Assessing the Impact of Sustainable Practices on Organizational Performance

Mina Jafari

A Thesis

In The Department

Of

Institute for Information Systems Engineering (CIISE)

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Applied Science

(Quality Systems Engineering)

Concordia University

Montreal, Quebec, Canada

April 2017

Concordia University

School of Graduate Studies

By: Mina Jafari

Entitled: Assessing the Impact of Sustainable practices on organizational performance

And submitted in partial fulfillment of the requirements for the degree of

Masters of Applies Science in Quality Systems Engineering

Complies with regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

Dr. Ahmet Satir	External Examiner
Dr. Arash Mohammadi	Internal Examiner
Dr. Walter Lucia	Chair
Dr. Anjali Awasthi	Supervisor

Approved By: ______________________________

Chair of Department or Graduate Program Director

____

Dean of Faculty

____

Abstract

Assessing the Impact of Sustainable practices on organizational performance

Mina Jafari

Over the past few decades, there has been a growing pressure on organizations to be fully responsible for their business operations in order to minimize their environmental impact. These pressures have evolved the green practice adoption procedures that companies are undertaking.

In this thesis, we study the overall impact of adoption of various green practices on firms' performance outcome. The green practices included in the study are: Internal environmental management, green design and product development, green purchasing and procurement, green distribution, investment recovery, reverse logistics and finally socially sustainable practices. The effectiveness of each of these seven practices is examined against environmental and financial performance of organizations. The influence level of different environmental drivers in form of regulatory pressure and other non-coercive pressures is also investigated.

A survey among 45 Canadian firms is conducted for this purpose. The data obtained is subject to partial least square structural equation modeling using SmartPLS software for performing of statistical analysis. The model results show that internally oriented environmental practices such as internal environmental management and socially sustainable practices impact more the environmental and financial performance of companies than other practices. Furthermore, no significant relationship between product recovery practices and environmental and financial performance was observed.

Keywords: Green supply chain management, environmental performance, green practices, PLS-SEM, survey questionnaire.

Acknowledgements

First of all, I wish to thank my thesis supervisor, Prof. Anjali Awasthi, for her strong support and guidance throughout my entire Masters' and providing an enjoyable work environment.

I also want to thank people who participants and replied to our survey.

I also acknowledge support from CN center for studies is sustainable supply chain management who have provide me with financial support, Concordia University and specifically CIISE department.

Table of Contents

List of Tables

List of Figures

List of Acronyms

GSCM: Green Supply Chain Management

SSCM: Sustainable Supply Chain Management

TQEM: Total Quality Environmental Management

EMS: Environmental Management System

LCA: Life Cycle Assessment

CB-SEM: Covariance Based Structural Equation Modeling

PLS-SEM: Partial Least Square Structural Equation Modeling

IEM: Internal Environmental Management

GD: Green Design and Development

GPP: Green Purchasing and Development

GPT: Green Packaging and Transportation

IR: Investment Recovery

RSC: Reverse Supply Chain

SS: Socially Sustainable

FP: Financial Performance

EP: Environmental Performance

Chapter 1

Introduction

1.1 Background

The world commission on environmental development defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"(Brundtland, 1987). As the environmental concerns has increased over the past few decades, integrating sustainable practices within the context of supply chain management is becoming popular in both academia and industry attempting to mitigate environmental impacts while achieving financial performance gains (Lee *et al.,* 2014). Historically, environmental policies were applied by firms to an extent enough to meet the regulatory requirements. In addition, earlier studies on environmental management were centered around economic advantages that may be achieved from end of pipe control or waste treatment activities, referred to as "picking the low-hanging fruit". However, due to scarcity of resources and extensive exploitation of the natural environment as a consequence of environmentally unconscious manufacturing practices, more effective and proactive approaches to environmental management is required. Therefore, the new era of environmental management operation has started to meet this need by expanding the boundaries of green initiatives through the entire supply chain. Figure (1-1) summarizes how environmental management has evolved from reactive and internal viewpoint to a one that embraces prevention of environmental damage throughout the entire product life cycle as well the entire supply chain.

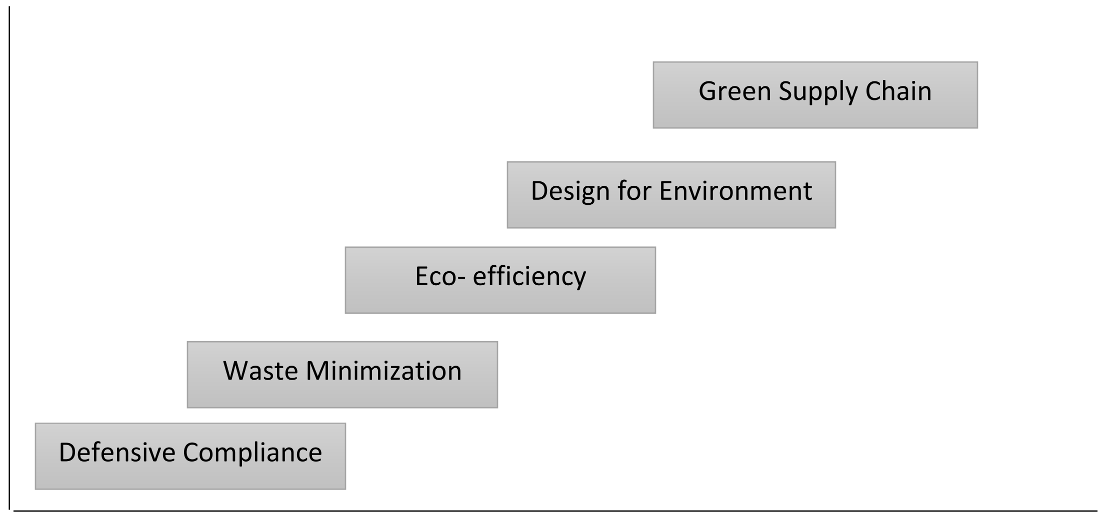


Figure 1-1 Shift in environmental management (Eltayeb & Zailani, 2009)

1.2 Research Objectives

This thesis has two prime research objectives:

(1) Compare the influence level of different groups of environmental drivers on the adoption of GSCM (Green Supply Chain Management) practices;

(2) Investigate the consequences of implementing GSCM practices in terms of performance outcomes.

Even though some studies with above objectives have been reported in the past, yet the number is limited in Canadian context. Over the past few decades, numerical analysis of the environmental practices and outcomes has shifted from event studies which track the market reactions to certain environmental incidents and awards (Klassen & Laughlin, 1996), (Jacobs, Singhal, & Subramanian, 2010) to numerical studies which are based on survey researches among manufacturers to reflect not only the financial aspect but also to explore other features of sustainable supply chain (Zhu & Sarkis, 2004). In this study, we are following the latter approach through a survey study and a selection of supply chain phases that has the potential to improve environmentally; then we propose a model that explores the links between them.

1.3 Thesis outline

The rest of the thesis is organized as follows.

In chapter 2 we present the literature review. It includes more than 20 years of studies in the area of SSCM or GSCM. Different classifications and solution approaches that we have extracted from the literature to base our research are also covered.

In chapter 3 we present the solution approach. We explain the choice of the methodology, data collection procedure, and hypothesis development.

Chapters 4 presents the survey study and application results.

Finally, chapter 5 summarizes the final results, provides conclusions and gives directions for future studies.

Chapter 2

Literature Review

The following chapter reviews literature and research studies associated with sustainable practices through different stages of supply chain.

2.1 Sustainable Supply Chain Management

Sustainability is becoming one of the key factors for planning and management within organizations and across supply chains. Companies are increasingly ameliorating traditional supply chain management practices in order to integrate sustainable practices internally and in coordination with other firms along their supply chains. (Rossi et al. , 2013).

According to (Beske-Janssen, Johnson, & Schaltegger, 2015) the most cited definition and broad enough to allow further theorization of GSCM was given by (Ahi & Searcy, 2013) as follows:

"[…] the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements"

Therefore sustainable supply chain management may be translated a synchronized system of all activities within the supply chain in order to minimize the environmental impact.

2.2 Environmental Pressures and Drivers

This section gives an insight to reasons and motivations behind GSCM adoption by manufacturing firms.

GSCM researchers frequently explain environmental drivers by referring to institutional theory, which provides an appropriate structure to study in what ways firms respond to institutional pressure. According to institutional theory, there are three types of forces which lead to isomorphic changes through the organization: Coercive, normative and mimetic. While coercive pressures are exert by those in power (e.g., government), normative pressures are defined as the result of collective efforts of groups of professionalized organizational practices (e.g. industry standards), and mimetic pressure is characterized by mimicking the practices of best in class manufactures. Despite this precise categorization, it is not clear how these forces interactively shape GSCM decisions (Sierra, 2015). Furthermore, none of the survey-based studies have explored the linkage between different categories of drivers and features of GSCM practices.

Manufacturers adopt environmental management practices due to several external and internal pressures. Scarcities of resources and environmental degradation have provoked governmental agencies, at local, national and international level to exert pressures on manufacturers, who are the main resource consumers and polluters. And this is usually enforced by increasing environmental regulatory and tax policies (Esfahbodi *et al.*, 2016). Hence, governmental regulatory pressure, also referred to as coercive driver, is recognized to be the most influential factor that leads to green practice implementation (Zailani et al., 2012) (Holt & Ghobadian, 2009). Therefore, they conclude that government agencies through their regulatory force can influence the actions of an organization by enacting environmental regulations.

However, other studies reported different results. Aside from coercive/governmental pressures, firms have other incentives to implement green practices including competition over both resources and customers. To increase awareness on environmental issues, a number of other stakeholders put pressure on companies to adapt to environmentally friendly practices. For example, customers and buyers require their suppliers to offer products and materials which take environmental issues into consideration (Chiou et al. 2011). Such pressure may also be transmitted by financial institutions, suppliers, owners, and other shareholders, who are directed by the possible subsequent rewards from environmental transformation. Additionally, the adoption of environmental practices by competitors can create a source of pressure. A recent research recognizes these important influences and suggests that stakeholders should be closely involved in the development of public environmental policies (González-Benito & González-Benito, 2008). According to a study conducted among Spanish manufacturers, using a sample data yield from 186 Spanish manufacturing firms, González-Benito recognized two main categories of environmental drivers namely: govermental and non-govermental pressures. Furthermore, their result suggests that market orientation is linked to more intense perceptions of pressure from non-governmental stakeholders, whereas govermental pressure was not as effective (González-Benito & González-Benito, 2008). The same classification of drivers was applied and confiremed later in 2015 (Sierra, 2015).

Following previous studies in this field, we refer to governance pressure as coercive pressure which appears in the form of environmental regulation, and non-governmental pressure as non-coercive. Non-coercive pressures are defined by any voluntarily adaptation of GSCM due to competition, or as required by costumers (buyers), public pressure (society) or financial institutes such as investors (Sierra, 2015).

2.3 Green Supply Chain Management Dimensions

This section provides an insight to various dimensions of green supply chain management which researchers have identified as measures of sustainability.

Zhu and Sarkis (2006) developed and tested a measurement model for GSCM practice implementation. They found five underlying constructs which represent dimensions of GSCM practices: Internal Environmental management (IEM), Green design and development (GD), green purchasing and development (GP), cooperation with costumers (GP) and investment recovery (IR). In this study, however, reverse supply chain (RSC) and social sustainability (SS) practices are added based on the preceding literature in order to expand the dimensions of our analysis and modifications that were made to the initial model. These seven dimensions of GSCM practices (e.g. IEM, GD, GPP, GPT, IR, RCS and SS) used in this research were selected after a careful review of existing literature.

2.3.1 Internal Environmental Management

In Green supply chain management literature, "internal environmental management" practices are defined as environmental strategies developed by companies at corporate level. The main propose of internal green management practices is to evaluate the extent to which a company is participating in environmental protection actions (Yu & Ramanathan, 2014). In order to operationalize sustainability policies, companies are required to develop and implement sustainability management tools, which includes decision-support systems to facilitate the organizational change process, including the design and selection of more sustainable materials, products and processes. (Agarwal & Vijayvargy, 2014) described the operational definition of internal environmental management as "the practice of developing GSCM as strategies imperative through full support of the top leaders and middle managers." In their initial survey model, (Zhu

& Sarkis, 2004) proposed five factors as main indicators of internal environmental management practices. An essential characteristic of all five elements is the need for cross functional cooperation among all departments rather than single fiction or department. The five elements were used extensively by later researchers and are listed below:

- Top management is committed to implement GSCM (Green Supply Chain Management) practices
- Mid-level management is committed to implement GSCM practices
- Engagement in cross-functional activities for TQEM (Total Quality Environmental Management) implementation
- Implementing an internal EMS (Environmental Management System)
- Performing in accordance to ISO 14000/ EMAS guidelines

2.3.2 Green design and product development

Green product design is especially important since most of the environmental impact of any product and its related processes are 'locked' into the product at the design phase when materials are chosen and product performance is determined (Zhu, Sarkis, & Lai, 2013). Green or sustainable design of products refers to initial development of a product as well as all the associated procedures in a way that minimizes the environmental impact. Type and amount of pollutants emission, solid and hazardous wastes generation, and resources and energy consumption are normally determined through product design and process development stage. Green product/ process design is a critical tool for firms to produce green products which enable them to minimize or completely remove emissions and wastes. Firms are now improving their operational practices to adopt green design and production that avoids environmentally hazardous components and makes it economically possible to save components that have high reuse value (Kleindorfer *et al.,* 2005). Therefore, Eco-design practices are a set of initiatives taken by manufacturers during the product design process that minimize consumption of materials and energy, while facilitating the reuse, recycle, and recovery of component materials and parts, and that avoid or reduce the use of hazardous products during the manufacturing process (Green *et al.*, 2012). Zhu and Sarkis (2004) have characterized the concept of Eco-design or design for environment with the following description:

- Design of products for reduced consumption of material/energy.
- Design of products for reuse, recycle, recovery of material, component parts
- Design of products to avoid or reduce use of hazardous of products and their manufacturing process,

Other indicators such as "performing a complete life cycle assessment" which systematically integrates LCA as an essential part of any product development or modification, and "design for ease of disassembly" which specifically focuses on feasibility of disassembling procedure has been added later as additional measures of Eco-design. (Mitra & Datta, 2014), (Eltayeb, 2009)

2.3.3 Green Purchasing, Procurement and Sourcing

The main emphasis of green procurement activities is to cooperate with suppliers for the purpose of developing products that are environmentally sustainable (Green et al., 2012) Therefore, green purchasing activities are generally categorized with the external aspect of supply chain management which extends beyond organization boundaries. Researchers have recognized two different approaches towards green purchasing initiatives, generally known as monitoring and collaborating practices. Monitoring activities are characterized by the use of an arm's length approach to control outputs by examining supplier's environmental records and conducting audits by the buyer or an independent third party. On the other hand, collaborative green purchasing is focused on providing training and education to suppliers or cooperating in design processes in order to ensure green design. (Zhu & Sarkis, 2006) have designed and tested one of the initial measurements of green purchasing activities which includes items with more emphasis on monitoring the suppliers to ensure they practice green manufacturing. Later researchers have enhanced the measurement by including more collaborative measures of green purchasing and some researches were based on differentiating the two approach (Vachon and Klassen, 2006). Below, a list of green procurement indicators is provided:

- Assessing suppliers' environmental performance through evaluation (questionnaire/ Audits).
- Requiring suppliers to implement Environmental management system.
- Providing environmental awareness seminars and/or training for its suppliers.
- Participating in joint planning sessions with its suppliers to resolve environmental related problems.

2.3.4 Green packaging, transportation and distribution

Sustainable distribution practices consist of transportation of products from suppliers to manufacturers and final customers with the purpose of minimizing negative environmental impact (Esfahbodi *et al.,* 2016). Packaging, storage, transportation and distribution activities also need to be designed environment-friendly. In addition, in choosing the packaging materials factors such as recyclability of the packaging material, minimal usage of raw material, and lightweight packaging for easy warehousing and transportation should be considered. (Mitra & Datta, 2014) Similarly, sustainable distribution and transportation involves replacing railways with conventional road and air transports. (Rao and Holt 2005; Green et al 2012, Wong et al. 2012)

For road transportation, in order to fulfill economies of scale, firms should always attempt to ship full truckload (FTL). The relevant items on environmentally sustainable packaging, storage, transportation and distribution include using environment-friendly and recyclable packaging, environment-friendly storage, alternative transport mechanisms and achieving economies of scale in transportation. Countries are now passing regulations requiring manufacturers to be in charge of waste management processes related to the recovery or safe disposal of their products after the point of consumption. These responsibilities may include collection, transportation, inspection, recovery and/or disposal of returns, collectively referred to as reverse logistics (Mitra & Datta, 2014). The following distribution practices have been applied as measurement of green distribution by researchers:

- Collaborating with its customers in order to use less energy during product transportation.
- Using high-tech freight logistics transportation systems (such as reducing container weight and improving refrigeration).
- Using route optimizing technology in order to perform transportation/distribution activities.
- Using environmentally-friendly packaging (such as bio-degradable packaging, low density packaging).
- Tracking and monitoring emissions caused in product distribution (e.g., carbon footprint).

