy, environment and society" (Guan et al., 2010).

Economic Sustainable Performance: "The evaluation of organizational cost reduction, promotes market shares, return on assets, improve income and profits, etc. regarding the economic goals of performance" (Green et al., 2012; Liu et al., 2012; Chan et al., 2012).

Environmental Sustainable Performance: "The evaluation of organizational reduction for emissions, decrease of consumption for hazardous/harmful/toxic materials, efficient energy/resources use, decrease of frequency for environmental accidents, and improve an enterprise's environmental situation, etc. regarding environmental goal performance" (Junquera et al., 2012; Cheng and Sheu, 2012).

Social Sustainable Performance: "The evaluation of organization to provide healthy work environment, social commitment and participation, education and training, and human resources development, etc. regarding social goals performance" (Teraji, 2009; Bessire and Onnée, 2010).

Supplier Integration: "Environmental collaboration between a firm and its suppliers in implementing environmental management practices" (Vachon and Klassen, 2008).

Customer Integration: "Environmental collaboration between a focal firm and its customers that aims to fulfil customer environmental requirements" (Vachon and Klassen, 2008).

Internal Integration: "Environmental management practices conducted within a company" (Rao and Holt, 2005).

Logistic Integration: "Environmental management practices of the planning, implementing, and controlling of goods or service to the point the consumer or customer is served, where it relates to the supplier and the customer in terms of managing information and material flow along supply chain management" **(**Vachon, 2003; Oy and Kamthunzi, 2014).

Technology Integration: "Environmental management practices of the use of technology tools taking place between a buying and supplying organization regarding activities such as product development, process reengineering, and technical training" (Vachon, 2003; Wu, 2013).

3.4 Research Design

The study was conducted in a method of quantitative involving hypotheses testing. Research hypotheses were constructed based on prior studies regarding the relationship between green supply chain integration and sustainable performance. The study used simple random sampling by focusing on ISO 14001 certified manufacturing firms in Malaysia. According to Sekaran and Bougie (2010), simple random sampling occurs when all elements in the population are considered and each element has an equal chance of being chosen as the subject. One of the advantages of simple random sampling is high generalizability of the findings (Sekaran, 2003), which explains the application of simple random sampling in this study.

The data was generated from two types of sources which were primary and secondary sources. The research design of this study is based on several criteria as suggested by Sekaran (2003) such as; (i) the degree of fit between research objectives and methodological choices available to the researcher, and appropriate type of data required to achieve those objectives, (ii) the extent to which findings are comparable to those of previous studies focusing similar questions, (iii) appreciation of possibility to yield unanticipated findings, and (vi) practical issues like time constraints and available resources, therefore quantitative method study was selected. The method was sought to

explore the extent of green supply chain integration practice in Malaysia. On this basis, the research design included questionnaire survey. Primary data were collected and obtained from the field survey whereas secondary data mainly came from books, reports, seminar papers, journal articles.

Quantitative approach is categorized with descriptive research, causal-comparative research, experimental research, and correlational research. Any data that is in numerical form such as statistics and percentages can be described as quantitative data (Sekaran and Bougie, 2010). A questionnaire survey was developed in order to investigate the relationship between Green Supply Chain Integration (GSCI) and Sustainable Performance among manufacturing firms in the country. A number of instruments is incorporated through which quantitative data was collected on every variable of interest. The questionnaire consists of variety of both previously validated instruments and measures developed specifically for the purpose of the study as well as to answer the research questions. It was designed in both electronic and paper format to adapt to respondent's preferences.

A cross sectional design was applied in this study. According to Hair, Black, Babin, and Anderson (2010), in cross sectional design, every individual based on the selected sample would be evaluated on several constructs at one period of time and the relationship between the constructs is determined. It is a study of the linkages that happen without any planned interference between variables or constructs (Hair, Black, Babin, Anderson, and Tatham, 2006).

3.5 Research Sample and Population

The main purpose of the sampling method is to attain representative cross-sectional sample of the total population (Cavana, Delahaye, and Sekaran, 2001). Loewenthal (1996) added that a bigger sample will be beneficial in improving the statistical power, hence it would be easy to detect significant association or relation of the difference related to sample size.

The population of this research consists all Malaysian manufacturing firms that are certified in MS ISO 14001. Based on Standards and Industrial Research Institute of Malaysia (SIRIM) and Federation of Malaysian Manufacturers (FMM) directory in August 2014, there were 722 ISO 14001 certified manufacturing companies in Malaysia. Each company selected as sample would be represented by a personnel from management level who has been appointed as in dealing or taking care of EMS or ISO documentations in the company. Therefore the unit of analysis applied in the study was organization.

The main reason manufacturing companies were sampled because they represented the largest sector in terms of employment, sales, and contribution to the economy (Abdullah et al., 2014). In addition, being ISO 14001 certified proved that the companies involved in the implementation of green supply chain management practices and aware with the requirement of environmental standards.

Krejcie and Morgan (1970) simplified sample size decision by providing a table to ensure a great decision model. Determining sample size requires precision and confidence. Based on the table provided by Krejcie and Morgan (1970), when the total population size is 700, the most appropriate sample size is 169. Therefore, a sample size of 169 respondents from ISO 14001 certified manufacturing firms in the country was required. However, Yamane (1967) also provided a table for determining the sample size based on the

population. According to Yamane's table of sample size, when the population size, N=700, a sample size of 88 is considered sufficient in order to get accurate results. As the total population in current study is 722 manufacturing firms, the sample size used for further data analysis was 107.

3.6 Instrumentation Methods

Research instrument is one of the modes to collect data and information. Various methods can be used to attain data such as observations, interviews, questionnaires, and focus group. Pursuant to Zikmund (2000), survey data collection technique by using questionnaire is the most common method to collect data due to its inexpensiveness and ability to cover wide number of respondents. The survey data collection technique was used because it has more advantages compared with other data collection methods like interviews and observations (Sekaran, 2003). One of the advantages is the reliability in obtaining information on facts, beliefs, desires, needs, and feelings (Majid, 1993).

A set of structured questionnaire was used to gather data and information in examining the relationship between green supply chain integration and sustainable performance as well as to test the proposed hypotheses. The unit of analysis chosen was organization whereby the data was collected from the target respondents at managerial level. The questionnaire contained a total of 55 questions that were divided into 3 sections asking questions on the background detail of the respondent and the firm and the evaluation criteria of the relationship between the GSCI and sustainable performance.

Section 1 consisted of 7 items that were geared to the background detail of the respondent and the firm such as number of employees in the company, type of industry,

company's age, company's type of ownership, management system used in the company, respondent's position in the company, and respondent's working years at the company.

Then, Section 2 of the questionnaire consists of 32 items related to the independent variable namely Green Supply Chain Integration (GSCI). The independent variable was divided into five parts which includes supplier integration, customer integration, internal integration, logistic integration, and technology integration. The items used for this section were adopted from Canning and Hanmer-Lloyd (2001), Wu (2013), and Vachon (2003).