2.3.5 Investment recovery

The main purpose of Investment recovery was to liquidate excess assets of companies. However it could also be interpreted as a green initiative as it efficiently decreases the disposal rate of companies. Even though investment recovery may not be the most sustainable practice, it does extend the life of the product or material where it can be recycled into other products or materials (Zhu and Sarkis, 2004). Previous research has proven that the U.S. and German enterprises identified investment recovery as the most important practice for green purchasing (Zhu and Sarkis, 2006). There has been three indicators that measure the extent to which an organization is involved in investment recovery activates. These items have been extensively used as the only measure of investment recovery throughout GSCM literature and are listed below. (Esfahbodi et al., 2016),(Lee et al., 2014)(Chiou *et al.,* 2011)(R.O.a & C.b, 2011)

- Sale of excess inventories or material.
- Sale of scrap and used materials or by-products.
- Sale of excess capital equipment.

2.3.6 Reverse supply chain management

While investment recovery concentrates on financial realization of excess capital and machinery through direct sale, the primary focus of reverse supply chain practices is on material and component recovery in various extensions and degrees from the point of consumption. Depending upon the product type and functionality, reverse supply chain activities may involve recycling, reuse, remanufacture, repair, refurbishing, or safe disposal of the products and materials. (Eltayeb & Zailani, 2009)In a survey study conducted among 118 American manufacturing companies with the propose of assessing the impact of different reverse supply chain practices on organizational performance, (Skinner, Bryant, & Richey, 2008) have identified five categories of reverse logistics as listed below and illustrated in Fig. (2-1).

- Destroying: safe disposal of products at the end of their life cycle when they cannot be sold or used at their location (perhaps because of prohibitively high transportation costs, too low of volume to warrant additional handling, etc.).
- Recycling: taking product back for re-work or disposal. Recycling is also a feasible option when materials of the original product can be used for another product or subassembly
- Refurbishing/ remanufacturing: collecting a used product or component from the field, assessing its condition, and replacing worn, broken, or obsolete parts with new or refurbished parts. Unlike recycling, the identity and functionality of the original product is reserved
- Repackaging of returned products: No re-work or additional processing is required, instead the product is repackaged to prepare it for reshipment and re-sale.

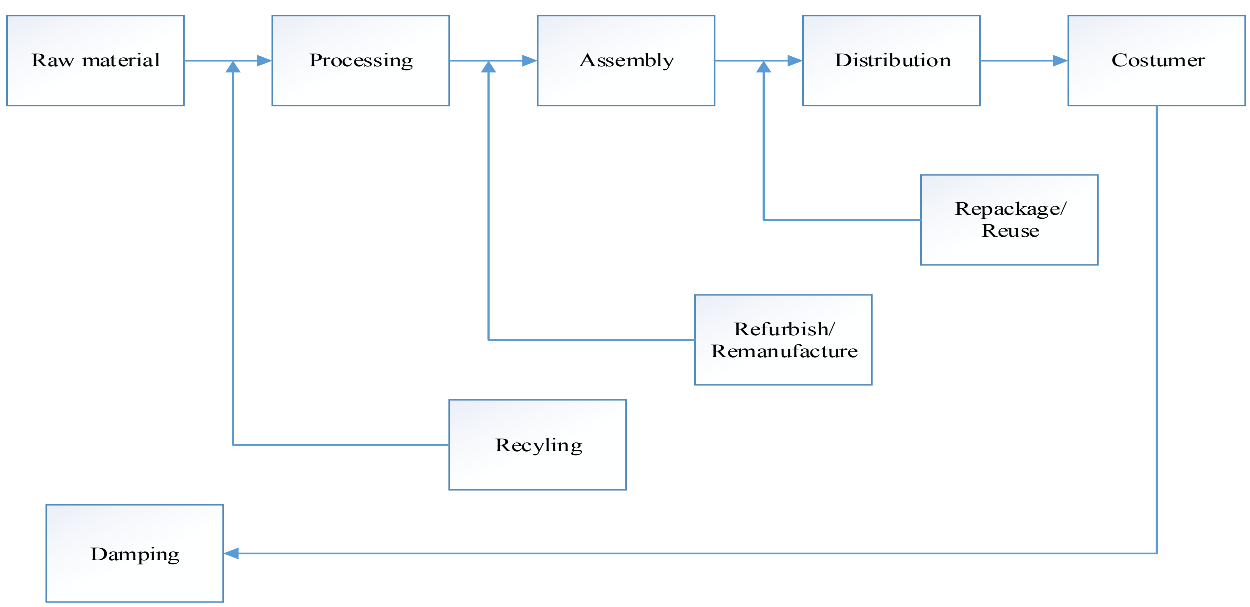


Figure 2-1 Product disposal options in Reverse logistics adopted from (Khor & Mohamed Udin, 2012)

2.3.7 Social Sustainability

Much of the previous research has focused on environmental sustainability because many successful multinational companies have incorporated this particular value system (Berry& Rondinelli 1998). However, research on social aspects of sustainability has been ignored in comparison with other features of sustainability (Dillard, Dujon and King 2009). According to social sustainability principles, the organization should provide judicious opportunities, encourage diversity, promote interactions and connections within and outside the community, ensure quality of life and provide democratic processes along with open and responsible governance structures (Elkington 1994). For human resource sustainability for instance, the organization should recognize, value and promote the capability of its people with appropriate human resource policies and practices for equity, development and well-being (Gimenez, Sierra, & Rodon, 2012). Worker participation and training proved to be positively related to environmental improvement (Florida 1996; Rothenberg et al. 2001) and overall improved sustainability outcomes Marshall et al. (2005) found that a concern for vineyard employee welfare was linked to the reduction of toxic spray applications and other potentially damaging environmental practices. Social sustainability is measured by the following attributes:

- Ensuring worker quality of life.
- Ensuring worker job satisfaction.
- Ensuring worker skill development (in-house education and vocational training).
- Fair compensation to all employees (Statement on normal working hours, maximum overtime & fair wage structures).
- Equal opportunity statements and implementation plans.

2.4 Performance metrics

Performance measurement can be defined as "the process of quantifying the efficiency and effectiveness of an action." (Neely *et al.,* 1995)

First, the parameters of measurement have to be properly defined. It is necessary to have a common understanding of the performance objectives that a company intends to pursue and explanations of how to measure these objectives (Neely, 1999). What might be difficult to measure inside a focal company becomes even more complex across the entire supply chain – both upstream and downstream. Second, the actual performance has to be measured, which requires the development and agreement on performance objectives and indicators which are clear, measurable and comparable throughout the whole supply chain (Schaltegger and Burritt, 2014). For complex sustainability issues, this is often not straightforward, as few standards on sustainability measurement exist, especially with regard to social issues. Third, performance measurement tools and management systems need to be developed and implemented across several partners in the supply chain to ensure valid and reliable information. Numerous approaches have been proposed and developed over the past decades to handle measurement for SSCM, including the sustainability balanced scorecard. (Janssen *et al*., 2015)

In this study we focus on two main and most frequently measured aspects of sustainability performance: environmental performance and financial performance as a result of SSCM practices.

2.4.1 Environmental performance

The ultimate purpose of implementing green initiatives in firms is to improve their environmental performance or to reduce negative environmental impact. The broad view of sustainability integrates the concepts of economic, social, and environmental performance, and the literature related to sustainability is relatively well developed (Green *et al.,* 2012*).* Environmental performance is defined as the ability of manufacturing companies to reduce air emissions, discharge waste, and solid wastes as well as the potential to decrease consumption of hazardous and toxic materials (Zhu et al., , 2008). "Many international firms now publish separate annual environmental performance report. Environmental performance measures how successful a firm is in reducing and minimizing its impact on the environment, often relative to some industry average or peer group. Externalities, such as the costs of polluted air, are transferred back to the firm to achieve environmental improvement, thus raising operating costs and hurting profitability. Environmental certifications, offer a new basis of differentiation for the consumer. In addition, environmental sensitivity may become necessary to preserve some markets in the longer term. On the cost side, firms that invest heavily in environmental management systems and safeguards can potentially avoid future environmental spills, crises, and liabilities. Costs resulting from materials waste and inefficient processes are also minimized. Environmental performance may also be interpreted to reflect the quality of underlying management systems" (Klassen and Laughlin 1996)

2.4.2 Financial performance

Economic performance represents savings that result from improved environmental performance (Zhu and Sarkis, 2006), and normally measured considering expectations and beliefs of the relations. The cost saving nature of environmental performance should lead to improved economic performance, sustaining decreases in the associated costs (Green et al., 2012). Economic performance is an important reason why manufacturing enterprises seek to implement environmental management practices. Previous studies show that success in addressing environmental issues may provide new opportunities for competition, and new ways to add value to core business programs. Studies have shown that corporate environmental management practices such as internal and external GSCM have a positive relationship with an organization's economic performance as part of 'win-win' propositions. Most companies can gain performance benefits through internal GSCM practices such as ISO14001. Sustainable management practices with a long term orientation can bring significant sales growth, return on assets, and profit before taxation and cash flows from operations (Ameer and Othman, 2012). Inter-organizational relationships may provide formal and informal mechanisms that promote trust, reduce risk, and in turn increase innovation and profitability. Sustainable supplier cooperation is found to have positive significant effects on economic performance (Zhu and Sarkis 2013). Some GSCM research have used actual financial numbers or accounting terms such as Return on Investment (ROI) and return on asset (ROA) as a separate category to assess the economic performance of firms. However due to confidentiality matters and constraint on number of respondents , most of the studies have decided to exclude financial measures in accounting context and only focus on financial improvements as a direct result of GSCM implementation.

2.5 Linking environmental practices and performance outcomes

The concept of GSCM has been viewed and analysed from different perspectives since it first emerged in 1990's. Researchers have developed several measurement methods to quantify green practices and performance indicators. This section summarises a history of various classifications, viewpoints and findings of some frequently cited empirical studies in the field.

Zhu and Sarkis (2006) developed one of the very first and frequently cited survey research studies on GSCM using empirical data collected from 186 Chinese manufacturing enterprises. They have examined the relationship between four GSCM practices, namely: Internal environmental management, External GSCM, Investment recovery, Eco-design and environmental and financial outcomes taking into account lean manufacturing and quality management techniques as moderators to the relationship. They reported direct and positive relationship between GSCM overall practices and both environmental and financial outcome specifically with moderating effect of quality management techniques (Zhu & Sarkis, 2004). Moreover, they have extended the study later by adding another category of empirical research on GSCM through examining the adoption of green practices in different stages of supply chain with respect to industrial sectors (Zhu & Sarkis, 2006). In this study Chinese firms were divided into three main sectors: the automobile industry, the thermal power plants and the electronic/electrical industry. The study suggests that different industrial sectors behave differently in terms of adoption of green practices. For example, the greatest pressure to implement green initiatives was for automobile manufacturing industry which is required by importer countries, while the most mature adoption was achieved in electronic and electrical industry.

A different classification of green supply chain activities was introduced by Roa and Holt (2005) by separating upstream and downstream green activities in two groups and formed inbound green and outbound green initiatives together with green production processes as the middle stage. They have found that greening the different phases of the supply chain leads to an integrated green supply chain and green outbound is the direct result of applying green inbound and green production initiatives. Klassen and Vachon (2006) presented another standpoint towards sustainability in supply chain by focusing on the type of relationship companies establish with their suppliers and customers. They have initiated a perspective that centers on whether companies are monitoring their suppliers' behaviour on sustainable practices or if they cooperate with them in order to better implement green practices. They defined monitoring activities as using arm's length approach to control outputs through examining of supplier environmental record, using questionnaires or audits performed directly or by third parties. They have claimed that the main propose of monitoring activities is to minimize the risk while collaborating activities would lead to prominent improvements in environmental performance. Collaborative practices were characterized as joint environmental goal setting, shared environmental planning, and working together with customers and suppliers to decrease pollution and other environmental impacts.

In order to fully investigate all aspects and outcomes of individual green initiatives, some studies have concentrated on fewer sustainable variables. For example, using a sample of 118 north American manufacturing firms, (Skinner *et al.,* 2008) have focused on operational and economical outcomes of various disposition strategies and effectiveness of reverse logistics. Their results demonstrate that under instances of active resource commitment to reverse supply chain plans, manufacturing firms may expect superior performance by choosing destroying, recycling, refurbishing, and/or remanufacturing of product.

Social concerns is another emerging concept in sustainability SSCM/GSCM literature which is less developed and received less attention. Social sustainability appears as both dependent (performance) and independent (practice/initiative) variable in GSCM research.

Studies that have integrated social sustainability as a performance metric have characterized social performance as: Significant improvement in firm's image in the eyes of its customers, product image and in relations with community stakeholders, e.g., Non-governmental organizations

(NGO) and community (Zailani et al., 2012). In addition, social performance was measured as: social welfare and betterment; community health and safety; risks to the general public, and occupational health and safety of employees (Paulraj, 2011). On the other hand, social concerns have been addressed as sustainable practices implemented by companies and their effectiveness were measured against other output metrics such as environmental, financial and operational performance (Pullman et al., 2009).

Other than examining the direct impact of green initiatives on what is referred to as triple bottom line (environmental, social, financial), (Kleindorfer, Singhal, & Van Wassenhove, 2005) there has been studies that switched the focus on other benefits of green practice adoption. (Chiou et al., 2011) for example have constructed a model that explains how greening the supplier would result in innovations in a wide range of areas including product, process and managerial innovations. Through conducting an empirical study on 124 manufacturing companies in Taiwan, they found that that greening the supplier through green innovation contributes significant benefits to the environmental performance and consequently on competitive advantage of the firm. However, another study that highlights the role of innovation in GSCM was performed using data from United Kingdom manufacturing sector reported different results.(Ramakrishnan et al., 2010) stated that while regulatory pressures for GSCM practice implementation directly and positively affect financial performance of UK firms, environmental regulations negatively influence innovation, and innovation negatively influences economic performance in short run.

Table (2-1) presents a summary of empirical researches in GSCM literature and construct variables and major findings of each study. It also demonstrates which variables were selected as independent or dependent variables. Most studies have considered green initiatives as dependent variables and worked towards investigating the extent of their effectiveness in terms of dependent variables or performance indicators (Lee ey al., 2012), (Wong, 2013), (Lee et al., 2014) (Zhu et al., 2013). In addition to practices and performances, few research studies have taken into account the underlying reasons for GSCM adoption. (Esfahbodi et al., 2016) proved that governmental environmental regulations, referred to as coercive pressures, play a crucial role in UK manufacturing firms. Despite these results, another study conducted in Spain, (Sierra, 2015) suggests that non-coercive drivers seem to be more operative. It should be noted that each of the following studies were performed in different countries and part on the inconclusive result could be interpreted by this geographical element.

Author	**Independent variable**	**Dependent variable**	**Major Findings**
(Zhu & Sarkis, 2004)	Internal environmental management, External GSCM, Investment recovery, Eco-design	Environmental performance Economic performance	Significantly positive impact of all green practices on environmental performance as well as economic performance. However, initial instalment of GSCM is costly and negatively affect the economic performance.
(Roa & Holt, 2005)	Greening Inbound, Green production, Greening outbound	Economic performance, Competitiveness	greening the inbound along with greening production, significantly lead to greening outbound and consequently to better economic performance and competitiveness
(Vachon; Klassen, 2006)	Environmental collaboration with suppliers and customers	Manufacturing performance in terms of Cost, Quality, Delivery and flexibility performance	Collaboration with suppliers predominantly linked to improved delivery and flexibility performance while collaboration with costumers improves quality performance
(Zhu & Sarkis, 2007)	Institutional pressures, Internal environmental management, Green purchasing, Investment recovery, Eco-design, Cooperation with customers	Environmental performance Economic performance	Institutional pressure helps improve environmental performance especially through eco-design and green purchasing activities. Regulatory pressures are mostly effective in adaptation of investment recovery and green purchasing, while competitive pressure helps GSCM adaptation with better economic performance.

Author	Independent variable	Dependent variable	Major Findings
(Skinner et al., 2008)	Destroying, Recycling, Refurbishing, Remanufacturing, Repackaging	Economic performance, Operational responsiveness, Operational service quality	Selecting a Reverse Logistic disposition strategy has no significant effect on economic performance and other performance indicators unless there is an active resource commitment strategy
(Zhu et al., 2008)	External GSCM relationships, Eco-design, Investment recovery	Organizational learning Management support	Significant positive relationships between organizational learning mechanisms, Management support and the adoption of GSCM practices was established.
(Pullman et al., 2009)	Social sustainability practices , Facility resource conservation, waste Recycling and reuse, Land management,	Environmental performance Quality performance Cost performance	Significant positive relationships between adoption of sustainable facility resource conservation and land management with environmental performance, however no significant relationship between socially sustainable practices and environmental and economic performance was reported.
(Ramakrishnan et al., 2010)	Environmental Regulations	Environmental performance Innovation	Environmental regulations are significantly and positively related to economic performance. However, in the short run, environmental regulations negatively influence innovation, and innovation negatively influences economic performance
(López-Gamero, Molina-Azorín, & Claver-Cortés, 2010)	Command and control legislation, Normative drivers. Managerial perception, Environmental management	Competitiveness on Cost Competitiveness in differentiation Financial performance	No significant relationship between command and control legislation and environmental management practices. Significant positive relationship between GSCM adoption and voluntarily norms resulting in competitive advantage which itself positively influence financial performance.
(Chiou et al., 2011)	Greening the supplier, Green product innovation, Green process innovation Green managerial innovation	Environmental performance Competitive advantage	Greening the supplier using green innovation significantly improves environmental performance and competitive advantage of the firm.
(Eltayeb, Zailani, & Ramayah, 2011)	Green purchasing, Eco-design, Reverse logistics	Environmental outcomes Economic outcomes Operational outcomes Intangible outcomes	Positive significant relationship between eco-design practices and environmental, financial and intangible performance and cost reduction, while RL has such relationship only with cost reduction.

Author	Independent variable	Dependent variable	Major Findings
(Yang, Hong, & Modi, 2011)	Internal environmental practices, Lean manufacturing Just-in-time flow Quality management Employee involvement	Environmental performance Market performance Financial performance	Environmental management practices alone are negatively related to market and financial performance. however improved environmental performance positively influence market and financial performance
(Paulraj, 2011)	Strategic Purchasing, Enviropreneurship	Sustainable supply management (SSM), sustainable performance (PERF)	Enviropreneurship positively and significantly links to all listed performance indicators. Strategic green purchasing has such relationship with SSM has no significant relationship with PERF
(Green et al., 2012)	Internal environmental management, Green information systems, Green purchasing, Eco-design, Investment recovery	Environmental performance Operational performance Organizational performance	green supply chain practices positively and directly lead to improved environmental and organizational performance
(S. Lee et al., 2012)	Internal environmental management, Green purchasing, Cooperation with costumers, Eco-design, Employee satisfaction	Operational Efficiency, Relational Efficiency, Employee Job Satisfaction, Business performance	Despite of direct and significant effect of GSCM Implementation on operational and relational efficiency and employee satisfaction, no significant relationship reported between GSCM implementation and business performance. Also, operational and relational efficiency have positive significant effect on business performance
(Zailani et al., 2012)	Environmental purchasing Sustainable Packaging	Operational performance, Economic performance, Environmental performance, Social performance	Environmental purchasing directly and positively affect economic, social and operational performance, whereas sustainable packaging has a positive effect on environmental, economic and social outcomes.
(Wong, 2013)	Internal environmental information integration (EII), Supplier(EII), Costumer (EII) Corporate Environmental innovativeness, Corporate environmental adaptability	Environmental performance, Financial Performance	Significant and direct relationships between costumer (EII) and Corporate Environmental innovativeness and Corporate environmental adaptability. Same holds true for the relationships between the latter two constructs and environmental and financial performance.

Author	Independent variable	Dependent variable	Major Findings
(Zhu et al., 2013)	Institutional pressure, Eco-design, Internal environmental management, Green purchasing, Customer cooperation, Investment recovery	Operational performance Economic performance Environmental performance	Significant positive relationship between Institutional pressure and adoption of GSCM. No significant relationship between GSCM practices and financial performance. However indirect improvement of financial performance was observed.
(Lee et al., 2014)	Internal environmental management, Green purchasing, Investment recovery, Eco-design, Cooperation with customers	Technological innovation	Significantly positive relationship reported between internal environmental management, eco-design and investment recovery to tech-innovation. Also, no significant relationship between green purchasing and corporation with costumers reported to tech-innovation
(Mitra & Datta, 2014)	Collaboration with suppliers, Environmentally sustainable product design and logistics	Economic performance, Competitiveness	Positive and significant result on collaboration with customers leading to environmentally sustainable product design & logistics which itself positively and significantly relates to both independent measures listed
(Sierra, 2015)	Coercive drivers, Non-coercive drivers, Monitoring activities , Collaborating activates	Environmental performance	Positive direct effect of collaboration on environmental performance, and no direct influence was found for monitoring. Also, negatively significant relationship between coercive drivers and collaborative activities was observed, along with positively significant link between both coercive and non-coercive drivers on monitoring activities.
(Laari, et al 2016)	Environmental collaboration with customers and suppliers, Environmental monitoring by customers and suppliers, Internal GSCM	Financial performance Environmental performance	Positive and direct effect of Internal GSCM and environmental monitoring of suppliers on environmental performance, in addition to significant positive affect of environmental collaboration with costumers on financial performance, while no significant relationship reported between environmental and financial performances.
(Esfahbodi et al., 2016)	Coercive drivers, Sustainable Design, Purchasing, Distribution, Investment recovery	Financial performance Environmental performance	Positive significant relationship between coercive drivers and adoption of GSCM except for partial significance for IR. Positive significant influence of all practices on environmental performance, while the same is not true for financial performance. Yet improved environmental performance positively and significantly affect financial performance.

Table 2-1 .Literature Review: GSCM Practices and Performance Constructs

2.6 Statistical Solution Approaches

The main purpose of GSCM studies which were summarized in the previous section is to explore the link between a number of dependent and independent variables. Therefore, in this section we reviewed the most frequently applied numerical approaches from the literature. Table (2-2) reviews these statistical methods.

Research Study	Method Selection
(Zhu & Sarkis, 2004)	Hierarchical regression
(Roa & Holt, 2005)	Structural Equation Modeling
(Vachon, Stephan ; Klassen, 2006)	Confirmatory Factor Analysis
(Zhu & Sarkis, 2006)	ANOVA, t-test
(Zhu & Sarkis, 2007)	Factor Analysis, hierarchical regression
(Skinner et al., 2008)	Multiple Regression Analysis
(Q. Zhu et al., 2008)	OLS(ordinary least square) hierarchical regression
(Pullman et al., 2009)	Path Analysis
(Ramakrishnan et al., 2010)	Structural Equation Modeling
(López-Gamero et al., 2010)	Structural Equation Modeling
(H.Hu & Hsu, 2010)	Factor Analysis
(Chiou et al., 2011)	Structural Equation Modeling
(Eltayeb et al., 2011)	Factor Analysis, Multiple Regression
(Yang et al., 2011)	Structural Equation Modeling
(Paulraj, 2011)	Structural Equation Modeling
(Green et al., 2012)	Structural Equation Modeling
(S. Lee et al., 2012)	Structural Equation Modeling
(Zailani et al., 2012)	Factor Analysis
(Wong, 2013)	Structural Equation Modeling
(Zhu et al., 2013)	Path Analysis
(V.-H. Lee et al., 2014)	PLS-SEM
(Mitra & Datta, 2014)	Structural Equation Modeling
(Sierra, 2015)	PLS-SEM
(Laari et al., 2016)	PLS-SEM
(Esfahbodi et al., 2016)	Structural Equation Modeling
(Vanalle, Ganga, Godinho Filho, & Lucato, 2017)	PLS-SEM

Table 2-2. Solution Approaches to empirical GSCM studies

From table (2-2) it is evident that while the majority of earlier studies have used hierarchical regression (Zhu & Sarkis, 2004), multiple regression (Skinner et al., 2008), and factor analysis (H.Hu & Hsu, 2010)(Vachon, Stephan ; Klassen, 2006) or a combination of both methods, (Eltayeb et al., 2011)(Zhu & Sarkis, 2007), later studies have widely used structural equation modeling (SEM) which is a simultaneous application of regression, factor and path analysis (Al-sheyadi, 2014). (Yang et al., 2011),(Lee et al., 2012), (Mitra & Datta, 2014),(Esfahbodi et al., 2016),(Wong, 2013). Partial least square structural equation modeling (PLS-SEM) is another emerging method which has been used since 2014 and is of special interest due to the high degree of flexibility it offers for the interplay between theory and data. (Vanalle et al., 2017)

Organization of Multivariate Methods		
	Primarily Exploratory	Primarily Confirmatory
First- Generation Techniques	• Cluster analysis • Exploratory factor analysis • Multidimensional scaling	• Analysis of variance • Logistic regression • Multiple regression
Second- Generation techniques	• PLS-SEM	• CB-SEM including Confirmatory factor analysis

Table 2-3. Table Organization of Multivariate methods-(Hair, Hult, Ringle, & Sarstedt, 2014)

The aforesaid evolution of solution approaches are also confirmed by table (2-3) which provides a history of multivariate techniques.

2.7 Research gaps (Canadian)

This section summarizes the research gaps based on the previous researches conducted on implementation of green supply chain management practices in organizations:

- Although the role of regulatory pressure on the adoption of green practices has been investigated, no single research considers both coercive and non-coercive environmental drivers on adoption of individual stages of green activities.
- Most studies in the area address mainly five green initiatives, identified as internal environmental management, green purchasing and distribution, investment recovery and corporation with costumers. Impact of reverse logistics and social sustainable practices have never been explored simultaneously in this group, instead they were examined in separate studies.
- Also, as mentioned before, since empirical researches are field studies and their results are mostly valid within the geographical region under examination, there is no such research study for Canadian manufacturing sector. The objective of this thesis is to address these gaps.

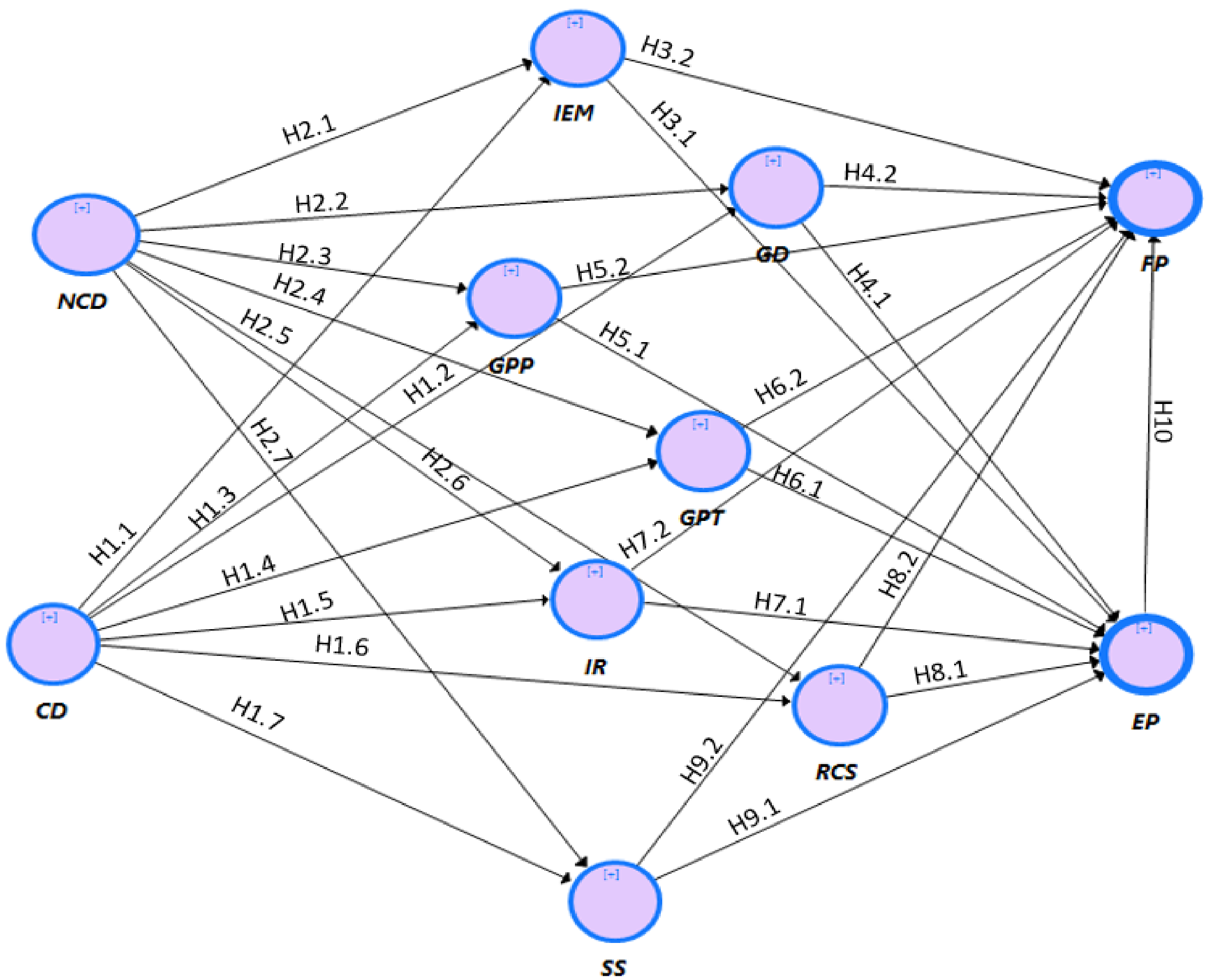
Chapter 3

Solution Approach

In the previous chapter, comprehensive literature review was done to study how implementation of GSCM activities affects different forms of performance factor. This chapter gives an insight into our solution approach and techniques used to address the research gaps in Canada. The chapter discusses the process of hypothesis generation, survey development, and data collection and approach for statistical analysis.

3.1 Development of Research Hypothesis

The main goal of this study is to analyze the interrelationships between sustainable supply chain management initiatives practiced by Canadian firms, sustainable drivers and their performance outcomes. In this chapter two groups of hypothesis are tested using a path model based on constructs derived from the literature on green supply chain management. The first groups of hypotheses are investigating the effectiveness of coercive and non-coercive drivers in adoption of sustainable practices, while the second group of hypotheses are exploring the impact of green supply chain practices on environmental and financial performance of Canadian firms. The proposed research model is shown in Fig. (3-1).



CD: NonCoercive drivers
CD: Coercive drivers
IEM: internal environmental management
GD: green design & development
GPP: green purchasing & procurement
GPT: green packaging & transportation

GPT: green packaging & transportation
IR: Investment recovery
RSC: reverse supply chain
SS: socially sustainable
EP: environmental performance

Figure 3-1 Proposed hypothesis model

3.1.1 Hypothesis H1.1 to H1.7 (Relationship between Coercive drivers and GSCM practices adoption)

As mentioned in chapter 2, one of the main forces for companies to implement GSCM practices is exerted by governments through regulatory agencies or carbon taxes. Considering the multi-dimensional expansion of GSCM, in this section we propose hypothesis based on seven dimensions of sustainability and examine the influence of government pressure on their adoption by Canadian organizations. We have taken into account both themes of practices: while internal environmental management, green design, investment recovery and socially sustainable activities are affecting the organizations internally, practices such as green purchasing, green transportation and reverse logistics require the organization to expand their efforts beyond their firm boundaries. Therefore, our first group of hypothesis, following the work of (Esfahbodi et al, 2016) tends to validate the assumption that governmental coercive pressure are positively and directly associated with adoption of each of the seven green initiatives.

- H1.1: Coercive environmental drivers are directly and positively associated with the adoption of internal environmental management practices
- H1.2: Coercive environmental drivers are directly and positively associated with the adoption of green design and development practices
- H1.3: Coercive environmental drivers are directly and positively associated with the adoption of green procurement and purchasing practices
- H1.4: Coercive environmental drivers are directly and positively associated with the adoption of green packaging and transportation practices

- H1.5: Coercive environmental drivers are directly and positively associated with the adoption of investment recovery practices
- H1.6: Coercive environmental drivers are directly and positively associated with the adoption of reverse supply chain practices
- H1.7: Coercive environmental drivers are directly and positively associated with the adoption of socially sustainable practices

3.1.2 Hypothesis H2.1 to H2.7 (Relationship between Non-coercive drivers and GSCM practices adoption)

As evidenced by GCSM literature, reactive implementation of green initiatives as a result of government regulation is not the only motive for organizations. Other than societal awareness of the negative environmental impact of manufacturing processes, which affect organization’s reputation and image, several other factors have lead manufactures to follow environmental practices in a more proactive and systematic manner. These elements include direct request from buyer companies, final consumers, loan and insurance companies, banks or investors. Therefore, companies may attempt to enlarge their market share by having the immediate flexibility to secure a wider range of customers or investors. Also depending on the product, companies may try to gain competitive advantage through implementing green practices. Following the work of (Zhu et al., 2013) on investigating the role of different institutional pressures on GSCM adaption, and as verified by preceding studies (Sierra, 2015) on the subject, in this section we investigate the role of non-coercive environmental drivers on the adoption of GSCM strategies under study. Therefore, the second group of hypothesis are as follows:

- H2.1: Non-Coercive environmental drivers are directly and positively associated with the adoption of internal environmental management practices

- H2.2: Non-Coercive environmental drivers are directly and positively associated with the adoption of green design and development practices
- H2.3: Non-Coercive environmental drivers are directly and positively associated with the adoption of green procurement and purchasing practices
- H2.4: Non-Coercive environmental drivers are directly and positively associated with the adoption of green packaging and transportation practices
- H2.5: Non-Coercive environmental drivers are directly and positively associated with the adoption of investment recovery practices
- H2.6: Non-Coercive environmental drivers are directly and positively associated with the adoption of reverse supply chain practices
- H2.7: Non-Coercive environmental drivers are directly and positively associated with the adoption of socially sustainable practices

3.1.3 Hypothesis H3.1 and H3.2 (Relationship between Internal environmental practices and performance outcomes)

In this section, the second group of hypothesis are proposed with the main purpose of investigating the degree of effectiveness of each of the seven aforementioned green practices on financial and environmental performance.

While some authors have claimed that environmental practices are expensive to initiate and leads to worse economic performance, research in the strategy literature suggest that firms that integrate environmental accountability in their economic strategies can achieve cost savings from resource reduction and efficiency. In addition, they benefit from increased revenue generation from improved stakeholder relations and brand image. Many empirical studies support the relationship between internal environmental programs and economic performance. At the plant level, the use of more environmentally friendly materials and processes can lead to resource reduction and manufacturing efficiency, resulting in reduced manufacturing costs.