Lastly, Section 3 of the questionnaire consisted of 16 items related to the dependent variable namely Sustainable Performance. It was divided into three dimensions consisted of economic sustainable performance, environmental sustainable performance, and social sustainable performance. The items of Sustainable Performance were developed by Brent' and Labuschagne' (2004) representing 16 items in the questionnaire. The summary of all items for each section in the questionnaire is shown in Table 3.1:

Table 3.1
Summary of the Questionnaire

Variables	Number of Items
Section 1: Respondent's Background	
Number of employees in the company	1
Type of industry	1
Company's age	1
Company's type of ownership	1
Management system used in the company	1
Respondent's position in the company	1
Respondent's working years at the company	1
Section 2: Green Supply Chain Integration	
Supplier integration	5
Customer integration	4
Internal integration	6
Logistic Integration	10
Technology Integration	7
Section 3: Sustainable Performance	
Economic sustainable performance	5
Environmental sustainable performance	6
Social sustainable performance	5

Table 3.2

Measure items for Green Supply Chain Integration and Sustainable Performance

Variables	Items	Resources
Green Supply Chain Integration		
Supplier Integration	1. Collaborating with suppliers to set up environmental goals. 2. Implementing environmental audit for suppliers' internal management. 3. Providing suppliers with environmental design requirements related to design specifications and cleaner production technology. 4. Requiring suppliers to implement environmental management or obtain third-party certification of environmental management system (e.g., ISO 14001). 5. Selecting suppliers according to environmental criteria.	Canning and Hanmer-Lloyd (2001)
Customer Integration	6. Achieving environmental goals through joint planning with customers. 7. Cooperating with customers to reduce environmental impact of the products. 8. Cooperating with customers for cleaner production, green packaging, or other environmental activities. 9. Sharing organizational know-how and experience with customers for environmental management and find solutions to environmental challenges.	Wu (2013)
Internal Integration	10. Senior and middle managers are committed to GSCM practices. 11. Cross-functional cooperation for environmental improvements. 12. Environmental issues are well communicated among departments. 13. Environmental compliance and auditing programs are implemented. 14. Environmental knowledge is accumulated and shared across departments. 15. An environmental management system exists.	Wu (2013)
Logistic Integration	16. Provides information to help supplier to improve logistic management. 17. Exchange operational and logistical information with supplier. 18. Exchange information informally with supplier without pre-specific agreements. 19. Inform supplier about events or changes that may affect them. 20. Face to face communication with supplier for planning purpose. 21. Customer provides information that help company's operations. 22. Customer discusses the issues related to major design changes in existing packaging (colours, size). 23. Customer share information informally without specific agreement.	Vachon (2003)

	24. Customer has face to face communication for planning purpose. 25. Customer willing to make cooperative changes.	
Technology Integration	26. Supplier visits company to assist in improving company's performance. 27. Supplier provides training on their products. 28. Supplier helps in process improvement activities (e.g., value analysis, cost reduction, problem solving). 29. Supplier collaborates in the design of new products or new product lines. 30. Customer provides personnel training. 31. Customer visits company to assist in improving company's performance. 32. Customer invites our company to their premises in order for us to increase our awareness on how our product used.	Vachon (2003)
Sustainable Performance		
Economic sustainable performance	1. Decrease in cost for materials purchasing. 2. Decrease in cost for energy consumption. 3. Decrease in fee for waste treatment. 4. Decrease in fee waste discharge. 5. Decrease in fine/ penalties for environmental accidents.	Brent' and Labuschagne' (2004)
Environmental sustainable performance	6. Reduction in air emission caused by firm's manufacturing activities. 7. Reduction in waste water caused by firm's manufacturing activities. 8. Reduction in solid wastes caused by firm's manufacturing activities. 9. Decrease in consumption for hazardous/ harmful/ toxic materials. 10. Decrease in frequency for environmental accidents of the firm. 11. Improvement in firm environmental situation.	Brent' and Labuschagne' (2004);
Social sustainable performance	12. Improvement of employees' health and safety resulting from green practices. 13. Incentives and engagement for local employment. 14. Development of economic activities. 15. Improvement of community health and safety resulting from green practices. 16. Reduction of the negative impact of products and processes on the local community.	Brent' and Labuschagne' (2004);

3.7 Measurement Scale

Apart from that, this study used interval scale in order to obtain a statistical measure in Section 2 and 3. The interval scale is easy to construct, administer, and it also facilitates respondent to understand the scale with ease (Malhotra, 2006). Precisely, the study required the respondents to rate the items based on semantic scale. According to Sekaran and Bougie (2010), the rating scale provides the flexibility to use as many points in the scale as considered necessary.

The survey was designed following extensive reviews on the literature to generate a pool of items that reflected the theoretical constructs. The questionnaire survey was divided into three sections; Section 1: respondent's background, Section 2: green supply chain integration, and Section 3: sustainable performance.

In the last two sections of the questionnaire, interval scale ranging from 1 (low) to 5 (high) were used. The respondents were requested to indicate the extent to which they agree with the level of GSCI practices in the organization (Section 2) and the extent to which they agree with the level of organization's sustainable performance (Section 3). The questionnaire survey used five point scale anchored by 1=low and 5=high. Five point scale is just as great as any, and an increase from five to seven or nine points on a rating scale does not improve the rating's reliability, where the anchors like unimportant to important and low to high are frequently used (Elmore and Beggs, 1975).

3.8 Data Collection Method and Procedure

Survey questionnaire has been used for data collection of this study. In order to accomplish the research objectives, a total of 500 questionnaire forms had been delivered by mail to the manufacturing firms' address. A total of 100 questionnaire forms had also been mailed online. Both paper and electronic format questionnaire forms have been targeted at management level as respondents for the study. In specific, the study focused on the personnel who in-charge or responsible of environmental management system or ISO documentations in the organization. Out of 600 questionnaire forms distributed by mail and online, the author received back a total of 107 questionnaires from respondents equaling to 17.8% response rate.

Despite a considerably low response rate, mainly due to lack of respondent's cooperation, budget limitation, and time constraint, the expected sample size of the study was referred to Yamane (1967). When the population size is 700, a sample size of 88 is considered as sufficient. The more data collected is better as a higher sample size will improve the statistical power in the study (Martin and Bateson, 1986).

3.9 Benefits and Limitations of Questionnaire Survey

According to Fowler (1988), there are a number of benefits and limitations associated with the questionnaire survey method. The cost of administering surveys is relatively low and respondents have time to think about their answers. Surveys promote anonymity and confidentiality, minimize the potential for interviewer bias, and provide access to widely-dispersed respondents. Questionnaires can be tested, standardized, and validated to produce large amounts of data from the sample populations. Consequently, quantitative

data gathered through questionnaire survey research is regarded as relatively accurate (Kerlinger, 1986).

However, there are still a number of limitations including the lack of opportunities to probe and the potential for poor response rate (Kidder, 1981). Since it is often impractical and quite difficult to design a survey to impact the difference between the observed and non-respondent answers, this study focused on reducing the non-response rate in order to reduce bias. The survey had been designed properly to reduce the non-response bias. Online, phone, and mailed survey techniques use to have a large impact on a way respondent chooses to participate in the survey, and to what extend they will complete the survey (Sekaran, 2003). Therefore, the survey had been created to have personable yet professional introduction, short survey length, interesting content, concise, and clear wording. Placing multiple follow-up calls, appealing incentives, and email reminders had been made on non-respondents.

3.10 Data Analysis

Statistical Package for Social Science (SPSS) version 20.0 was used to analyze the data. Both descriptive and inferential analysis were applied in the data analysis process. The data was first tested through data screening. Pre-tests such as factor analysis, reliability analysis, and normality analysis also had been conducted. Final phase of data analysis process involved descriptive analysis using frequency statistics, correlation analysis, and multiple regression analysis.

The first objective (to examine the relationship between variables) required Pearson's Correlation analysis to determine the relation and degree of relationships

between variables. Lastly, multiple regression had been used to answer the second objective of the study. Table 3.3 shows the statistical analyses used to answer two main objectives of the study.