In order to initiate, control and maintain sustainable practices through all departments of an organization with various functionalities and dimensions there is a need for a system that integrates all these cross functional activities. Once internal environmental management is recognized as a corporate strategic focus, the firm is more likely to implement GSCM in a systematic and more effective way. Thus, we make the following hypothesis to examine the effect of existence of an internal environmental management system on both financial and environmental performance:

- H3.1: Internal environmental management practices are positively related to environmental performance
- H3.2: Internal environmental management practices are positively related to financial performance

The above hypothesis are in accordance to several similar studies who have tested the impact of internal environmental management on performance indicators: (Zhu & Sarkis, 2006)(Zhu et al., 2013), (V.-H. Lee et al., 2014)(De Giovanni & Vinzi, 2012)

3.1.4 Hypothesis H4.1 and H4.2 (Relationship between green design and performance outcomes)

As mentioned by previous studies on GSCM, product design and process development is one of the critical stages when it comes to applying green initiatives. Most of the product characteristics including choice of material and scheme of related processes are determined in design stage. Therefore, much of the product environmental performance is basically shaped during the design process. Considering the fact that one main element of Eco-design is to decrease the consumption of both material and input energy through life cycle assessments and other means, it may also directly influence financial performance. Other crucial considerations such allowing for easy disassembly to encourage reuse, recycle and remanufacture processes is part of eco-design. Consequently, in coordination with similar propositions by previous studies, (Zhu & Sarkis, 2004),(Zhu & Sarkis, 2006), (Esfahbodi et al., 2016) we propose the following hypothesis:

- H4.1: Green design and development practices are positively related to environmental performance
- H4.2: Green design and development practices are positively related to financial performance

3.1.5 Hypothesis H5.1 and H5.2 (Relationship between green procurement and performance outcomes)

Green purchasing and procurement has been viewed as one of the green practices that indicates the tendency of a firm to extend green practices beyond its boundaries by demanding its suppliers to act in accordance to certain environmental practices. This specific practices has been analyzed from different perspectives including the response level of monitoring or collaborating partnership with suppliers. Green procurement leads to what's known as "greening the suppliers" and creates competition between them over receiving more share of the market. In addition, it facilitates further internal green activities for manufacturers resulting in final product with green attributes. Moreover, collaboration with suppliers towards sustainable development, such as joint design sessions may lead to financial savings for both sides. In this regard and following to preceding studies (Zhu & Sarkis, 2006), (Esfahbodi et al., 2016), (Green et al., 2012), (Eltayeb et al., 2011) we propose the following hypothesis:

•H5.1: Green purchasing and procurement development practices are positively related to financial performance

•H5.2: Green purchasing and procurement practices are positively related to financial performance

3.1.6 Hypothesis H6.1 and H6.2 (Relationship between green distribution practices and performance outcomes)

The globalization of businesses has impacted the way companies operate in all the dimensions. As a result, products and materials are being transferred in great amounts through large distances. One simple product may have travelled thousands of kilometers before it arrives to its final destination. Considering the fact that transportation is one of the most polluting industries, taking actions towards greening the transportation activities is of great importance. Similar to green purchasing, green transportation expands beyond organizational boundaries as it necessitates collaboration with other parties in many cases. In order to green the transportation activities, firms may take advantage of reduced packaging material, decrease containers weight, and use smart freight transport systems which minimizes travel time and distance. By implementing these green transportation practices, other than reducing the environmental impact, companies might benefit from additional financial savings. Therefore, this leads to the proposal of following hypothesis:

- H6.1: Green packaging and transportation practices are positively related to environmental performance
- H6.2: Green packaging and transportation practices are positively related to financial performance

The above hypothesis have been applied by preceding researches in UK (Esfahbodi et al., 2016) and among Indian manufacturers (Mitra & Datta, 2014)

3.1.7 Hypothesis H7.1 and H7.2 (Relationship between investment recovery practices and performance outcomes)

Investment recoveries refer to the process of recovering the value of both unused and/or end of life assets through effective reuse or surplus sales. It comprises of the sale of excess inventories, scraps and used materials as well as excess equipment and machinery. Investment recovery is one of the primary and well developed concepts in green supply chain management, and it is assumed that when properly performed it would positively impact both financial and environmental performance, through asset liquidation and reuse. Hence, we propose our next hypothesis in accordance to: (Zhu & Sarkis, 2004), (Zhu & Sarkis, 2006), (Esfahbodi et al., 2016)and (Green et al., 2012)

- H7.1: Investment recovery practices are positively related to environmental performance
- H7.2: Investment recovery practices are positively related to financial performance

3.1.8 Hypothesis H8.1 and H8.2 (Relationship between reverse logistics and performance outcomes)

Reverse logistics requires an integrated supply chain management system in order to operate appropriately. The reason is that reverse logistics is a complex process which requires involvement and coordination of several independent parties. Therefore, reverse supply chain management also classifies as green activities with organizational boundary expansion tendency. Starting from the point of consumption, used products need to be collected first and depending on their condition they may be considered for different levels of reuse, including direct repackaging, reconditioning of disassembled elements with same functionality, or recycling. Clearly, the fewer the additional processing required, the better the environmental and financial performance. Therefore, in coordination with (Eltayeb et al., 2011) and (Skinner et al., 2008) the following hypotheses are proposed

- H8.1: Reverse supply chain practices are positively related to environmental performance
- H8.2: Reverse supply chain practices are positively related to financial performance

3.1.9 Hypothesis H9.1 and H9.2 (Relationship between socially sustainable practices and performance outcomes)

Socially sustainable initiatives were introduced to GSCM literature later on and were analyzed with different perspectives. Firms may adopt socially sustainable practices due to a variety of reasons. GSCM researchers have argued that when companies account for their employee's concerns such as job satisfaction, health and safety, and standard wages working hours; they may simultaneously make a positive environmental and financial impact. This may include decreasing or eliminating the use of toxic materials in response to workers health concerns. Similarly, setting standard working hours would lead to decrease the rate of scrap and rework as a result of workers fatigue. In this regard, and in accordance to (Pullman et al., 2009), the following hypotheses are proposed:

- H9.1: Socially sustainable practices are positively related to environmental performance

- H9.2: Socially sustainable practices are positively related to financial performance

3.1.10 Hypothesis H10 (Relationship between environmental performance and financial performance)

It is worth mentioning that financial performance construct is this study basically reflects the economic advantages of improved environmental performance. The cost saving nature of environmental performance, such as less material and energy input, should lead to enhanced economic performance, sustaining decreases in the associated costs. Likewise, firms with better environmental reputations are more likely to attract more customers. Therefore, following the study of (Esfahbodi et al., 2016) an additional hypothesis linking environmental performance with economic performance is proposed:

- H10: Environmental performance is positively associated with financial performance.

3.2 Survey Study

Recent researches on GSCM literature shows that survey based questionnaire has been the most dominant approach to examine the extent of environmental conscious initiatives on organizational performance (Gimenez & Tachizawa, 2012). While reviewing the literature on this topic, it was noticed that the majority of these field surveys were performed in a single country using data collected from multiple industries. Considering the single country approach may be interpreted as easy control over the effect of country environmental expectations as well as business culture, while use of multiple industries permits researchers to understand and demonstrate what is happening within several industries rather than being restricted to environmental practices of isolated extreme cases (Al-sheyadi, 2014). Bearing this in mind, we conducted this study based on information received in form of filled questionnaires from manufacturers in eastern Canada. The study covers multiple industries ranging from food to electronic industry. In order to test the hypothesis explained in section 3.1, a 6-page survey questionnaire was conducted.

3.2.1 Survey Instrument

The 6-page survey questionnaire was prepared to collect data to study the effect of implementation of environmentally conscious initiatives on organizational environmental and financial performance through various factors namely, internal environmental management, green design and product development, green purchasing and procurement, investment recovery, reverse logistics and socially sustainable activities. The questionnaire also covers the environmental drivers that motivate firms to adapt GSCM practices.

The questionnaire items related to each of the above mentioned factors were taken after a thorough literature review: (Roa & Holt, 2005)(Zhu & Sarkis, 2006)(Zhu & Sarkis, 2004)(Skinner et al., 2008) (Esfahbodi et al., 2016)(Green et al., 2012)(Sierra, 2015) (Pullman et al., 2009)(Zhe et al., 2013). The survey questionnaire is presented in Appendix A.

The questionnaire consists of five main parts. The first part includes the seven sustainability practices that was mentioned formerly in this chapter. Each dimension covers three to six indicators, and the combination of all the indicators together are supposed to measure the associated construct. The respondents are asked to contribute to the study by providing their opinion on the level of advancement of each of the indicators. In order to do so, a 5-point Likert scale was provided with the following options:

1= no implementation; 2= planning to consider implementation; 3= currently considering implementation; 4 =initiating implementation; 5 = implementing fully

In the next section, respondents were asked to provide their judgment on the extent of improvement of environmental and financial performance of their firm as a direct consequence of GSCM practices. Just like GSCM practices constructs, performance constructs were composed of indicators that measured them, and five-point Likert scale was used with the following choices:

1 = not at all; 2 = a little bit; 3 = to some degree; 4 = relatively significant; 5 = significant

The same options were used to measure the influence level of environmental drivers in the third section.

Moreover, the questionnaire includes a section providing seven of the most frequently reported barriers of GSCM implementation including technologic and economical obstacles.

Finally, in the last section, respondents were requested to provide their company name, industrial sector, their position title and years of experience in that position.

When the questionnaire was finalized a pilot test was performed to ensure contextual reliability of items by requesting colleagues and academics to review the final version.

3.2.2 Data Collection

The final version of the questionnaire was posted on google forms in order to initiate the data collection process. (Survey Link) Using INDUSTRY CANADA database we recognized a number of Canadian manufacturing firm in Quebec and Ontario region. Subsequently, industry professionals at different supervisory levels were contacted to participate in the study. 45 respondents agreed to participate in our study and filled the questionnaire. Responses were collected from January to February of 2017. Since all the collected data was done by the first run and no reminder or follow up were used, we do not consider late response bias. Out of the 45 collected responses, 3 showed inconsistency and were identified as outliers and therefore excluded from the sample. Participants were also requested to identify their industrial sector. Fig. (3-2) illustrates the distribution of responses with respect to their industrial sectors.

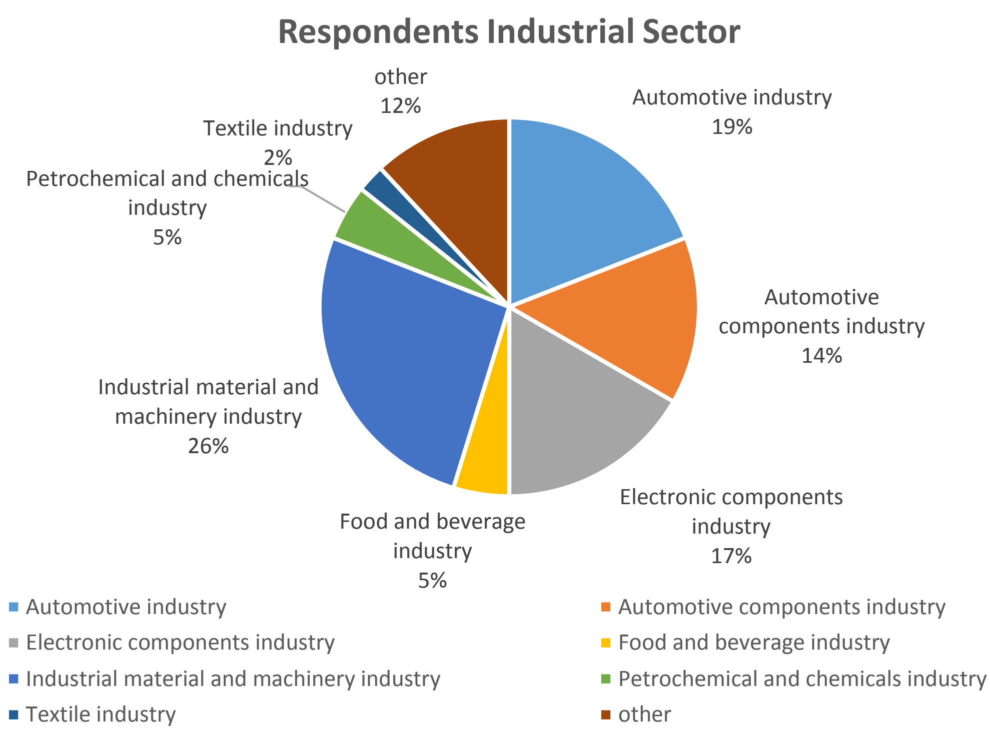


Figure 3-2 Participants industrial sector

Finally, a total of 42 completed questionnaires were considered for further analysis in our research. All responses were received from professionals with experience ranging from 2 to 30+ years and working at engineer level, managers, directors, consultants, auditors and owners of organizations. Table (3-1) shows the respondents profile in terms of number of years of experience and the company they represent.

No	Job title	Experience	Company name
1	Technical director	15	Tritex Fabrics Ltd
2	Quality Manager	6	Presvac Systems
3	Material flow coordinator	2	Schneider electric
4	Engineer	9	Genie civil office
5	Director of engineering	25	-
6	Quality control manager	6	Valtech fabrication Inc
7	Quality Assurance Manager	13	Pullmatic Mfg
8	Sales manager	9	Esterline
9	Quality assurance engineer	7	Tallysman Wireless Inc
10	Quality Control engineer	4	-
11	A: Manufacturing operations manager	20+	*A*: Fortress Paper Ltd
12	production manager	30	Savaria
13	Senior Supply Chain Planner	20	Hain Celestial Canada
14	Quality Inspector	5	Chantier Davie Canada Inc
15	Corporate Engineer	7	Velan Inc
16	Quality Assurance Coordinator	8	Splendid chocolate
17	Plant Supervisor	8	Confidential
18	Supply Chain Manager	5	Mylan pharmaceutical
19	Process Engineer	30	IKO Industries LTD
20	Senior Process Engineer	20	worleyparsons
21	Production Assembly Planner	9	Cyclone
22	Director	9	UGE Inc
23	Design Engineer	11	Buhler Versatile Inc
24	Quality Engineer	2	Magna International
25	Quality assurance engineer	18	MULTIMATIC
26	Mechanical Designer	3	PH Windsolutions
27	Operational Excellence Coordinator	5	Sobeys Inc
28	Process Engineer and Quality Manager	18	Major Wire Industries
29	Quality Engineer	2	Butcher Industrial Finishing I
30	Quality Engineer	2	Vuteq Canada Inc
31	Field and Supplier Quality Manager	35	Magna Clousers
32	Senior Quality Engineer	35	Future Electronics
33	Internal Auditor	7	Martinrea International Inc.
34	Senior Management Consultant	15	*Medtronic*
35	Manufacturing Engineering Manager	25	Marwood Metal Fabrication
36	Manager	15	DENSO Corporation
37	Environmental Coordinator	8	Wolf Steel Limited

38	Quality engineer	6	Venmar Ventilation
39	Quality Manager	10	EL
40	Industrial engineer	5	Nailor Industries
41	Advanced Engineering Manager	20+	Warren Industries Ltd
42	Quality Assurance Manager	17	Exova

Table 3-1 Respondent's profile

3.3 Data analysis and method selection: PLS-SEM

Among the various approaches to SEM, covariance-based SEM (CB-SEM) and its associated software such as LISREL and AMOS, is the most well-known. Variance based partial least squares SEM (PLS-SEM), is an alternative approach which has started to receive considerable attention in recent empirical research due to its flexible features.

As evident by previous research approaches on empirical analysis which aim to assess the impact of sustainable and green initiatives on firm performance, structural equation modeling (SEM) was the dominant approach and PLS-SEM has started emerging this area of research in recent years. (Lee et al., 2014). SEM is a multivariate statistical method, which is capable of performing a series of regressions while observable items are related to various unobserved latent factors either directly or indirectly. This feature of SEM have made this method a more comprehensive and popular technique rather than using a single statistical tool. In this regard, Fig. (3-3) illustrates the procedure for our data analysis method selection. "When examining the structural model, it is important to understand that PLS-SEM fits the model to the sample data to obtain the best parameter estimates by maximizing the explained variance of the endogenous latent variable(s). This aspect of PLS-SEM is different from CB-SEM, which estimates parameters so that the differences between the sample covariance and those predicted by the theoretical/ conceptual model are minimized. As a result, with CB-SEM (covariance based structural equation modeling), the covariance matrix implied by the theoretical/conceptual model is as close as possible to the sample covariance matrix. Goodness-of fit measures associated with CB-SEM (which are based on the difference between the two covariance matrices), such as the chi square statistic or the various fit indices, are not applicable in a PLS-SEM context" (Hair *et al.*, 2014).

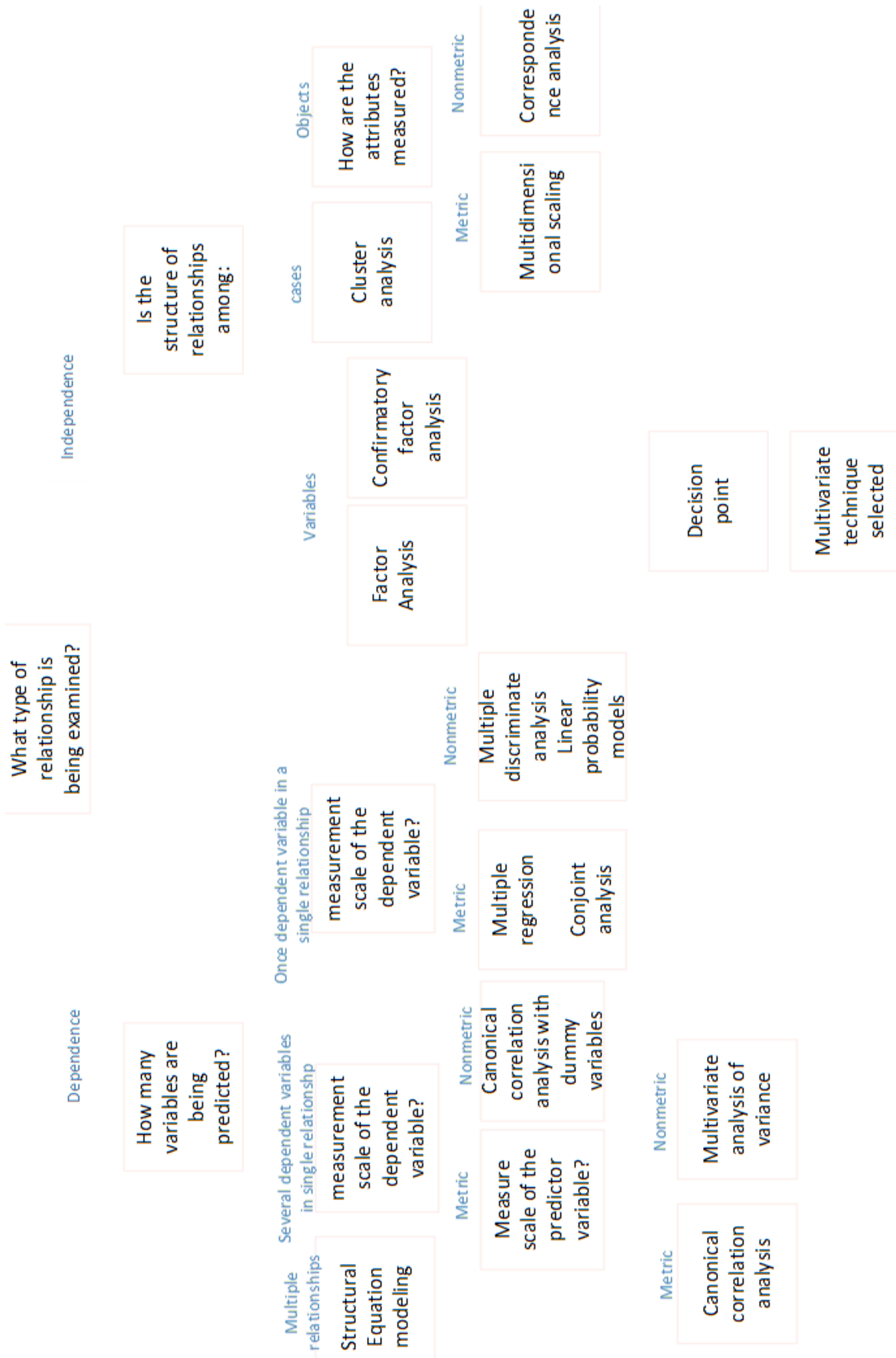


Figure 3-3 Multivariate data analysis and approaches (Hair et al., 2010)

PLS-SEM has quite a few advantages over CB-SEM in many situations commonly encountered such as small sample sizes, non-normal data distributions, or when a complex model with many indicators and model relationships is to be studied. Table (3-2) presents the main features of CB-SEM and PLS-SEM and summarizes the differences between the two approaches (Hair e al., 2014).

PLS-SEM	CB-SEM
• Normal distribution not required (Kolmogorov-Smirnov or Shapiro-Wilk test)	• Normal distribution is required
• Exploratory research- used where theory is less developed	• Confirmatory research- applied to more developed concepts
• Estimation procedure: Ordinary Least Squares(OLS) regression-based	• Estimation procedure: Maximum-Likelihood (ML)
• Efficient for small sample sizes and more complex models	• Requires large sample size of above 100
• Formative and Reflective measurement models	• Only Reflective measurement model
• Greater statistical power (more likely to render a specific relationship significant when in fact significant in the population)	• Global goodness of fit

Table 3-2 PLS-SEM vs CB-SEM

PLS-SEM is also a more powerful tool when categorizing population relationships and more suitable for exploratory research purposes-a feature that is further supported by the less restricting requirements of PLS-SEM in terms of model setups, model complexity, and data features. (Hair et al., 2014) Due to more flexibility that PLS-SEM is providing and considering our small sample size for this kind of statistical analysis, we have chosen to apply PLS-SEM to examine the relationships between our data.

When applying PLS-SEM, we need to follow a multi-stage procedure which includes the specification of the inner and outer models, data collection and investigation, the actual model estimation, and finally the evaluation of results. Section 3.4 summarizes the process that we have executed in this study.

3.4 Evaluation of Measurement and Structural Models

In order to perform the data analysis through PLS-SEM, SmartPLS software package was used in this study. The procedure consists of the following stages: after the initial set-up of the structural model which specifies the constructs and their associated measurement indicators, the model measurement model is examined first. This is to make sure the model is design properly and indicators are measured what they were supposed to measure. Once this step is completed with satisfactory results, in the last phase the path model in evaluated to test for significance and relevance of hypotheses.

3.4.1 Content validity

A construct is generally considered to have an acceptable content validity, if there is a general notion that measurement variables cover almost all the aspects of construct, that measurement variables were intended to measure. The measurement indicators for each construct variable for this research study were selected after an extensive research GSCM literature review. (Roa & Holt, 2005)(Zhu & Sarkis, 2006)(Zhu & Sarkis, 2004)(Skinner et al., 2008) (Esfahbodi et al., 2016)(Green et al., 2012)(Sierra, 2015) (Pullman et al., 2009)

3.4.2 Internal consistency reliability

Construct validity is the extent to which a set of measured variables reflects the hypothetical construct they were supposed to measure. In other words, construct validity represents measurement accuracy and internal consistency of the data. In addition, the logic of using a number of individual variables to measure a concept achieves a more accurate measurement. Thus, in this section we will calculate the internal consistency of our model using our collect data by calculating Cronbach's Alpha. However due to limitation of Cronbach's alpha including the assumption of equal outer loadings and sensitivity to number of items in the scale, Composite reliability (ρ_c)" is introduced as a more appropriate measure of internal consistency in PLS-SEM. While Cronbach's alpha needs to be above 0.7, composite reliability suggests values between 0.7 and certainly below 0.95. The upper constraint of 0.95 can be interpreted as measuring the exact same thing and therefore is not desirable. Composite reliability (ρ_c) is based on different outer loadings of the indicator variables and is calculated using the following formula:

$$\rho_c = \frac{(\sum_i l_i)^2}{(\sum_i l_i)^2 + \sum_i var(e_i)}$$

Where,

- l_i = Standardized outer loading of the indicator variable i for each construct
- e_i = Measurement error of indicator variable i
- $var(e_i)$ = variance of the measurement error, which is defined as 1 -l_i. (J. F. J. Hair et al., 2014)

3.4.3 Average Variance Extracted (AVE)

Average variance extracted (AVE), is a measure of **convergent validity**, which is the extent to which a measure correlates positively with alternative measures of the same construct. Since indicators of a construct are viewed as different approaches to measure the same construct, they need to converge or share a high proportion of variance. To establish convergent validity, both outer loadings of the indicators and AVE values must be considered. While as a common rule of thumb outer loading values should be above 0.7, if the value of an outer loading falls below this threshold, then AVE values should be evaluated. In this case, if the relative AVE value falls between 0.4 and 0.7 the researcher may analyze the effect of removing the indicator, and values below 0.4 should definitely be removed.

3.4.4 Fornell-Larcker criterion

Once the internal consistency and validity of indicators for all constructs are established within desired limits, the interrelationship between constructs is to be examined. The constructs need to be truly distinctive from other constructs by empirical standards. This indicates a need to perform discriminate validity analysis. Fornell-Larcker criterion is one statistical tool for conducting discriminate validity analysis by comparing the square root of the AVE values with the latent variable correlations. The logic of this method is based on the idea that a construct shares more variance with its associated indicators than with any other construct. Therefore, the square root of each construct's AVE should be greater than its highest correlation with any other construct.(Hair et al., 2014)

3.4.5 Variance inflation factor (VIF)

When it comes to assessing the features of the structural model measurement, the first criteria that our model needs to fulfill is the degree of collinearity. Collinearity is an expression of the relationship between two independent variables, and if a correlation exists between more than two independent variables, then we have multicollinearity.(Hair et al., 2010) Variance inflation factor is a statistical tool to measure multicollinearity. The tolerance values for VIF should be greater than 0.1 and smaller than 10, otherwise there is multicollinearity concern. However, in the context of PLS-SEM the tolerance values are rescaled to 0.2 and 5.

3.4.6 Path coefficients

By running the PLS-SEM algorithm, estimates are obtained for the structural model relationships. These relationships are representing the hypothesized relationships among the constructs and known as path coefficients. The path coefficients have standardized values between -1 and + 1. Estimated path coefficient closer to +1 shows a strong positive relationship with the constructs, and a value closer to -1 represents a strong negative relationship. Also, the closer the path coefficient value to 0, the weaker the relationship.

3.4.7 Bootstrapping

Whether a coefficient is significant or not ultimately depends on its standard error that is obtained by means of bootstrapping. Bootstrapping is applies because PLS-SEM does not have the normality assumption and as a result parametric significance tests used in regression analysis cannot be applies here. “Bootstrapping is an approach to validate a multivariate model by drawing a large number of sub-samples and estimating models for each subsample. Estimates from all the subsamples are then combined, providing not only the best estimated coefficients, but their expected variability and thus their likelihood of differing from zero. This approach does not rely on statistical assumptions about the population to assess statistical significance, but instead makes its assessment based solely on the sample data.” (Hair et al., 2010). In bootstrapping, a large number of subsamples are drawn from the original sample with replacement. (Hair et al.,2014).

The bootstrap standard error allows computing the empirical *t*-value. For example, to estimate the significance of the path coefficient linking independent construct X to dependent construct Y, we need to divide the path coefficient value (P_{xy}) by the bootstrap standard error (Se_{xy}) to obtain the *t*-value.

$$t = \frac{P_{xy}}{Se_{xy}}$$

When the empirical t-value is larger than the critical value, we conclude that the coefficient in significant at a certain error probability (e.g. significance level: **1.65** for 10% significance level)

P-value is also generated along with the t values in order to provide us with the probability of erroneously rejecting the null hypothesis, given the sample data. Normally P-values of less than 0.05 is desired, to conclude that a particular result has not occurred by random chance. Based on the research model, different tolerance limits are considered for P-value up to 0.1 in some contexts.

3.4.8 R square

PLS-SEM assessment of the structural model includes predicting ability of the model. Therefore, after reliability and validity are established, one key evaluation criteria for PLS-SEM results are the coefficients of determination (R^2 values) along with the level and significance of the path coefficients(Hair, Hult Ringle., & Sarstedt, 2014). “The coefficient is a measure of the model's predictive accuracy and is calculated as the squared correlation between a specific endogenous construct's actual and predicted values. The coefficient represents the exogenous latent variables' combined effects on the endogenous latent variable. The R^2 value ranges from 0 to 1 with higher levels indicating higher levels of predictive accuracy.” (Hair et al., 2014)

3.4.9 f square

In addition to evaluating the R^2 values of all endogenous construct, the change in the R^2 value when a specified exogenous construct is omitted from the model can be used to explore whether the omitted construct has a practical impact on the endogenous constructs. This measure is known to as the f^2 effect size, and is calculated as:

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

Where,

$R^2_{included}$ = R^2 value of the endogenous latent variable when a selected exogenous latent variable is included in the structural model

$R^2_{excluded}$ = R^2 value of the endogenous latent variable when a specified exogenous latent variable is excluded from the structural model.(Hair et al., 2014)

Chapter 4:

Survey Results

This chapter presents and discusses the results obtained from application of the survey study and tests the proposed hypotheses.

4.1 Data Analysis

The collected data were analyzed with the application of SmartPLS 3 (Ringle *et al*., 2005). IBM SPSS 22 and Microsoft EXCEL also were used as well.

The procedure of data analysis consists of two main sections: in the first section, the quality of the measurement is verified. In order to test the measurement quality, the measurement model is tested for internal consistency, convergent validity and discriminate validity. To examine the internal consistency of the model, Cronbach's alpha and composite reliability are evaluated. Similarly, convergent validity and discriminate validity of the model are evaluated using Average variance extracted and Fornell-Larcker values respectively. Since Fornell-Larcker is based on AVE values, we also applied cross loading criteria to test for discriminate validity of the measurement model.

The second part deals with evaluating the structural model through calculation of path coefficients, and the relevance and significance of the path coefficients are examined using *t*-test and *p*-values. Finally, the predictive relevance of the structural model is analyzed using R^2 and f^2 values.

To handle the missing data we have used mean replacement option. This option replaces all missing data points with the mean value of all residual data points per column (i.e., indicator or variable). Mean replacement has the advantage not to modify the sample size. Also, the mean value of variables in the sample does not change.

Recalling the format of the questionnaire discussed in section 3.2.1, consisting of 46 items of 5-point Likert scale questions, Table (4-1) provides the descriptive statistics of the distribution of all the collected responses.

Descriptive Statistics

	N	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
IEM1	42	3.10	.195	1.265	-.339	.365	-.845	.717
IEM2	42	3.12	.202	1.310	-.230	.365	-.909	.717
IEM3	42	2.81	.229	1.486	.250	.365	-1.281	.717
IEM4	42	3.07	.240	1.552	-.042	.365	-1.473	.717
IEM5	42	2.71	.253	1.642	.276	.365	-1.578	.717
GD1	42	3.12	.232	1.501	-.212	.365	-1.351	.717
GD2	42	2.64	.228	1.479	.134	.365	-1.449	.717
GD3	42	2.88	.244	1.580	-.106	.365	-1.646	.717
GD4	42	3.48	.202	1.311	-.696	.365	-.456	.717
GD5	42	3.52	.205	1.330	-.675	.365	-.673	.717
GPP1	42	2.52	.213	1.383	.296	.365	-1.372	.717
GPP2	42	2.29	.222	1.436	.558	.365	-1.265	.717
GPP3	42	2.02	.227	1.473	.918	.365	-.896	.717
GPP4	42	2.17	.204	1.324	.540	.365	-1.316	.717
GPT1	42	2.40	.236	1.531	.553	.365	-1.250	.717
GPT2	42	2.26	.207	1.345	.632	.365	-.888	.717
GPT3	42	2.48	.242	1.565	.427	.365	-1.458	.717
GPT4	42	2.26	.218	1.415	.648	.365	-.953	.717
GPT5	42	2.29	.232	1.503	.526	.365	-1.467	.717
RSC1	42	3.93	.222	1.438	-1.058	.365	-.306	.717
RSC2	42	4.26	.190	1.231	-1.683	.365	1.781	.717
RSC3	40	3.80	.241	1.522	-.975	.374	-.550	.733
RSC4	40	3.40	.272	1.722	-.440	.374	-1.573	.733
IR1	39	2.97	.274	1.709	-.058	.378	-1.772	.741
IR2	41	3.49	.257	1.645	-.526	.369	-1.418	.724
IR3	39	2.95	.257	1.605	.007	.378	-1.577	.741
SS1	41	4.05	.223	1.431	-1.220	.369	.083	.724
SS2	41	3.88	.221	1.418	-.992	.369	-.324	.724
SS3	41	3.90	.215	1.375	-.908	.369	-.405	.724
SS4	41	3.83	.212	1.358	-.807	.369	-.496	.724
SS5	41	3.78	.230	1.475	-.928	.369	-.586	.724
FP1	41	3.07	.205	1.311	-.141	.369	-.897	.724
FP2	42	3.31	.240	1.554	-.220	.365	-1.539	.717
FP3	42	3.17	.198	1.286	-.254	.365	-.636	.717
FP4	42	3.40	.187	1.211	-.415	.365	-.483	.717
FP5	42	3.26	.216	1.398	-.438	.365	-.994	.717
EP1	42	3.40	.216	1.398	-.441	.365	-1.019	.717
EP2	42	3.76	.218	1.411	-.758	.365	-.832	.717
EP3	40	3.58	.205	1.299	-.543	.374	-.622	.733
EP4	42	3.71	.200	1.293	-.784	.365	-.341	.717
EP5	42	3.43	.202	1.309	-.521	.365	-.759	.717
DE1	42	3.12	.227	1.468	-.118	.365	-1.238	.717
DE2	42	3.17	.215	1.395	-.142	.365	-1.134	.717
DE3	42	3.19	.232	1.502	-.069	.365	-1.452	.717
DE5	42	3.05	.231	1.497	.007	.365	-1.375	.717
DE4	42	3.69	.220	1.423	-.700	.365	-.823	.717

Table 4-1 Descriptive statistics demonstrating the distribution of the data for all indicators

4.2 Evaluation of the measurement model

This section verifies the measurement model quality and evaluates the path model.