Table 3.3
Statistical Analysis

Main Objectives	**Statistical Analysis**
Objective 1: To determine the possible relationship between GSCI practices and sustainable performance.	**Pearson's Correlation**
Objective 2: To determine which practice of GSCI has the most impact on sustainable performance.	**Multiple Regression**

3.10.1 Factor Analysis

Factor analysis was used to identify complex interrelationships among items and group items that are part of unified concepts. The results from factor analysis would be able to confirm whether or not the theorized dimensions emerge (Sekaran and Bougie, 2010). In factor analysis, the communality value, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy value, and Bartlett's Test of Sphericity significance have to be focused on where the communality value is considered as acceptable if the value is above 0.5, the KMO value must exceed the recommended value of 0.6, and the Bartlett's Test of Sphericity must reach statistical significance (Kim and Mueller, 1994). As for this study, interrelationship among items in dependent variable and independent variables had been tested.

3.10.2 Reliability Analysis

The reliability test was used to measure the goodness of data which includes the stability and consistency of the items. Cronbach's Alpha is the most common method used to examine the consistency of the data. Sekaran (2003) suggested that the closer the value of Cronbach's Alpha to 1, the higher the reliability of internal consistency. The Cronbach's Alpha value which is less than 0.60 is considered to be poor while those in the range of 0.70 are acceptable. Whereas, the value over 0.80 is considered to be good and having a higher internal consistency.

3.10.3 Normality Analysis

The most important assumption in conducting multivariate analysis is normality. The normality test was required to ensure normal distribution of data and inspection of the outliers (Hair et al., 2010). They added that the outliers would be eliminated and the result could be obtained through the graphical analysis and statistical test of normality. Generally, the data normality can be evaluated through a straight diagonal line where the plotted data values are in line or parallel to the diagonal line (Coakes and Steed, 2007). In addition, normality also can be analyzed through skewness and kurtosis. The z-values for skewness and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George and Mallery, 2010). The statistical value (z) for skewness and kurtosis can be calculated by dividing the value of skewness and kurtosis by the appropriate standard error of each skewness and kurtosis (Hair et al., 2006).

3.10.4 Descriptive Analysis

Descriptive analysis was carried out as the data analysis on the respondents and firms general information. This analysis was also applied to identify mean for every variable. Generally, descriptive analysis involves transformation of raw data into a form that would provide information to describe a set of factors in a situation (Sekaran, 2003). Descriptive statistics was focused on the frequencies and percentages.

3.10.5 Correlation Analysis

The Pearson correlation was used to examine the relationship between dependent and independent variables, to predict the strength of the relationship as well as the direction of the relationship. This test was mainly used to answer the first research question in this study. Gliner, Morgan, and Leech (2009) recommended that Pearson correlation can vary from -1.0, which considered as perfect negative correlation through 0.0, which is no correlation at all to +1.0, which is considered as perfect positive correlation. The coefficient scale and relationship strength of correlation has been lined out by Hair, Money, Samouel, and Page (2008) to interpret the relationship between two variables as shown in Table 3.4:

Table 3.4
The Coefficient Scale and Relationship Strength of Correlation

Coefficient Scale	Relationship Strength
± 0.91 - ± 1.00	Very Strong
± 0.71 - ± 0.90	Strong
± 0.41 - ± 0.70	Moderate
± 0.21 - ± 0.40	Weak
± 0.01 - ± 0.20	Very Weak

(Source: Hair, Money, Samouel and Page (2008))

In order to determine the significance between two variables, it can be seen through the significant value. If the significant value, $p<0.05$, therefore, there is correlation between the variables. If the value is above the sign value, it can be concluded that the variable is not significant and there is no relationship between the variables involved (Coakes and Steed, 2007).

3.10.6 Multiple Regression Analysis

The purpose of implementing this test is to see how much of the variance in the dependent variables that are being affected by the independent variables. A value of R square is used to interpret the data in terms of variance explained of both variables (Gliner et al., 2009). This test was also required to achieve the second objective of the study. Multiple regressions analysis was applied to analyze the best predictor among the GSCI in influencing the sustainable performance of ISO 14001 certified manufacturing firms.

To determine the influence of independent variables on dependent variables, it can be seen through the significant value provided in the regressions table. If the value is below the significant level of $p<0.05$, this means that the independent variable influences the dependent variable. In contrast, if the value is above the sign value, it indicates that there is no influence between the independent and dependent variables (Gliner et al., 2009).

Therefore, the multiple regressions had been implemented in order to determine the strongest influence of green supply chain integration on sustainable performance. Model 3.1 shows the formulation of multiple regressions. It was assumed that β (coefficient) was positive, meaning that all the variables positively influenced sustainable performance.

Model 3.1
Formula for Multiple Regression

$$\mathbf{SP} = \alpha + \beta_1 \mathbf{SI} + \beta_2 \mathbf{CI} + \beta_3 \mathbf{II} + \beta_4 \mathbf{LI} + \beta_5 \mathbf{TI} + \mu$$

Where:

SP	= Sustainable Performance	ESP	= Economic Sustainable Performance
SI	= Supplier Integration	EnSP	= Environmental Sustainable Performance
CI	= Customer Integration	SSP	= Social Sustainable Performance
II	= Internal Integration	μ	= Error term
LI	= Logistic Integration	B	= Unstandardized beta coefficient
TI	= Technology Integration		
α	= Intercepts (constant value)		
i	= respondent 1 2 …… 107		

3.11 Conclusion

This chapter has explained on the methods applied in this study. All the stages starting from the collection of data until the types of tool used to analyze the data have been discussed. The result from the data analysis are presented in the next chapter. Based on the needs of the study, the next chapter explains about the findings or results obtained in this research.

CHAPTER FOUR

ANALYSIS AND FINDINGS

4. Introduction

This chapter contains the findings of data analysis for this study. The result outcomes for data analysis were completed using SPSS programs. The data analysis involved pilot study, factor analysis, reliability test, and normality test. In addition, this chapter also addressed the findings from respondent's background. Last but not least, the results obtained from the correlation and regression analysis were also explained in order to identify the relationship and influence among the variables. The analyses were based solely on the data furnished by the respondents through returned questionnaires.

4.1 Pilot Study

A pilot study was conducted in September 2014. The purpose of the pre-test was to identify ambiguous items in the instruments. A total of 30 questionnaires were sent online to the respondents in Malaysian ISO 14001 certified manufacturing firms. The pilot test requires around 30 to 50 respondents and is considered enough to identify any weakness or mistakes in a study (Bullen, 2014).

4.2 Factor Analysis

Table 4.1 shows the result of factor analysis for the independent variables consisted of supplier integration, customer integration, internal integration, logistic integration, and technology integration. The independent variables were measured using 32 items in five dimensions, which were subjected to Principal Component Analysis (PCA) using SPSS Version 20. Principal component analysis was performed to determine the factors of the construct (Hair et al., 2010). They added that the main objective of factor analysis is also to reduce a vast number of variables into an interpretable and meaningful set of factors.

Communality value for each item of all five independent variables are more than 0.6 (see Appendix B) as suggested by Kim and Mueller (1994), therefore none of the 32 items had to be deleted in order to increase factor's loading. As shown in Table 4.1, the factor's loadings of every variable representing the GSCI are above 0.7 and can be considered as excellent (Tabachnick and Fidell, 2007). The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value of supplier integration is 0.809, while the lowest KMO value is shown by customer integration with 0.678. These results exceed the recommended value of 0.6 (Hair et al., 2008) and Bartlett's Test of Sphericity also reach statistical significance, supporting the factorability of the dimensions. The PCA also reveals the presence of components with eigenvalues exceeding 1 for all five independent variables, respectively explaining percentage of variance for supplier integration (78.035%), customer integration (86.543%), internal integration (86.217%), logistic integration (75.818%), and technology integration (74.777%). Thus, all of the items used to measure independent variables were sustained.