4.2.1 Content validity:

Content validity is a subjective measure. Content validity refers to the capability of indicators for each construct to fully capture all the aspects that the construct are meant to measure. The indicator variables for each construct for our research study were taken directly from prior research studies and selected after an extensive research synthesis and literature review. Therefore, content validity is assumed. (Roa & Holt, 2005)(Zhu & Sarkis, 2006)(Zhu & Sarkis, 2004)(Skinner et al., 2008) (Esfahbodi et al., 2016)(Green et al., 2012)(Sierra, 2015) (Pullman et al., 2009)

4.2.2 Internal Consistency Reliability

After performing the data entry, we run the PLS-SEM algorithm for the first time. As illustrated in Table (4-2), Cronbach's alpha value for the construct "Investment recovery" is 0.561 and doesn't meet the minimum requirement value of 0.7. In addition, three other constructs of "Packaging and Transportation", "Procurement and Purchasing" and "Socially Sustainable" activities, have composite reliability values of 0.961, 0.961 and 0.956 respectively which exceed the upper limit of 0.95 and indicating existence of indicators with almost same concept. Therefore, considering the outer loadings of these four construct, we need to modify some of their associated indicators. In should be mentioned that, the value of "one" for "coercive drivers" construct is due to the fact that this item has a single indicator item and consequently internal consistency validation does not apply to it.

First Run	Cronbach's Alpha	Composite Reliability
Coercive Drivers	1.000	1.000
Design & Development	0.871	0.903
Environmental Performance	0.934	0.950
Financial Performance	0.889	0.919
Internal Environmental Management	0.917	0.939
Investment Recovery	*0.561*	0.775
Non-Coercive Drivers	0.891	0.925
Packaging & Transportation	0.949	*0.961*
Procurement & purchasing	0.946	*0.961*
Reverse Logistics	0.854	0.901
Socially Sustainable	0.943	*0.956*

Table 4-2 construct reliability and validity

In order to perform the necessary modifications, outer loadings of each of the indicators for every single construct should be considered.

Table (4-3) provides the associated loadings for each of the indicators for “internal environmental management construct”. As shown in the table, all the values are above the recommended limit of 0.7. The values for all the five indicators vary between 0.779 and 0.918. Thus, this construct remains unchanged.

Indicators		Loading
IEM 1	Top management is committed to implement GSCM (Green Supply Chain Management) practices	0.918
IEM 2	Mid-level management is committed to implement GSCM practices	0.947
IEM 3	Engagement in cross-functional activities for TQEM(Total Quality Environmental Management)implementation	0.885
IEM 4	Implementing an internal EMS(Environmental Management System)	0.803
IEM 5	Performing in accordance to ISO 14000/ EMAS guidelines	0.779

Table 4-3 Internal Environmental management practices indicators loadings

The second construct to be investigated for outer loading values in "green design and product development" consists of five indicators as described in Table (4-4). Other than the value for the first indicator "GD 1" which falls slightly below the recommendations, the other four indicators are between 0.731 and 0.888 and perfectly acceptable. However, we decided to keep GD 1 as it doesn't negatively affect any of the reliability measures.

Indicators		Loading
GD 1	Performing Life Cycle Assessment during product/process design	0.672
GD 2	Considering use of recycled/ refurbished/remanufactured components during the design process	0.731
GD 3	Considering quick disassembly during product/process design	0.808
GD 4	Considering reduction of material usage during product/process design	0.888
GD 5	Considering reduction of hazardous material usage during product/process design	0.848

Table 4-4 Green design and product development practices indicators loadings

The third construct is "green procurement and purchasing". Although the Cronbach's Alpha value is acceptable and above 0.7, the high value of composite reliability is to a certain degree problematic and it translates as repetitive indicator selection which means, indicators that measuring the same concept. Therefore we adjust the construct by removing GPP2 from the indicators list as shown in Table (4-5).

Indicators		Loading
GPP 1	Assessing suppliers' environmental performance through evaluation (questionnaire/ Audits)	0.930
GPP 2	Requiring suppliers to implement Environmental management system	Removed
GPP 3	Providing environmental awareness seminars and/or training for its suppliers	0.919
GPP 4	Participating in joint planning sessions with its suppliers to resolve environmental related problems	0.930

Table 4-5 Green procurement and purchasing practices indicators loadings

Similar to the previous latent variable, composite reliability value was falling out of the recommended limits by PLS-SEM, and therefore there we removed two items GPT2 and GPT3 so that the value of composite reliability will be acceptable. The removed and the remained indicators are illustrated in Table (4-6). Remaining values are ranges between 0.871 and 0.933.

Indicators		Loading
GPT 1	Collaborating with its customers in order to use less energy during product transportation	0.933
GPT 2	Using high-tech freight logistics transportation systems (Such as reducing container weight and improving refrigeration)	Removed
GPT 3	Using rout optimizing technology in order to perform its transportation/distribution activities	Removed
GPT 4	Using environmentally-friendly packaging (such as bio-degradable packaging, low density packaging)	0.910
GPT 5	Tracking and monitoring emissions caused in product distribution (e.g., carbon footprint)	0.871

Table 4-6 Green Packaging and transportation practices indicators loadings

"Investment recovery" construct consists of three indicators listed below in table (4-7). According to the outputs of the first run, Cronbach's alpha for this variable falls below the limit of 0.7, and therefore indicator variables need to be modified. Having the lowest value, IR3 was removed from the list and the remaining items have values which perfectly meets the requirement.

Indicators		Loading
IR 1	Sale of excess inventories or material	0.863
IR 2	Sale of scrap and used materials or by-products	0.892
IR 3	Sale of excess capital equipment	Removed

Table 4-7 Investment recovery practices indicator loadings

"Reverse supply chain" containing four items with loadings between 0.774 and 0.883 resulted in Cronbach's alpha value of 0.854 and composite reliability value of 0.901. Therefore, no further action in required for this construct. Table (4-8)

Indicators		Loading
RSC 1	Destroying (scrapping and dumping)	0.800
RSC 2	Recycling (material reclaim)	0.883
RSC 2	Refurbishing/ Remanufacturing (repairing or upgrading)	0.873
RSC 4	Reuse (Repackaging of returned products)	0.774

Table 4-8 Reverse supply chain practices indicator loadings

The last latent variable representing green practices is "social sustainability" with five indicator variables is demonstrated in table (4-9). While Cronbach's alpha for this construct is 0.943 and satisfactory, composite reliability value exceed the limit of 0.95, and consequently we have to modify the indicators by removing SS 2.

Indicators		Loading
SS 1	Ensuring worker quality of life	0.870
SS 2	Ensuring worker job satisfaction	Removed
SS 3	Ensuring worker skill develop (in-house education and vocational training)	0.903
SS 4	Fair compensation to all employee (Statement on normal working hours, maximum overtime & fair wage structures)	0.905
SS 5	Equal opportunity statements and implementation plans	0.898

Table 4-9 Socially sustainable practices indicator loadings

We initiate the investigation of performance outcome factors by examining indicator loadings for "Financial performance" construct. As shown in table (4-10), there are five indicators with relative loadings ranging from 0.745 to 0.897 which resulted in Cronbach's value of 0.889 and composite reliability of 0.919. Hence, this latent variable remains unchanged.

Indicators		Loading
FP 1	Decrease of fee for waste treatment	0.878
FP 2	Decrease of fine for environmental accidents	0.818
FP 3	Decrease cost of raw material purchase	0.745
FP 4	Decrease cost of energy consumption	0.818
FP 5	Decrease fee of waste discharge	0.897

Table 4-10 Financial performance indicator loadings

The second performance outcome is "environmental performance" which contains five indicators with loading values between 0.854 and 0.911 which produced Cronbach's alpha of 0.934 and composite reliability value of 0.95 which is the maximum allowable limit for composite reliability. So, this construct remains unchanged. Table (4-11)

Indicators		Loading
EP 1	Reduced waste (solid, liquid, air emissions)	0.900
EP 2	Reduced the frequency of environmental accidents	0.911
EP 3	Reduced the consumption of hazardous/toxic material	0.854
EP 4	Improved in enterprise's environmental situation	0.898
EP 5	Reduced input energy consumption considering the volume of production	0.882

Table 4-11 Environmental performance indicator loadings

The last construct under study is "non-coercive drivers" construct, which has listed all the non-regulatory drivers of sustainable adoption according to the literature. This construct has four indicators with loading between 0.876 and 0.901 and since both Cronbach's alpha and composite reliability values are satisfactory we do not apply any modifications to its indicators. Table (4-12)

Indicators		Loading
NCD 1	Costumer Demand	0.876
NCD 2	Competitors (e.g. to gain competitive edge)	0.826
NCD 3	Society (e.g. NGOs, public pressure)	0.901
NCD 5	Financial institutions (banks, insurance companies, investors)	0.876

Table 4-12 Non-coercive environmental derivers' indicators loadings

After applying all the necessary adjustments and removing five indicators: IR3, GPP 2, GPT 2, GPT3 and SS 2, we recalculated the variables to ensure internal consistency. Table (4-13) demonstrates the recalculated values of modified constructs.

Second Run with Modified Indicators	Cronbach's Alpha	Composite Reliability
Coercive	1.000	1.000
Design & Development	0.850	0.894
Environmental Performance	0.934	0.950
Financial Performance	0.889	0.919
Internal Environmental Management	0.917	0.939
Investment Recovery	0.703	0.870
Non-Coercive Drivers	0.891	0.925
Packaging & Transportation	0.890	0.931
Procurement & purchasing	0.917	0.948
Reverse Logistics	0.854	0.901
Socially Sustainable	0.917	0.941

Table 4-13 Second run of reliability analysis with modified indicators

Fig. (4-1) illustrates the final model with the entire latent variables and associated indicators as produced by SmartPLS software.

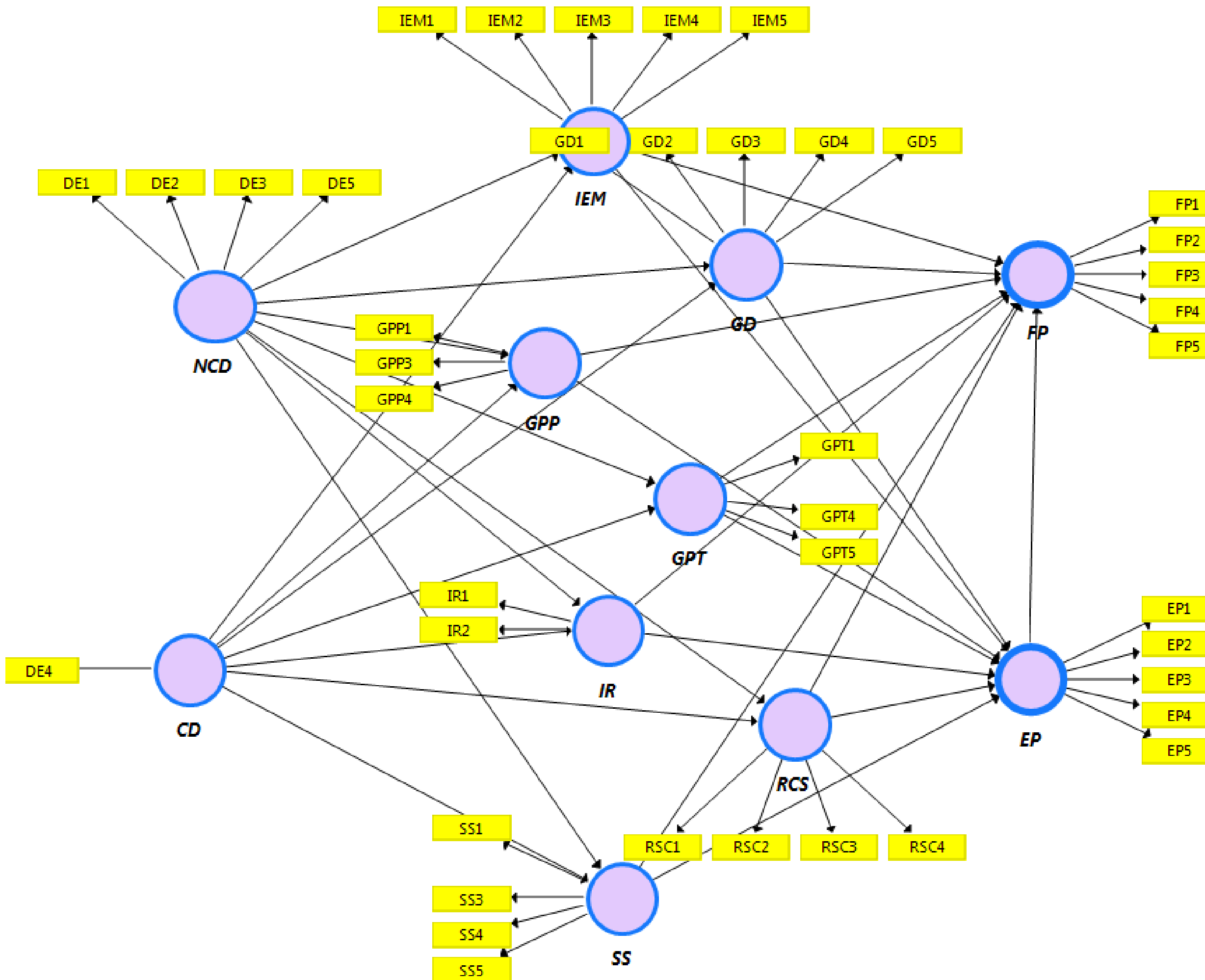


Figure 4-1. Model framework with all construct and relative indicators included.

4.2.3 Indicator Reliability and Convergent Validity (AVE)

Convergent validity is defined as the extent to which a measure correlates positively with alternative measures of the same construct. Since the indicators of any construct are interpreted as different approaches to measure the same concept (construct), they should share a high proportion of variance. To evaluate the convergent validity for all constructs, average variance extracted (AVE) values is used. Table (4-14) shows the AVE values. It should be mentioned that since "coercive drivers" is a single item construct, AVE value is set to one.

Latent Variables	Average Variance Extracted (AVE)
Coercive	1.000
Design & Development	0.629
Environmental Performance	0.791
Financial Performance	0.694
Internal Environmental Management	0.755
Investment Recovery	0.771
Non-Coercive Drivers	0.755
Packaging & Transportation	0.819
Procurement & purchasing	0.858
Reverse Logistics	0.695
Socially Sustainable	0.800

Table 4-14 AVE values of construct variables

In order for AVE values to be considered as satisfactory, the value for each construct should be above 0.7. Assessment of AVE values is closely related to indicators loading values. Indicators with loading above 0.7 are perfectly acceptable, and values below 0.4 should undoubtedly be removed. However if indicators loadings are between 0.4 and 0.7 their removal should check against their effect on AVE value. Considering our data set, the only indicator loading of below 0.7 is “GDD1” with the value of 0.672 which is very close to the limit. In addition, its removal wouldn’t help the AVE value to improve. Therefore, convergent validity of all constructs is considered satisfied.

4.2.4 Discriminate Validity (Fornell-Larcker criterion and cross loadings)

Discriminate validity measures the extent to which a construct is truly distinct from other constructs by empirical standards. Discriminate validity is needed to guarantee that the construct is measuring a unique concept and no two constructs measurements are overlapping. Two statistical tools are applied in this section in order to ensure discriminate validity of all construct. First, we applied Fornell-Larcker criterion by comparing the square root of AVE value of each construct with its correlations with other constructs. To establish discriminant validity, the square root of each constructs AVE must be larger than its correlation with other constructs.

Fornell-Larcker criterion	Coercive Driver	Environmental Performance	Financial Performance	packaging and transportation	Internal Environmental Management	NonCoercive drivers	Reverse supply chain	Socially Sustainable	design and development	purchasing and procurement	investment recovery	$\sqrt{AVE}$	Discriminate validity?
Coercive Driver	1.000											1.000	Yes
Environmental Performance	0.611	0.889										0.889	Yes
Financial Performance	0.406	0.757	0.833									0.833	Yes
packaging & transportation	0.338	0.353	0.518	0.905								0.905	Yes
Internal Environmental Management	0.553	0.632	0.428	0.519	0.869							0.869	Yes
NonCoercive drivers	0.756	0.757	0.562	0.422	0.616	0.869						0.869	Yes
Reverse supply chain	0.303	0.424	0.315	0.360	0.406	0.416	0.834					0.834	Yes
Socially Sustainable	0.482	0.684	0.570	0.449	0.594	0.594	0.566	0.894				0.894	Yes
design and development	0.292	0.412	0.540	0.634	0.561	0.393	0.415	0.495	0.793			0.793	Yes
purchasing &procurement	0.372	0.380	0.335	0.598	0.609	0.438	0.240	0.481	0.411	0.926		0.926	Yes
investment recovery	0.033	0.316	0.281	0.034	-0.039	0.180	0.405	0.302	0.207	-0.084	0.878	0.878	Yes

Table 4-15 Fornell-Larcker Criteria

As illustrated in table (4-15), the $\sqrt{AVE}$ value for the entire ten construct has a highest value among all the correlations with other construct. Therefore, we can conclude that the requirement for discriminant validity for the entire construct is met. Meaning all constructs share more variance with their associated indicators compared to any other construct. Just like other measures the single item construct, coercive drivers, is excluded from this analysis.

Another criterion to ensure discriminate validity of measurement constructs is to perform cross loading analysis. Cross loading of all indicators verifies if the variables have higher loadings in their original factors than in the other constructs. Table (4-16) shows the cross loading analysis for each all constructs, and Indicators with the highest value of loadings are shaded.