Table 4.1
Result of Factor Analysis for Independent Variable

Items	Component		
supplier1	0.735	Eigenvalue	3.902
supplier2	0.861	Percentage of Variance (%)	78.035
supplier3	0.973	KMO	0.809
supplier4	0.941	Bartlett's Test of Sphericity	133.160
supplier5	0.887	Significance	0.000
customer1	0.927	Eigenvalue	3.462
customer2	0.961	Percentage of Variance (%)	86.543
customer3	0.960	KMO	0.678
customer4	0.870	Bartlett's Test of Sphericity	133.316
		Significance	0.000
internal1	0.925	Eigenvalue	5.173
internal2	0.910	Percentage of Variance (%)	86.217
internal3	0.939	KMO	0.769
internal4	0.968	Bartlett's Test of Sphericity	241.554
internal5	0.918	Significance	0.000
internal6	0.910		
logistical1	0.900	Eigenvalue	7.582
logistical2	0.893	Percentage of Variance (%)	75.818
logistical3	0.933	KMO	0.779
logistical4	0.858	Bartlett's Test of Sphericity	357.978
logistical5	0.828	Significance	0.000
logistical6	0.892		
logistical7	0.785		
logistical8	0.862		
logistical9	0.819		
logistical10	0.926		
tech1	0.777	Eigenvalue	5.324
tech2	0.928	Percentage of Variance (%)	74.777
tech3	0.936	KMO	0.808
tech4	0.863	Bartlett's Test of Sphericity	246.751
tech5	0.904	Significance	0.000
tech6	0.754		
tech7	0.874		

Table 4.2
Result of Factor Analysis for Dependent Variable

Items	Component		
economic1	0.940	Eigenvalue	4.103
economic2	0.933	Percentage of Variance (%)	82.058
economic3	0.955	KMO	0.823
economic4	0.950	Bartlett's Test of Sphericity	157.977
economic5	0.733	Significance	0.000
environmental1	0.909	Eigenvalue	5.142
environmental2	0.962	Percentage of Variance (%)	85.706
environmental3	0.881	KMO	0.791
environmental4	0.917	Bartlett's Test of Sphericity	246.986
environmental5	0.943	Significance	0.000
environmental6	0.940		
social1	0.893	Eigenvalue	4.214
social2	0.958	Percentage of Variance (%)	84.288
social3	0.918	KMO	0.804
social4	0.929	Bartlett's Test of Sphericity	168.591
social5	0.891	Significance	0.000

Table 4.2 shows the dependent variable, sustainable performance, which is measured by 16 items in three dimensions and was subjected to principal component analysis (PCA) using SPSS Version 20. Inspection of the factor's loading for every dimension reveals the presence of value above 0.7 and can be considered as excellent (Tabachnick and Fidell, 2007). Referring to Table 4.2, the KMO value for economic sustainable performance (first dimension) is 0.823. Meanwhile, the KMO value for environmental sustainable performance (second dimension) is 0.791 and social sustainable performance with 0.804. The KMO value of these three dimensions exceed the

recommended value of 0.6 (Hair et al., 2008) and Bartlett's Test of Sphericity reach statistical significance, supporting the factorability of the dimensions as suggested by Kim and Mueller (1994). The PCA reveals the presence of economic sustainable performance, environmental sustainable performance, and social sustainable performance with eigenvalues exceeding 1, which the dimension of economic explains 82.058% of the variance. The environmental sustainable performance explains a total of 85.706% of the variance, and social sustainable performance with 84.288% of the variance. Thus, the 16 items used to represent sustainable performance were maintained.

4.3 Reliability Test

The main purpose of reliability test is to measure the goodness of the data which includes the internal consistency and stability of the items (Hair et al., 2010). Table 4.3 represents the Cronbach's alpha for each variable.

Table 4.3
Cronbach's Alpha for each variable

Variable	**Cronbach's Alpha**
Supplier Integration	0.926
Customer Integration	0.947
Internal Integration	0.966
Logistic Integration	0.964
Technology Integration	0.940
Sustainable Performance	0.977
Economic sustainable performance	0.941
Environmental sustainable performance	0.964
Social sustainable performance	0.952

Table 4.3 indicates the Cronbach's Alpha for each variable in this study. As the results, Sustainable Performance states the highest rate with 0.977, where three of its dimension; economic sustainable performance (0.941), environmental sustainable performance (0.964), and social sustainable performance at 0.952. Followed by internal integration (0.966), logistic integration (0.964), customer integration (0.947), technology integration (0.940), and supplier integration (0.926). Based on the results obtained, the internal consistency among all items of dependent variables and independent variables are considered as very good, which are above 0.9 as suggested by Sekaran (2003).

4.4 Normality Test

After applying the reliability test, the data must undergo a screening process which is known as normality test. The normality test was required to ensure normal distribution of data and inspection of the outliers (Hair et al., 2010). As a result, the distribution of data in this study are normal. Besides, the assessment of normality had already proved that the data used in this study was also normally distributed by using the Q-Q plot (see Appendix B). Table 4.4 represents the normality test result:

Table 4.4
Normality Test

Variable	Mean	Skewness	Kurtosis	z-value (Skewness)	z-value (Kurtosis)
Supplier Integration	2.97	0.069	-0.578	0.16	-0.69
Customer Integration	3.62	-0.557	0.010	-1.30	0.01
Internal Integration	3.66	-0.826	0.056	-1.93	0.07
Logistic Integration	3.31	-0.545	-0.546	-1.28	-0.66
Technology Integration	3.11	0.187	-0.896	0.49	-1.08
Sustainable Performance	3.28	-0.536	-0.641	-1.26	-0.77
Economic sustainable performance	3.29	-0.342	-0.448	-0.80	-0.54
Environmental sustainable performance	3.28	-0.501	-0.658	-1.17	-0.79
Social sustainable performance	3.26	-0.261	-0.690	-0.61	-0.83

Based on Table 4.4, the mean for Supplier Integration is 2.97, skewness (0.069) and kurtosis (-0.578). Followed by the mean for Customer Integration with 3.62, skewness (-0.557) and kurtosis (0.010). For Internal Integration, the mean value is 3.66, skewness (-0.826) and kurtosis (0.056). The mean for Logistic Integration is 3.31, skewness (-0.545) and kurtosis (-0.546). As for technology integration, the mean value is 3.11 with skewness of 0.087 and kurtosis of -0.896. Lastly, the mean value for Sustainable Performance is 3.28, skewness (-0.536), and kurtosis (-0.641), whereas its dimensions; economic

sustainable performance mean value is 3.29 with skewness of -0.342 and kurtosis of -0.448, environmental sustainable performance mean is 3.28, skewness (-0.501) and kurtosis (-0.658), and social sustainable performance's mean at the value of 3.26 with skewness of -0.261 and kurtosis of -0.690.

Overall, the value for skewness and kurtosis for each variable is near to zero as suggested by Hair et al. (2010) in determining normal distribution of data. Furthermore, the z-value for both skewness and kurtosis of each variable is between the range of -2 and +2, considered to be acceptable in order to prove normal univariate distribution (George and Mallery, 2010).

4.5 Descriptive Analysis of Respondent's Background

As for this part, frequency distribution was applied to summarize respondents' general information or background. Table 4.5 shows that 49.5% of 107 ISO 14001 certified manufacturing firms have been represented by manufacturing firms with more than 200 employees. Followed by manufacturing firms between 76-200 employees (28%) and between 5-75 employees (20.6%). There are 2 manufacturing firms with employees not more than 5 persons (1.9%) participating in the study.

Table 4.5
Employee's Number in Manufacturing Firms

Number of Employees	Frequency	Percent
< 5	2	1.9
5 - 75	22	20.6
76 - 200	30	28.0
> 200	53	49.5
Total	**107**	**100.0**

Table 4.6
Types of Industry among Manufacturing Firms

Types of Industry	**Frequency**	**Percent**
Packaging	3	2.8
Automotive and transportation equipment	49	45.8
Telecommunication	4	3.7
Petro-chemical	7	6.5
Medical device	2	1.9
Electrical	7	6.5
Printing and publishing	5	4.7
Water-meter	1	0.9
Metal and steel	11	10.3
Rubber	1	0.9
Paint-coating	3	2.8
Energy	3	2.8
Recycling	2	1.9
Wood and timber flooring	1	0.9
Stationery	2	1.9
Plastic	4	3.7
Ceramic and tiles	1	0.9
LLDPE stretch film	1	0.9
Total	**107**	**100.0**

Table 4.6 highlights the variance of industry type among manufacturing firms involved as automotive and transportation equipment industry tops with the highest percentage at 45.8%. Metal and steel industry comes second with 10.3%. Petro-chemical and electrical industries share same percentage at 6.5%, followed by printing and publishing industry at 4.7%. The result also shows that telecommunication industry and plastic industry share same percentage at 3.7%.

Table 4.7
Company's Age

Company's Age	**Frequency**	**Percent**
Less than 3 years	2	1.9
3-10 years	11	10.3
More than 10 years	94	87.9
Total	**107**	**100.0**

The result from Table 4.7 shows that 87.9% are manufacturing firms aged more than 10 years. Manufacturing firms aged between 3-10 years follow with 10.3%. Respectively, manufacturing firms that have been operating less than 3 years shows the least percentage at 1.9%.

Table 4.8
Company's Types of Ownership

Types of Ownership	**Frequency**	**Percent**
MNC	43	40.2
GLC	4	3.7
Local Company	43	40.2
Joint Venture (JV)	10	9.3
Foreign Company	4	3.7
Private Limited	3	2.8
Total	**107**	**100.0**

Based on Table 4.8, it is found that most of the respondents for the study are from multinational company (MNC) and local company where both ownership types share same percentage at 40.2%. Followed by Joint Venture (JV) at 9.3%, government-linked company (GLC) and foreign company at 3.7%, and private-limited company with 3%.

Table 4.9
Management Systems used in the Company apart from ISO 14001

Company's Management Systems	Frequency	Percent
ISO 9000	71	66.4
ISO 26000	2	1.9
ISO/TS16949	5	4.7
ISO 9001	8	7.5
Only ISO 14001	6	5.6
ISO 17025, OHSAS 18001, and ISO 9001	11	10.3
OSHA 18001, ISO 9001, and TS16949	3	2.8
ISO 9000 and OHSAS 18001	1	0.9
Total	**107**	**100.0**

Apart from being ISO 14001 certified manufacturing firms in Malaysia to be qualified as respondent for the study, a total of 66.4% from the respondents also use ISO 9000 management system in the company. Table 4.9 indicates that these companies also apply other management systems like ISO 26000, ISO/TS16949, ISO 9001, ISO 17025, and Occupational Health and Safety Advisory Services (OHSAS) 18001. There is one manufacturing firm with ISO 9000 and OHSAS 18001 being the lowest with 0.9%.

Table 4.10
Respondent's Current Position in Company

Position in Company	Frequency	Percent
Director	1	0.9
Executive	40	37.4
Manager	53	49.5
Engineer	10	9.3
Others	3	2.8
Total	**107**	**100.0**

The result from Table 4.10 shows that the respondent's current position are mostly managers and executives at 49.5% and 37.4% respectively. As the study required personnel

who specifically in-charge of ISO documentations in the companies, the table 4.10 also shows variance of positions such as engineer (9.3%), others (2.8%), and director at 0.9%.

Table 4.11
Respondent's Years in Current Position Held

Number of Years	**Frequency**	**Percent**
1-5 years	71	66.4
6-10 years	27	25.2
11-15 years	5	4.7
More than 15 years	4	3.7
Total	**107**	**100.0**

Lastly, from Table 4.11, the data of respondent's experience years of holding current position shows that 66.4% as the highest with 1-5 years out of 107 respondents. The lowest percentage of holding current position at the firms is more than 15 years with 3.7%.

4.6 Pearson's Correlation Analysis

The correlation analysis was carried out to determine the type and the strength of relationship exists between the variables in the hypothesis. In order to achieve the first objective of the study, the Pearson's correlation was used to examine the relationship between Green Supply Chain Integration (supplier integration, customer integration, internal integration, logistic integration, technology integration) and sustainable performance (economic sustainable performance, environmental sustainable performance, social sustainable performance). One-tailed test was used since the

statements of hypotheses stipulate the direction of the relationships are positive. Table 4.12 represents the result of Pearson's correlation analysis:

Table 4.12
Correlation between Independent Variables and Sustainable Performance (N=107)

Variables	**Pearson Correlation**			
	SP	Eco	Env	Social
Supplier Integration	**0.567****	0.523**	0.454**	0.582**
Customer Integration	**0.557****	0.433**	0.501**	0.593**
Internal Integration	**0.678****	0.555**	0.613**	0.688**
Logistic Integration	**0.623****	0.500**	0.562**	0.646**
Technology Integration	**0.678****	0.617**	0.584**	0.654**

**Correlation is significant at the 0.01 level (1-tailed)

According to Table 4.12, the correlation analysis shows that supplier integration has positive correlations with sustainable performance and its three dimensions namely economic, environmental, and social at significance level of 0.01. The result also shows that the strength of the relationships are moderate. Referring to Hair et al. (2008), when the coefficient scale is between ±0.41 and ±0.70, the relationship strength is considered as moderate. Therefore, Hypothesis H1 to H1c (Table 4.13) are supported.

Hypothesis H2 to H2c (Table 4.13) are also supported. Based on Table 4.12, there are moderate positive relationships between customer integration and sustainable performance (economic, environmental, and social) at significance level of 0.01.

The internal integration has also been found to have positive relationship with sustainable performance and its three dimensions. With correlation coefficients of 0.678, 0.555, 0.613, and 0.688, the relationship strength of internal integration and overall sustainable performance, economic sustainable performance, environmental sustainable performance, and social sustainable performance are moderate at significance level of 0.01. Therefore, hypothesis H3 to H3c (Table 4.13) are supported.

Table 4.12 also shows that there are significant positive correlations between logistic integration and sustainable performance, as well as its three dimensions at significance level of 0.01. The positive correlation implies that higher logistic integration to go with higher sustainable performance and lower logistic integration to go with lower sustainable performance. Thus, hypothesis H4 to H4c (Table 4.13) are also supported.

Lastly, as for technology integration, Table 4.12 shows the significance with sustainable performance and the dimensions of economic sustainable performance, environmental sustainable performance, and social sustainable performance at 0.01 level. The results support hypothesis H5 to H5c (Table 4.13).