	Coercive Driver	Environmental Performance	Financial Performance	packaging and transportation	Internal Environmental Management	NonCoercive drivers	Reverse supply chain	Socially Sustainable	design and development	purchasing and procurement	investment recovery
DE1	0.707	0.612	0.483	0.409	0.612	0.901	0.337	0.601	0.326	0.431	0.104
DE2	0.567	0.652	0.518	0.267	0.472	0.852	0.399	0.460	0.374	0.276	0.245
DE3	0.770	0.705	0.491	0.416	0.579	0.920	0.425	0.594	0.356	0.400	0.084
DE4	1.000	0.611	0.406	0.338	0.553	0.756	0.303	0.482	0.292	0.372	0.033
DE5	0.557	0.674	0.470	0.361	0.461	0.798	0.281	0.383	0.317	0.409	0.224
EP1	0.494	0.900	0.751	0.379	0.571	0.648	0.414	0.625	0.389	0.388	0.267
EP2	0.582	0.911	0.672	0.304	0.591	0.679	0.393	0.742	0.370	0.356	0.315
EP3	0.482	0.854	0.612	0.223	0.486	0.536	0.340	0.434	0.365	0.185	0.320
EP4	0.667	0.898	0.582	0.324	0.625	0.796	0.426	0.632	0.297	0.357	0.259
EP5	0.492	0.882	0.738	0.326	0.531	0.699	0.309	0.582	0.408	0.383	0.247
FP1	0.384	0.736	0.878	0.445	0.466	0.541	0.264	0.428	0.415	0.437	0.262
FP2	0.298	0.670	0.818	0.464	0.401	0.355	0.254	0.526	0.446	0.229	0.218
FP3	0.255	0.406	0.745	0.411	0.144	0.372	0.148	0.265	0.429	0.223	0.225
FP4	0.414	0.662	0.819	0.403	0.387	0.631	0.313	0.634	0.456	0.239	0.221
FP5	0.324	0.637	0.896	0.434	0.340	0.430	0.311	0.482	0.504	0.254	0.247
GD1	0.315	0.267	0.219	0.443	0.604	0.457	0.354	0.539	0.672	0.369	0.046
GD2	0.085	0.327	0.555	0.505	0.406	0.237	0.302	0.395	0.731	0.376	0.087
GD3	0.103	0.305	0.464	0.594	0.357	0.251	0.422	0.249	0.808	0.297	0.242
GD4	0.382	0.398	0.503	0.504	0.446	0.337	0.382	0.407	0.888	0.316	0.269

GD5	0.281	0.314	0.333	0.457	0.444	0.303	0.168	0.395	0.848	0.270	0.144
GPP1	0.295	0.336	0.329	0.593	0.573	0.396	0.232	0.419	0.387	0.930	-0.109
GPP3	0.318	0.316	0.327	0.547	0.547	0.414	0.247	0.425	0.420	0.919	-0.062
GPP4	0.417	0.402	0.277	0.522	0.571	0.408	0.190	0.491	0.336	0.930	-0.062
GPT1	0.283	0.295	0.479	0.933	0.499	0.383	0.292	0.361	0.619	0.548	0.032
GPT4	0.320	0.352	0.532	0.910	0.466	0.439	0.393	0.447	0.601	0.523	0.015
GPT5	0.316	0.306	0.376	0.871	0.442	0.307	0.278	0.406	0.489	0.559	0.051
IEM1	0.545	0.613	0.363	0.400	0.918	0.614	0.370	0.535	0.466	0.547	-0.069
IEM2	0.517	0.574	0.354	0.418	0.947	0.583	0.367	0.565	0.486	0.513	-0.062
IEM3	0.364	0.547	0.383	0.524	0.885	0.473	0.310	0.536	0.559	0.670	-0.027
IEM4	0.529	0.529	0.448	0.460	0.803	0.363	0.277	0.379	0.493	0.549	-0.035
IEM5	0.431	0.473	0.316	0.466	0.779	0.626	0.437	0.557	0.441	0.369	0.032
IR1	-0.161	0.188	0.266	0.011	-0.102	0.045	0.208	0.131	0.229	-0.048	0.863
IR2	0.199	0.357	0.230	0.047	0.026	0.259	0.488	0.385	0.138	-0.096	0.892
RSC1	0.096	0.311	0.222	0.152	0.311	0.221	0.800	0.487	0.244	0.133	0.402
RSC2	0.242	0.461	0.314	0.317	0.336	0.379	0.883	0.617	0.280	0.255	0.409
RSC3	0.423	0.374	0.206	0.369	0.460	0.494	0.873	0.435	0.370	0.254	0.224
RSC4	0.192	0.216	0.317	0.336	0.209	0.229	0.774	0.307	0.535	0.112	0.343
SS1	0.336	0.509	0.400	0.359	0.433	0.424	0.705	0.870	0.404	0.402	0.344
SS3	0.399	0.604	0.438	0.401	0.527	0.536	0.589	0.903	0.445	0.420	0.325
SS4	0.468	0.634	0.552	0.367	0.570	0.551	0.393	0.905	0.412	0.366	0.202
SS5	0.493	0.674	0.610	0.466	0.570	0.588	0.402	0.898	0.498	0.521	0.234

Table 4-16 Cross loading analysis

4.3 Evaluation of the structural model

Once the quality of the measurement model is approved through the above mentioned analysis, we can then evaluate the structural model. When examining the structural model, it is important to understand that PLS-SEM fits the model to the sample data to obtain the best parameter estimated by maximizing the explained variance of the endogenous latent variables. In this section we first check the model for collinearity problems, and then we proceed with assessing the path model, significance testing and hypothesis testing.

4.3.1 Assessing the structural model for collinearity

As mentioned in section 3.4.5, "to assess multicollinearity, we need a measure expressing the degree to which each independent variable is explained by the set of other independent variables.

In simple terms, each independent variable becomes a dependent variable and is regressed against the remaining independent variables."(Hair *et al*., 2010). To do so Variance Inflation Factor (VIF), is applied in this section. VIF is the degree to which the standard error has been increased due to multicollinearity. If the degree of collinearity is very high, below 0.2 or above 5, we should consider removing one of the corresponding indicators. Table (4-17) shows the VIF values.

VIF values	Design & Development	Environmental Performance	Financial Performance	Internal Environmental Management	Investment Recovery	Packaging & Transportation	Procurement & purchasing	Reverse Logistics	Socially Sustainable
Coercive	2.331			2.331	2.331	2.331	2.331	2.331	2.331
Design & Development		2.107	2.122						
Environmental Performance			2.483						
Internal Environmental Management		2.386	3.004						
Investment Recovery		1.440	1.595						
NonCoercive Drivers	2.331			2.331	2.331	2.331	2.331	2.331	2.331
Packaging & Transportation		2.218	2.218						
Procurement & purchasing		2.054	2.063						
Reverse Logistics		1.741	1.755						
Socially Sustainable		2.194	2.626						

Table 4-17 VIF values

As evident from table (4-17), the lowest observed VIF values is between “Investment recovery” and “Environmental performance” constructs with the value of 1.440. Furthermore, the highest value is between “internal environmental management” and “Financial performance” constructs by the value of 3.004. The rest of the VIF values are scattered between these two values. Thus, we conclude that there is no sign of collinearity in our data set.

4.3.2 Structural model path coefficients

The structural model path coefficients can be interpreted relative to one another. If one path coefficient is larger than another, its effect on the endogenous latent variable is greater. These coefficients represent the estimated change in the endogenous construct for a unit change in the exogenous construct. If the path coefficient is statistically significant, meaning that the coefficient is significantly different from zero in the population, its value indicates the extent to which the exogenous construct is associated with the endogenous construct. Table (4-18) demonstrates the path coefficients with respect to the structural model. We consider values above 0.2 to be significant. As a result, we assume “coercive drivers” to have a positive effect in adoption of “internal environmental management” strategies, having values of 0.203 and -0.241. Similarly, “Non-coercive drivers” tend to positively affect the adoption of all the seven practices, as the path coefficients are 0.403, 463, 0.362, 0.388, 0.366, 0.437 and 0.537 for “design and development”, “internal environmental management”, “Investment recovery”, “packaging and transportation”, “Procurement and purchasing”, “Reverse logistics” and “socially sustainable” practices respectively.

Path Coefficients	Design & Development	Environmental Performance	Financial Performance	Internal Environmental Management	Investment Recovery	Packaging & Transportation	Procurement & purchasing	Reverse Logistics	Socially Sustainable
Coercive	-0.012			**0.203**	**-0.241**	0.045	0.095	-0.027	0.077
Design & Development		-0.077	**0.254**						
Environmental Performance			**0.785**						
Internal Environmental Management		**0.499**	**-0.323**						
Investment Recovery		**0.249**	-0.018						
NonCoercive Drivers	**0.403**			**0.463**	**0.362**	**0.388**	**0.366**	**0.437**	**0.537**
Packaging & Transportation		0.009	**0.290**						
Procurement & purchasing		-0.060	-0.048						
Reverse Logistics		-0.073	-0.112						
Socially Sustainable		**0.417**	0.060						

Table 4-18 Path coefficient values

When it comes to analyzing the impacts on performance outcomes we observe the following: “Internal environmental management”, “Investment recovery” and “socially sustainable” activities positively influence “Environmental performance” as marked by their path coefficient values. The path coefficient results also indicate a considerable effect of “Design and development” and “packaging and distribution” practices on “Financial performance”. Finally, “Environmental performance” seems to significantly affect “Financial performance”.

4.3.3 Assessing the significance and relevance of the structural model relationships

The goal of PLS-SEM is to identify not only significant path coefficients in the structural model but significant and relevant effects. The significance of a path coefficient mainly depends on its standard error that is obtained by means of bootstrapping. The bootstrap standard error allows computing the empirical ***t*-value** as explained in section 3.4.7. For our study, considering the number links and small samples size, we have set 10% two tail significance level. Meaning that if the *t*-value resulted from the bootstrapping procedure exceeds 1.65, we suggest that the relationship between the associated constructs is significant. Moreover, the bootstrap procedure comprising 5000 sub-samples, as recommended by PLS-SEM algorithm, was used to estimate the statistical significance of the relationships presented in the model. Also, complementary to *t*-value, researchers usually also report *p*-values that correspond to the probability of mistakenly rejecting the null hypothesis, given the data at hand. In the next section we discuss the results in detail and test the hypothesis.

4.3.3.1 Link between coercive pressure and adoption of green initiatives

We start the hypothesis testing by evaluating the effectiveness of government regulation, known as coercive drivers, on the adoption of each of the listed GSCM practice, which is investigated through Hypothesis H1.1 to H.17. Recalling the path coefficients of 0.203 for adoption “internal environmental” practices, and -0.241 for investment recovery, we now investigate the significance of the two relationships. As indicated in table (4-19) the resulting *t*-values for each of the relationships are 1.215 for “internal environmental management” practices, and 1.041 for “investment recovery” practices and below the theoretical *t*-value of 1.65. The same holds true for the rest of the relationships between coercive drivers and adoption of practices. Therefore we fail to accept any of the hypotheses H1.1 to H1.7. It means that that we haven't observed any significant relationship between government regulatory pressure and adoption of any of the seven listed GSCM practices.

	Hypothesis	**T -Statistics**	**P Values**
H1.1	Coercive→ Design & Development	0.069	0.945
H1.2	Coercive → Internal Environmental Management	1.215	0.224
H1.3	Coercive→Investment Recovery	1.041	0.298
H1.4	Coercive → Packaging & Transportation	0.306	0.760
H1.5	Coercive → Procurement & purchasing	0.565	0.572
H1.6	Coercive → Reverse Logistics	0.139	0.889
H1.7	Coercive → Socially Sustainable	0.423	0.672

Table 4-19 Significance testing of H.1.1 to H1.7

4.3.3.2 Link between Non-Coercive pressure and adoption of green initiatives

The second group of hypothesis explore the relationships between non-governmental drivers for GSCM initiatives adoption. Following the high values of path coefficients in this group of hypothesis, we expect to observe a positive relationship between non-coercive drivers and the adoption of GSCM practices. As demonstrated in table (4-20), hypothesis H2.2, H2.4, and H2.7 are supported to have substantial positive relationship as they all exceed the theoretical t-value of 1.65, having p-values of maximum 0.096. Conversely Eco-design, investment recovery, reverse logistics and green procurement don't seem to be significantly influenced by non-coercive environmental drivers.

	Hypothesis	T -Statistics	P Values
H2.1	NonCoercive Drivers → Design & Development	1.649	0.099
H2.2	NonCoercive Drivers → Internal Environmental Management	2.386	0.017
H2.3	NonCoercive Drivers → Investment Recovery	1.362	0.173
H2.4	NonCoercive Drivers→Packaging & Transportation	1.665	0.096
H2.5	NonCoercive Drivers→Procurement & purchasing	1.280	0.201
H2.6	NonCoercive Drivers → Reverse Logistics	1.458	0.145
H2.7	NonCoercive Drivers → Socially Sustainable	2.234	0.025

Table 4-20 Significance testing of H2.1 to H2.7

4.3.3.3 Link between Internal environmental management practices and performance outcomes

The second group of hypothesis is intended to examine the impact of the GSCM practices on environmental and financial performance of organizations. The first practice to be investigated is "internal environmental management" which demonstrated high path coefficients of 0.499 with "environmental performance" and - 0.323 with "financial performance" constructs, resulted in t-values of 2.291 and 1.702 respectively. This results is also approved by corresponding p-values as shown in table (4-21), and support the hypothesis H3.1 stating a strong positive relationship between internal environmental management and environmental performance, however H3.2 is not supported as our results indicate a strong negative relationship between internal environmental management and financial performance. Instead, we observe a significantly negative effect on financial performance.

	Hypothesis	T - Statistics	P Values
H3.1	Internal Environmental Management → Environmental Performance	2.291	0.022
H3.2	Internal Environmental Management → Financial Performance	1.702	0.089

Table 4-21 Significance testing of H3.1 and H3.2

4.3.3.4 Link between green design and development practices and performance outcomes

"Green design and development" construct is connected to "environmental performance" and "financial performance" with path coefficient values of -0.077 and 0.254 respectively. So, it is expected that there exist a positive significant relationship between "green design and development" and "financial performance" while such a relationship is not true for "environmental performance" due to low value of the relationship path coefficient. However since *t*-value of 1.371 is lower than the theoretical 1.65 the positive relationship between eco-design and financial performance is not significant.

	Hypothesis	T -Statistics	P Values
H4.1	Design & Development → Environmental Performance	0.360	0.719
H4.2	Design & Development →Financial Performance	1.371	0.170

Table 4-22 significance testing of H4.1 and H4.2

4.3.3.5 Link between green purchasing and procurement practices and performance outcomes

Since the path coefficients connecting the "procurement and purchasing" construct to both Environmental and financial performance constructs have insignificant values of -0.060 and -0.048 we do not expect hypothesis H5.1 and H5.2 to get approved. As shown in table (4-23), t-values of below 1.65 confirm this result.

	Hypothesis	T -Statistics	P Values
H5.1	Procurement & purchasing → Environmental Performance	0.627	0.531
H5.2	Procurement & purchasing → Financial Performance	0.417	0.677

Table 4-23 Significance testing of H5.1 and H5.2

4.3.3.6 Link between green packaging and transportation practices and performance outcomes

The link between "green packaging and transportation" activities and "financial Performance" exhibits a strong positive relationship due the weight path coefficient value of 0.290. The significance of this relationship is also confirmed by the *t*-value of 2.059 which is well above the theoretical limit of 1.65 as indicated in Table (4-24). However, there is no noticeable relationship between "green packaging and transportation" activities and environmental performance. Therefore, hypothesis H6.1 is not supported.

	Hypothesis	T -Statistics	P Values
H6.1	Packaging & Transportation → Environmental Performance	0.072	0.942
H6.2	Packaging & Transportation → Financial Performance	2.059	0.040

Table 4-24 Significance testing of H6.1 and H6.2

4.3.3.7 Link between Reverse supply chain practices and performance outcomes

Subsequently, the path coefficients connecting the "Reverse Supply chain" practices construct to both environmental and financial performance constructs have insignificant values of -0.073 and -0.112, and consequently we do not expect to H7.1 and H7.2 to be supported. As shown in table (4-25), *t*-values of below 1.65 confirm this result.

	Hypothesis	T -Statistics	P Values
H7.1	Reverse Logistics → Environmental Performance	0.565	0.572
H7.2	Reverse Logistics →Financial Performance	1.063	0.288

Table 4-25 significance testing of H7.1 and H7.2

4.3.3.8 Link between Investment recovery practices and performance outcomes

Having path coefficient value of 0.249 we expect to observe a significant positive relationship between investment recovery practices and environmental performance, however due to the low *t*-value of 1.488 which is below the theoretical 1.65 value this relationship is not significant. Also, the path coefficient between investment recovery activities and financial performance is not noticeable. Consequently, neither of the hypotheses H8.1 and H8.2 are supported. The results shown in Table (4-26)

	Hypothesis	T -Statistics	P Values
H8.1	Investment Recovery → Environmental Performance	1.488	0.137
H8.2	Investment Recovery → Financial Performance	0.219	0.827

Table 4-26 significance testing of H8.1 and H8.2

4.3.3.9 Link between Socially sustainable practices and performance outcomes

The link between "socially sustainable" activities and "environmental performance" latent variable demonstrate a strong positive relationship which is expected due the significant path coefficient value of 0.417. The significance of this relationship is also confirmed by the *t*-value of 2.018 and p-value of 0.044 as demonstrated in Table (4-27). However, there is no substantial relationship between "socially sustainable" activities and financial performance. Therefore, while H9.1 is supported, hypothesis H9.2 is not supported due to the negligible path coefficient of 0.06.