Table 4.13
Summary of All Hypotheses (N=107)

Hypothesis	Hypothesis Statements	Remarks
H1	**There is a positive relationship between supplier integration and sustainable performance.**	Supported
H1a	There is a positive relationship between supplier integration and economic sustainable performance.	Supported
H1b	There is a positive relationship between supplier integration and environmental sustainable performance.	Supported
H1c	There is a positive relationship between supplier integration and social sustainable performance.	Supported
H2	**There is a positive relationship between customer integration and sustainable performance.**	Supported
H2a	There is a positive relationship between customer integration and economic sustainable performance.	Supported
H2b	There is a positive relationship between customer integration and environmental sustainable performance.	Supported
H2c	There is a positive relationship between customer integration and social sustainable performance.	Supported
H3	**There is a positive relationship between internal integration and sustainable performance.**	Supported
H3a	There is a positive relationship between internal integration and economic sustainable performance.	Supported
H3b	There is a positive relationship between internal integration and environmental sustainable performance.	Supported
H3c	There is a positive relationship between internal integration and social sustainable performance.	Supported
H4	**There is a positive relationship between logistic integration and sustainable performance.**	Supported
H4a	There is a positive relationship between logistic integration and economic sustainable performance.	Supported
H4b	There is a positive relationship between logistic integration and environmental sustainable performance.	Supported
H4c	There is a positive relationship between logistic integration and social sustainable performance.	Supported

H5	**There is a positive relationship between technology integration and sustainable performance.**	Supported
H5a	There is a positive relationship between technology integration and economic sustainable performance.	Supported
H5b	There is a positive relationship between technology integration and environmental sustainable performance.	Supported
H5c	There is a positive relationship between technology integration and social sustainable performance.	Supported

4.7 Multiple Regression Analysis

Multiple regression analysis was applied to identify the best predictor influencing the sustainable performance among ISO 14001 certified manufacturing firms in Malaysia. The variables of supplier integration, customer integration, internal integration, logistic integration, and technology integration were tested using multiple regression to achieve the second objective of this study.

If the value is below the significant level of $p<0.05$, this means that the independent variable influences the dependent variable. In contrast, if the value is above the sign value, it indicates that there is no influence between the independent and dependent variables (Gliner et al., 2009).

Table 4.14
Multiple Regression Result

R	R Square	Adjusted Square	R Std. Error of the Estimate	F	Sig
0.769	0.592	0.572	0.57672	29.283	.000
Dependent Variable: Sustainable Performance					
Model		**Standard Coefficient Beta**		**T**	**Sig**
(Constant)				2.105	0.038
Supplier Integration		0.066		0.711	0.479
Customer Integration		0.049		0.527	0.599
Internal Integration		0.379		4.102	0.000
Logistic Integration		0.034		0.309	0.758
Technology Integration		0.367		3.742	0.000

The regression result in Table 4.14 shows that green supply chain integration consisted of supplier integration, customer integration, internal integration, logistic integration, and technology integration jointly explain 59.2% of the variance in predicting sustainable performance. The GSCI model proposed is significant at 0.00 level (F=29.283, p=0.000). Two variables been found to have statistically significant associations with sustainable performance. The variables are internal integration (Beta=0.379, p=0.000) and technology integration (Beta=0.367, p=0.000). The largest beta coefficient obtained was 0.379 for internal integration and this corresponds with the highest t-statistic of 4.102. This means that this variable makes the strongest unique contribution in explaining the dependent variable, sustainable performance when the variance explained by all other predictor variables in the model was controlled for. It suggests that one standard deviation increase in internal integration is followed by 0.379 standard deviation increase in sustainable performance. The Beta value for technology integration was the second highest with 0.367. However, supplier integration, customer integration, and logistic integration

do not contribute toward sustainable performance as the significance value for these three independent variables are bigger than 0.05. Therefore, internal integration and technology integration are the strongest predictors in influencing sustainable performance among MS ISO 14001 certified manufacturing firms in Malaysia based on the findings of this analysis.

4.8 Conclusion

This chapter deliberates on the findings congregated from the data analyses. The validation of instruments was conducted through factor analysis. After testing the reliability and normality of data, descriptive test was prepared. Finally, correlation test and multiple regression test were done to answer the research questions and to achieve the research objectives. Most of the findings under Pearson's correlation were as expected and in concurrent with previous findings. More discussion and conclusion in the next chapter elaborates further on the result and their implication to the theory and management.

CHAPTER FIVE

DISCUSSIONS AND CONCLUSION

5. Introduction

This chapter is divided into eight sections. In section 5.1, the objectives of this study are recapitulated. Then, discussions of the findings are provided in Section 5.2 and Section 5.3. The implications of the study which are separated into theoretical and managerial are explained in Section 5.4 and 5.5. The limitation of the study and direction for future research are discussed in Section 5.6 and 5.7. The conclusion of the study is finally covered in Section 5.8.

5.1 Recapitulation of the Study

The first objective of this study is to determine the relationship between green supply chain integration on sustainable performance of MS ISO 14001 certified manufacturing firms in Malaysia; the second objective was to identify which practice of the GSCI (supplier integration, customer integration, internal integration, logistic integration, and technology integration) has the most impact on sustainable performance. The research framework of this study was based on Coordination Theory; where the theoretical framework of the GSCI was enhanced with logistical and technological integration.

Data was collected through survey method. The sample used for this study is ISO 14001 certified manufacturing firms. The unit of analysis was organization with the managerial level such as directors, managers, executives, and engineers as the respondents. Out of 600 questionnaires distributed by mail and online, the author received back a total of 107 questionnaires from the respondents. Table 5.1 summarizes the hypotheses testing results of this study:

Table 5.1
Results of the Hypotheses Testing of the Study

Research Questions	Research Objectives	Test of Hypotheses
Is there any relationship between supplier integration and sustainable performance?	To determine the relationship between supplier integration and sustainable performance.	**H1 SI → SP 0.567** Supported** **H1a SI → ESP 0.523** Supported** **H1b SI → EnSP 0.454** Supported** **H1c SI → SSP 0.582** Supported**
Is there any relationship between customer integration and sustainable performance?	To determine the relationship between customer integration and sustainable performance.	**H2 CI → SP 0.557** Supported** **H2a CI → ESP 0.433** Supported** **H2b CI → EnSP 0.501** Supported** **H2c CI → SSP 0.593** Supported**
Is there any relationship between internal integration and sustainable performance?	To determine the relationship between internal integration and sustainable performance.	**H3 II → SP 0.678** Supported** **H3a II → ESP 0.555** Supported** **H3b II → EnSP 0.613** Supported** **H3c II → SSP 0.688** Supported**
Is there any relationship between logistic integration and sustainable performance?	To determine the relationship between logistic integration and sustainable performance.	**H4 LI → SP 0.623** Supported** **H4a LI → ESP 0.500** Supported** **H4b LI → EnSP 0.562** Supported** **H4c LI → SSP 0.646** Supported**
Is there any relationship between technology integration and sustainable performance?	To determine the relationship between technology integration and sustainable performance.	**H5 TI → SP 0.678** Supported** **H5a TI → ESP 0.617** Supported** **H5b TI → EnSP 0.584** Supported** **H5c TI → SSP 0.654** Supported**

SP	= Sustainable Performance	ESP	= Economic Sustainable Performance
SI	= Supplier Integration	EnSP	= Environmental Sustainable Performance
CI	= Customer Integration	SSP	= Social Sustainable Performance
II	= Internal Integration		
LI	= Logistic Integration		
TI	= Technology Integration		

The first objective is to determine the relationship between supplier integration, customer integration, internal integration, logistic integration, technology integration, and sustainable performance. The correlation analysis showed that all independent variables; supplier integration, customer integration, internal integration, logistic integration, and technology integration have a significant positive relationship with sustainable performance.

The second objective of this study is to determine the level of influence of supplier integration, customer integration, internal integration, logistic integration, and technology integration on sustainable performance. The findings from the multiple regression test revealed that the supplier integration, customer integration, internal integration, logistic integration, and technology integration influence 59.2% of MS 1SO 14001 certified manufacturing firms' sustainable performance with the internal and technology integration being the strongest predictors of the dependent variable.

5.2 Discussions on Hypotheses Testing Results (Objective 1)

H1 There is a positive relationship between supplier integration and sustainable performance.

H1a There is a positive relationship between supplier integration and economic sustainable performance.

H1b There is a positive relationship between supplier integration and environmental sustainable performance.

H1c There is a positive relationship between supplier integration and social sustainable performance.

Referring to correlation analysis, the results showed that all hypotheses H1, H1a, H1b and H1c are supported. Supplier integration and sustainable performance have been found to be positively significant. The result is parallel with previous study by Vachon and Klassen (2006) which they found that integration from supplier side improved business organization' performance in terms of economic and environment. They suggested that information exchange on strategies, goals, and performance standards related to environmental concerns with suppliers would benefit the manufacturer on their operation costs and green activities. The correlation analysis also showed that collaboration with suppliers among Malaysian ISO 14001 certified manufacturing firms in green supply chain practices is positively correlated with social sustainable performance. The same result had been shown in previous studies from Geffen and Rothenberg (2000) and Zhu et al. (2010) which found that coordinating green process with supplier lead to improvement of employees and community's health and safety.

H2 There is a positive relationship between customer integration and sustainable performance.

H2a There is a positive relationship between customer integration and economic sustainable performance.

H2b There is a positive relationship between customer integration and environmental sustainable performance.

H2c There is a positive relationship between customer integration and social sustainable performance.

It is found that customer integration also has positive relationship with sustainable performance. Based on the result of Pearson's correlation test, customer integration with manufacturer to tackle environmental challenges and to reduce environmental impacts from products or services provided is positively correlated to manufacturing firms' sustainable performance. From the dimension of economic sustainable performance, the result showed that customer's joint planning correlates to organization's cost reduction due to less environmental impacts which is parallel with prior study from Chen et al. (2012). Correlation analysis also showed that customer integration is positively correlated with environmental sustainable performance. Knowledge and experience sharing between customer and manufacturer for environmental management have significant positive relationship with environmental sustainable performance (Chan et al., 2012). Similarly, Eltayeb et al. (2011) emphasized on the importance of customer participation in increasing organization's environmental performance. The manufacturing firm's social sustainable performance is also positively correlated with customer integration. In other words, the customer integration and achievements in creating social welfare of employee, supplier, customer, and society are significantly correlated (Simpson et al., 2007). Hence, H2, H2a, H2b and H2c are supported.

H3 There is a positive relationship between internal integration and sustainable performance.

H3a There is a positive relationship between internal integration and economic sustainable performance.

H3b There is a positive relationship between internal integration and environmental sustainable performance.

H3c There is a positive relationship between internal integration and social sustainable performance.

Both correlation analysis and multiple regression analysis showed that internal integration has positive relationship and significantly influences sustainable performance. The internal integration was found to be the strongest predictor of sustainable performance. These results indicated that great impacts can be made through internal integration in achieving organization' sustainable performance. Prior studies from Green et al. (2012) and Sroufe (2003) have identified positive link between internal environmental management and organization performance. Further investigation through this study supported by Green et al. (2012) and Sroufe (2003) findings which highlighted that through internal integration such as environmental reports for internal evaluation, management systems and certification of environmental, and cross-functional cooperation within management is positively and significantly associated with multiple areas of sustainable performance namely economic, environmental, and social. The significance also reinforced the proposition that internal integration is central to improve green operational performance (Melnyk, Sroufe, and Calatone, 2003; Zhu et al., 2008). In addition to that, business firms that practice internal integration through information sharing across the functional areas obtain better coordination of operations to improve their performances (Yu et al., 2014). The proposed hypotheses; H3, H3a, H3b and H3c are supported.

H4 There is a positive relationship between logistic integration and sustainable performance.

H4a There is a positive relationship between logistic integration and economic sustainable performance.

H4b There is a positive relationship between logistic integration and environmental sustainable performance.

H4c There is a positive relationship between logistic integration and social sustainable performance.

Logistic integration and sustainable performance linkage is significant based on the findings of this study. The research was conducted on MS ISO 14001 certified manufacturing firms in Malaysia and it is found that logistic integration involving information and material flow management is positively correlated to all three dimensions of sustainable performance. Although previous studies (Lai and Wong, 2012; Lee and Wu, 2014) have confirmed on the significance of logistic integration and environmental performance, this study comprehensively measures sustainable performance from three important aspects of economic, environmental, and social as suggested by Brent' and Labuschagne' (2004). Business firms are required to look further on the evaluation of their sustainable performance to ensure their competitiveness and better market position in the long run (Dunphy, 2011; Eweje, 2011). Moreover, the variable of logistic integration has been proposed with the aim to enrich the GSCI constructs. According to Lee and Wu (2014) and Wu (2013), the integration of logistics and sustainable performance linkage in environmental management scope is still a new phenomenon. The findings also indicated that the supply chain partners should work together and depend on each other to manage information and material flow in order to ensure great environmental outcomes. The responsibility to provide accurate information through communication among supplier, manufacturer, and customer also leads to operational efficiencies, reduces waste, conserves resources, and satisfies social expectation for environmental protection (Lai and Wong, 2012). Therefore, H4, H4a, H4b and H4c are supported.

H5 There is a positive relationship between technology integration and sustainable performance.

H5a There is a positive relationship between technology integration and economic sustainable performance.

H5b There is a positive relationship between technology integration and environmental sustainable performance.

H5c There is a positive relationship between technology integration and social sustainable performance.

Technology integration has also been found to have a positive relationship with three dimensions of sustainable performance. As a result, the last hypotheses; H5, H5a, H5b and H5c, proposing the linkage between technology integration and sustainable performance (economic, environmental, and social) can be supported. These results significantly prove the positive relationship between technology integration and sustainable performance. Wu (2013) mentioned about the lack of study on technology integration as a crucial variable of the GSCI despite being a great tool to integrate green supply chain partners more efficiently and leading to the enhancement of environmental performance. Based on the multiple regression analysis, the result reinforced the fact that technology integration is a necessity and key driver in most industries toward environmental achievements (Nidumolu et al., 2009; Dangelico and Pujari, 2010). Although there are a few existing challenges through technology integration such as the difficulty to obtain the latest green manufacturing technologies, costly affair, huge requirement of managerial techniques, and expertise (Vachon, 2003; Nidumolu et al., 2009), manufacturing firms in Malaysia considered technology integration as a strong predictor of sustainable performance. However, the technology integration still requires involvement from suppliers, customers, and internal to improve the exchange of technological knowledge (Vachon, 2003; Wu, 2013). The findings of the hypotheses testing concluded that the use of integrated-technology process along the green supply chain would improve sustainable performance.

5.3 Discussions on Multiple Regression Results (Objective 2)

The internal integration and technology integration have been found to be significantly influential on sustainable performance. Although supplier, customer, and logistic integration have been found to be positively correlated with sustainable performance, based on the multiple regression results (Table 4.14), these three variables representing the GSCI construct do not significantly influence sustainable performance of Malaysian's ISO 14001 certified manufacturing firms. This result emphasizes that these firms considered internal integration and technology integration as the most influential and significant predictors on sustainable performance.

The insignificance of supplier, customer, and logistic integration in predicting sustainable performance occurs because the proposed model of GSCI in the study is not collectively significant in predicting sustainable performance. It is possible for several independent variables to be individually correlated with a dependent variable, but not all of them will be statistically significant in the same multiple linear regression model (Creech, 2011). In conclusion, all five variables representing the GSCI (supplier integration, customer integration, internal integration, logistic integration, technology integration) are positively correlated with sustainable performance, but not all five add up to significantly predict the sustainable performance.

Table 5.2
Summary of the Findings

Research Questions	Research Objectives	Statistical Analysis	Research Findings
Is there any relationship between supplier integration, customer integration, internal integration, logistic integration, technology integration and sustainable performance?	To determine the possible relationship between GSCI practices and sustainable performance.	Pearson's Correlation	Green Supply Chain Integration (supplier integration, customer integration, internal integration, logistic integration, technology integration) are positively correlated to sustainable performance.
Which of the GSCI practices (supplier integration, customer integration, internal integration, logistic integration, and technology integration) has the most impact on sustainable performance?	To determine which practice of GSCI has the most impact on sustainable performance.	Multiple Regression	Internal integration and technology integration are the strongest predictors of sustainable performance.

5.4 Theoretical Implication

The study contributes to the GSCI knowledge in several ways. In response to previous studies (e.g., Wu, 2013; Yu et al., 2014) where the findings found that there are possibilities of other variables in representing the GSCI theoretically, this study clarifies the relationship between multiple GSCI dimensions and sustainable performance dimensions to extend the understanding of GSCM research. Furthermore, there is a lack of theory in explaining how and why green integration leads to better performance, and what and who are supposed to be integrated (Wong, Wong, and Boon-itt, 2015). The previous studies (e.g., Walton et al., 1998; Zailani et al., 2012) have also separately investigated internal and external

characteristics when investigating the supply chain and inter-organizational performance. Therefore, the first contribution of this study is to provide and test an integrated framework, which incorporates various GSCI dimensions simultaneously with addition of logistic and technology integration.

Second, choosing the most appropriate performance measures is difficult due to complexity and interdependence of green supply chains (Flynn, Huo, and Zhao, 2010). This can be seen through common selection of organizational performance, a measurement using composite of several performance dimensions, which suggests a bias towards the universal applicability of manufacturing practices. Apart from that, many studies (e.g., Lai and Wong, 2012; Green et al., 2012) examining the effect of GSCI on organizational performance have pulled different dimensions of sustainable performance altogether within one construct, which can lead to a shortcoming in the findings. This study contributes theoretically via the measurement of sustainable performance which includes dimensions of economic, environmental, and social. The use of sustainable performance measurement fits with the GSCM study as environmental becomes the main objective and the fact that it covers the perspective of organization's economy, environmental protection through organization's green practices, and protection on social's welfare, health, and safety. Hence, as sustainable performance is multi-dimensional in nature, it must be analysed as such.

The results enrich the knowledge on the relationship of GSCI and sustainable performance. This study provides comprehensive explanation of the GSCI with a combination of both internal integration and external integration (supplier and customer) to suggest that a relationship between the GSCI and sustainable performance might be miscast if either internal integration or external integration is overlooked (Zhu et al., 2010).

This study also includes logistic integration and technology integration in exploring the relationship between supply chain integration and sustainable performance, in which the technology integration turned out to be the strongest predictor of sustainable performance. Nevertheless, further theoretical investigation of the GSCI would be encouraged as there are more possible factors of integrated green supply chain that may strengthen the sustainable performance.

5.5 Managerial and Practical Implication

The study's findings have a number of managerial implications that could contribute valuable insights for manufacturer to plan and develop a GSCI strategy from the internal, upstream, and downstream of the green supply chain perspective. The major managerial implication of this study is that manufacturers should develop integrated-green practice that combines five important elements, namely supplier, customer, internal, logistic, and technology integration. The managers should develop a comprehensive environmental strategy, which requires the implementation of internal environmental management initiatives and cooperation from both suppliers and customers. In the process, the manufacturers need to work directly with both parties to achieve desired results – an improved sustainable performance in terms of economic, environmental, and social. The failure to recognize the roles and importance of external efforts in building environmental collaboration with the supply chain partners would affect the firms' environmental goals (Rao and Holt, 2005; Vachon and Klassen, 2006; Vachon and Klassen, 2008).

The practical views of this study suggest that manufacturers should also extensively integrate their environmental management practices with logistic and technology by

pursuing an environmental strategy with a broad arc of green integration. The proposed and empirically supported GSCI model provides more specific direction to manufacturers that seek to extend environmental practices throughout their supply chains. Thus, the GSCI framework proposed in this study would be able to provide supply chain and operations managers a new way to understand the opportunities and risks that business face in the light of sustainability demands and growing environmental pressures. The results clearly suggested that it is important for managers to simultaneously consider the integration through internal, technology, customer, supplier, and logistic when implementing environmental sustainability in the supply chains. Overlooking one of these elements may hinder their efforts to improve sustainable performance.

Although the study was conducted on Malaysia's manufacturing firms, the implications are able provide valuable insights for firms in other developing countries that have economic and green culture conditions similar to those in Malaysia. The reason is that the companies in developed countries are more culturally or politically sensitive to environmental issues and adopt green practices (Yu et al., 2014). The GSCM has become one of the most important environmental and social issues that are gaining popularity in the South East Asian region, and many leading companies in this region are realizing a competitive dimension to having a green supply chain as they aim for the balance of sustainable performance (Rao and Holt, 2005).

5.6 Limitations of the Study

The findings of the study have several constraints encountered during data collection process. Lack of cooperation from the respondents, budget limitation, and time constraints

have led into a small sample size, which might influence the results. Therefore, the findings of the study have to be taken with caution due to these limitations.

5.7 Direction of the Future Research

The study on green supply chain management has various potentials to be further explored. Due to pressure from the customer side and governmental body on environmental protection, the manufacturing industry is expected to achieve the balance of sustainable performance.

The construct of green supply chain integration can be extended to cover a broader area of the GSCM. Based on the multiple regression result, the value of R Square explains 59.2% of the variance in predicting sustainable performance. This suggests that there are other factors influencing sustainable performance. Furthermore, there is still a lack of parsimonious GSCI theory in explaining how and why green integration leads to better performance, and what and who are supposed to be integrated (Wong, Wong, and Boon-itt, 2015).

In term of data collection process, a bigger sample size could contribute to the accuracy of the result (Loewenthal, 1996). Therefore, an increase of the sample size would be a good suggestion for the future research. In addition to that, each country is facing with different level of pressures and different level of technology advancement to practice green manufacturing (Zhu et al., 2010), a comparison related study should be able to achieve more conclusive result. This will also help to generally provide indication on how

sustainable performance can be achieved through green practices particularly among manufacturing firms.

5.8 Conclusion

Achieving sustainable performance is now becoming main objective for business firms globally. In depth, to ensure long-term sustainability in the market and to gain competitive advantage, the balance of economic, environmental, and social are required to be sustained as well. Environmental obligation has caused many business firms to comply with the regulations. The practice of the GSCM however requires integration among green supply chain partners to achieve sustainable performance.

The GSCI consisted of supplier integration, customer integration, internal integration, logistic integration, and technology integration are proven to be significant with organizational sustainable performance. In other word, supplier, manufacturer, and customer have to collaborate through their green supply chain activities. These partners depend on each other to ensure good information exchange, material, and cash flow along their supply chain. In addition to that, the roles played by logistic and technology integration are also important where they are positively correlated to sustainable performance through the supply chain activities. It is found that internal integration and technology integration are the strongest predictors on sustainable performance. Therefore, manufacturing firms should focus more on integration within the company and the use of technology to achieve sustainability in the market as well as to keep up with the core requirement of environmental.

Despite being the main contributors to the nation's economy, manufacturing firms have to look forward to decrease global environmental causes. The efforts taken through integration would lead to organization's cost reduction from green supply chain activities. Nevertheless, to offer cooperative value chain with the supplier and the customer, the manufacturing firms should always monitor their activities and communicate to clearly understand their environmental direction. Building collaborative relationship and appropriate integration strategies through the GSCI are important to cope with the environmental pressures and to ensure satisfaction among various stakeholders including supplier, employee, customer, and society.

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