	Hypothesis	T -Statistics	P Values
H9.1	Socially Sustainable →Environmental Performance	2.018	0.044
H9.2	Socially Sustainable → Financial Performance	0.275	0.783

Table 4-27 Significance testing of H9.1 and H9.2

4.3.3.10 Link between Environmental performance and financial performance.

In the final phase of hypothesis testing we explore the relationship between environmental performance and financial performance, which due to the high path coefficient value of 0.785 we expect it to be significant. As indicated in Table (4-28) by t-value of 5.576 and 0 as the *p*-value, there exists a strong positive relationship between the two constructs and therefore Hypothesis H10 is supported.

	Hypothesis	T -Statistics	P Values
H10	Environmental Performance →Financial Performance	5.576	0.000

Table 4-28 Significance testing of H10

4.3.4 Coefficient of Determination (R^2)

As mentioned in chapter 3, R^2 indicates the model predictive accuracy by repressing the exogenous latent variables' combined effects on the endogenous latent variable and its values vary between 0 and 1. Assuming the properly developed structural model, the higher the value of R^2, the greater the explanatory power of the regression equation, and therefore the better the prediction of the dependent variable. Table (4-29) demonstrates the R square values for each of the construct considering our data set and structural model. Considering the fact that interpretation of R square values also depends on the research context, which is has a more exploratory tendency in our case, we consider values of 0.2 and above to have acceptable predictive relevance for our model. In general, R^2 values are interpreted differently with respect to field of study. For example, while a R^2 value of 0.2 is perceived as high in disciplines such as consumer behavior, in other fields like market research studies values of 0.7 and above are satisfactory. Therefore, "internal environmental management", "socially sustainable", "green packaging and distribution", "Environmental performance" and "Financial performance" with R^2 values of 0.397, 0.356, 0.196, 0.597 and 0.722 respectively are considered as construct which our structural model can explain the best.

Construct	**R Square**
Green Design & Development	0.155
Environmental Performance	0.597
Financial Performance	0.722
Internal Environmental Management	0.397
Investment Recovery	0.057
Green Packaging & Transportation	0.179
Green Procurement & purchasing	0.196
Reverse Logistics	0.174
Socially Sustainable	0.356

Table 4-29 R square values

Fig. (4-2) illustrates the strength of the relationships between latent variables and structural model predictive accuracy

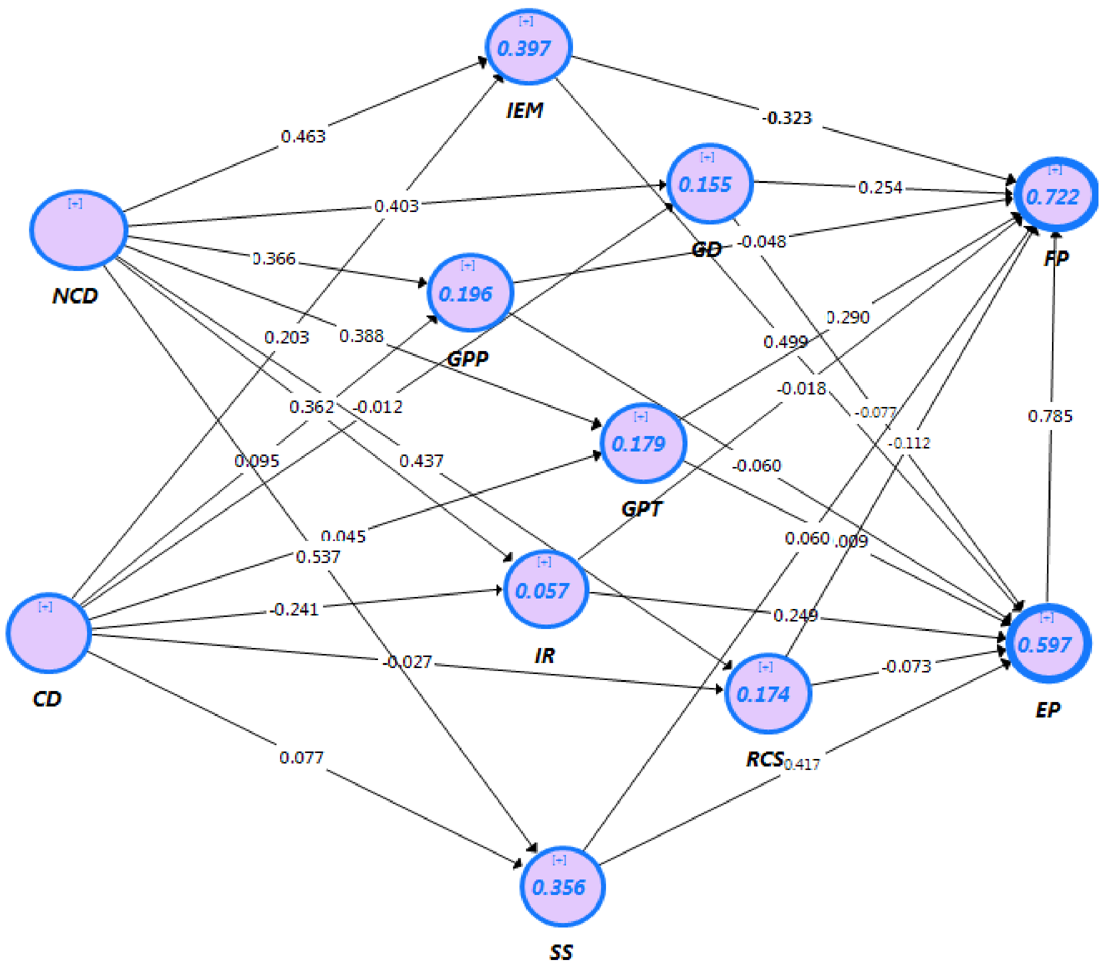


Figure 4-2 Final model with R square values on latent variables and path coefficient on links

4.3.5 Assessing the effect size f^2

After evaluating R^2 for all endogenous constructs, effect size is the measure to evaluate the effect of omitting a construct from the structural model. Effect size calculation may be considered as a complementary analyze to R^2. More specifically, f^2 can help analyze how much a predictor construct contributes to R^2 value of a target construct in the model. The formula for calculating f^2 is provided in chapter 3. Evaluation of f^2 value is basically centers around examining the effect of excluding or including an exogenous construct on the R^2 values of the related endogenous constructs. Table (4-30) demonstrates the effect sizes of all the constructs except for “financial performance” as it is only an endogenous latent variable. The effect size values are interpreted as follows:

0.02 → small, 0.15 → medium, 0.35 → large effect (Cohen, 1988)

effect size f^2	Design & Development	Environmental Performance	Financial Performance	Internal Environmental Management	Investment Recovery	Packaging & Transportation	Procurement & purchasing	Reverse Logistics	Socially Sustainable
Coercive	0.000			0.029	0.026	0.001	0.005	0.000	0.004
Design & Development		0.009	0.115						
Environmental Performance			0.904						
Internal Environmental Management		0.258	0.137						
Investment Recovery		0.107	0.000						
NonCoercive Drivers	0.120			0.153	0.059	0.079	0.071	0.099	0.193
Packaging & Transportation		0.000	0.134						
Procurement & purchasing		0.005	0.003						
Reverse Logistics		0.008	0.023						
Socially Sustainable		0.202	0.001						

Table 4-30 f square values

So, as evident by the values of the effect size calculation, in terms of environmental drivers, non-coercive drivers are having values between 0.059 and 0.193 and therefore their removal may impact the adoption of GSCM practices from small to moderate amounts. Likewise, internal environmental management, having values of 0.258 and 0.137 on each of the performance outcomes, is crucial to our model. Green distribution activities tend to moderately influence financial performance only and socially sustainable activities have medium effect on environmental performance. Reverse logistics seem to have small effect on financial performance while, investment recovery appears to moderately affect environmental performance.

The most effective relationship according to f^2 values is the impact of environmental performance on financial performance. This is expected as the financial performance is a direct result of a successful and operational environmental performance.

4.4 Barriers in implementing GSCM practices

Investigating the barriers of GSCM practices implementation is another study concentration and has received considerable attention as the literature of GSCM is developing. Once the necessity of sustainable development is recognized and environmentally conscious manufacturing becomes part of companies strategic planning, it is important to methodically analyze the obstacles in the system. Since studying the barriers of GSCM has several classifications and researchers have taken different approaches to numerically analyze this subject, we assigned the final part of our survey questionnaire to examine the primary barrier firm may encounter while attempting to integrate green and sustainable concerns into their organizations' daily activities. After reviewing the literature on barriers of GSCM adoption, the most frequently mentioned barriers were selected and respondents were asked to check the main implementation barrier.(Govindan et al., 2014)(Grimm, Hofstetter, & Sarkis, 2014)(Ansari & Kant, 2016)(Roa & Holt, 2005). According to results provided in Fig. (4-3), 38% of our respondents perceive “high cost of initial investment” of green initiatives as the leading barrier. 17% believed that complexity of their product design makes it hard or even impossible to disassemble the products for any kind of recovery, reuse or recycling. Another frequently reported barrier is the high cost of environmental friendly material which was claimed by 14% of our respondents. Surprisingly, “lack of new technology” is reported only by 10% of our respondents as the main implementation barrier. Therefore, according to our sample population of respondents, economical concerns is the main barrier blocking the way of GSCM implementation.

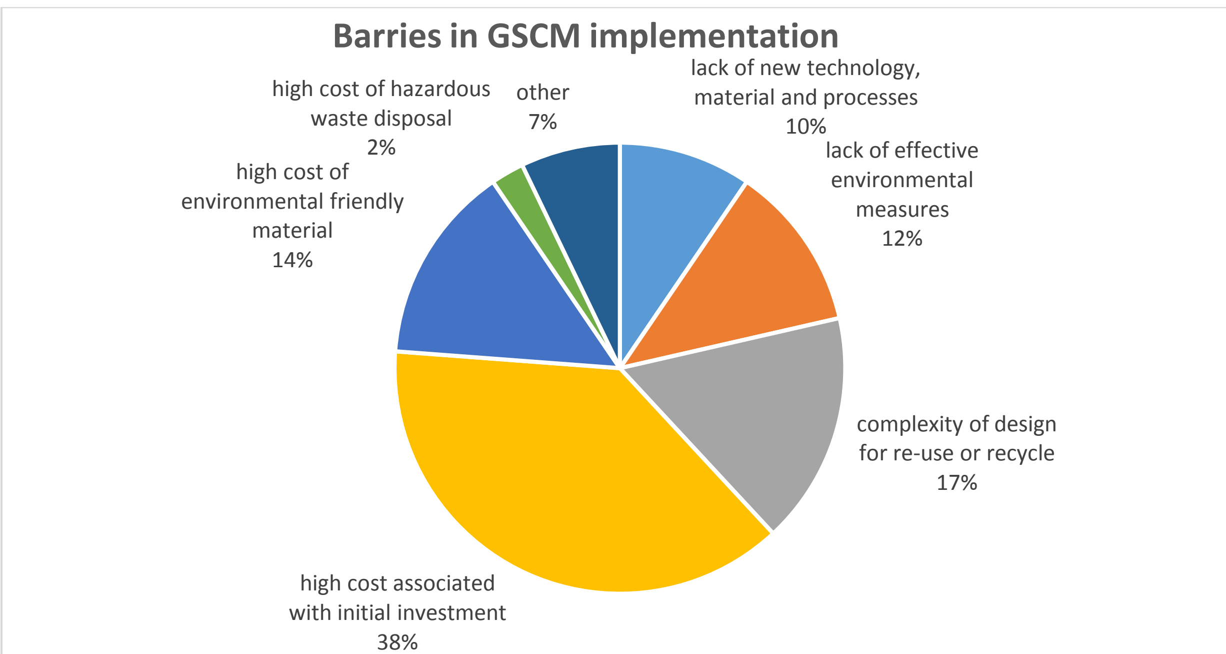


Figure 4-3 Barriers in GSCM according to respondents

4.5 Validation of Results

Table 4-31 presents validation of results of this survey study with the results of some of the previous research done in the area of drivers and implementation of GSCM. Since the study of various institutional pressures on GSCM adoption is less developed and is relatively new comparing to study the effectiveness of GSCM practices on performance indicators, we haven't find much in common results for the first two groups of hypothesis from the literature. However, for the second group of hypothesis, where we investigate the effectiveness of various GSCM practices, studies with similar outcomes are listed in the last column of table 4-31. Further explanations on connections between our study and previous studies is provided in chapter 5.

Hypothesis	Supported or not	Research Study
H1.1 CD → IEM	not supported	(López-Gamero et al, 2010)
H1.2 CD → GD	not supported	-
H1.3 CD → GPP	not supported	-
H1.4 CD → GPT	not supported	-
H1.5 CD → IR	not supported	-
H1.6 CD → RSC	not supported	-
H1.7 CD → SS	not supported	-
H2.1 NCD → IEM	supported	(Zhue et al., 2013), (López-Gamero et al, 2010)
H2.2 NCD → GD	not supported	-
H2.3 NCD → GPP	not supported	-
H2.4 NCD → GPT	supported	-
H2.5 NCD → IR	not supported	-
H2.6 NCD → RSC	not supported	-
H2.7 NCD → SS	supported	-
H3.1 IEM → EP	supported	(Zhu & Sarkis, 2007)
H3.2 IEM → FP	Negatively supported	(Yang, Hong, & Modi, 2011)
H4.1 GD → EP	not supported	-
H4.2 GD → FP	not supported	(Esfahbodi et al. 2016)

H5.1 GPP → EP	not supported	(Paulraj, 2011)
H5.2 GPP → FP	supported	(Paulraj, 2011)
H6.1 GPT → EP	not supported	-
H6.2 GPT → FP	supported	(Zailani et al., 2012)
H7.1 IR → EP	not supported	-
H7.2 IR → FP	not supported	(Esfahbodi et al. 2016)
H8.1 RSC → EP	not supported	(Eltayeb et al., 2011)
H8.2 RSC → FP	not supported	(Skinner et al., 2008)
H9.1 SS → EP	supported	-
H9.2 SS → FP	not supported	(Pullman et al., 2009)
H10 EP → FP	supported	(Esfahbodi et al. 2016),(Zhu et al., 2013)

Table 1 4-31 Validation of results

Chapter 5:

Conclusion and future works

5.1 Conclusion

The goal of this study was to investigate the effect of greening the supply chain management on the organizational environmental and financial performance in Canadian context. Different supply chain activities considering both internal and external aspects were included in this study. Internal environmental management, eco-design of products and processes, green purchasing and green distribution as well as reverse logistics and investment recovery along with integrating social concerns in the form of socially sustainable activities were studied. We also tried to draw a link between environmental drivers to see how they affect the adoption process by distinguishing between government regulatory pressure in form of coercive driver, and non-coercive drivers which direct firms to adapt green practices in a more proactive manner, for example, attract more customer as a result of environmental friendly practices, brand reputation or to gain competitive edge in the market.

The result of our survey indicates direct positive relationship between non-coercive drivers and the adoption of internal environmental management, green distribution and social sustainability activities. However, no significant relationship was conveyed by governmental regulations. This is also in accordance with (Sierra, 2015) who conclude that coercive drivers are not as effective as non-coercive environmental drivers. However (Esfahbodi et al., 2016) outcomes who investigated the influence of coercive pressure in UK industrial sector suggests a strong positive relationship between coercive pressures and adoption of GSCM.

In terms of effectiveness of practices, “internal environmental management”, “green packaging and transportation” and “socially sustainable activities” were identified as practices with most effective performance outcomes. According to our findings, “Eco-design”, “Reverse logistics” and “Investment recovery” are not efficiently influencing the performance outcome, neither environmentally nor financially. Considering that fact that the main purpose of green design is to facilitate reusability of products to allow for reverse logistics and investment recovery practices, these three constructs have connected concepts. This is also confirmed by the correlation values between the three mentioned latent variables in Table (4-15). Green purchasing also doesn’t seem to be an influential factor with respect to firms’ environmental and financial performance. This result is also in line with (Eltayeb et al., 2011) and partially with (Esfahbodi *et al.*, 2016) results who argue that since green purchasing and reverse logistics are externally-oriented activities, their impact may not be reflected on firms’ performance indicators.

On the other hand, existence of an internal environmental management system proves to be the most crucial factor to perform a successful execution of GSCM practices. In addition, socially sustainable practices demonstrated a strong positive relationship with environmental performance. One possible explanation could be the application of less toxic material or noise level reduction in manufacturing plants in order to ensure workers health condition. This is partially in line with result of (Pullman *et al.,* 2009) and (Beske-Janssen *et al.*, 2015) who figured that refraining from toxic dyes in textile production in order to improve the health condition for workers and customers would also lead to reduction of environmental impacts.

5.2 Future works:

Finally, this research has some limitations which can be translated into opportunities for further research as follows:

- In order to ensure content validity we relied on previously developed concepts for our survey questions which were initially based on developing countries and few European context. Thus, the survey may be further refined to adjust to the Canadian.
- This study covers a wide variety of sectors, consequently some items were not practiced by all. For example pharmaceutical firms barely involved in any kind of recycling activities. Therefore a more precise study may be conducted for certain industries with noticeable differences. For example what features of sustainability are applicable to pharmaceutical industry could be further investigated.
- In this thesis, our sample size was limited to 40 respondents. A more reliable and conclusive result may be achieved in presence of a larger sample size. Comparisons can be made across small-size, medium-size and large-size manufacturing organizations. Sector-wise comparisons can also be done.
- The focus of this thesis was on manufacturing companies. The study can also be extended to service industries.
- In the study, the impact of green initiatives was measured on buyer organization performance. Future studies can also cover supplier organizations and study the mutual impact.

References

Agarwal, G., & Vijayvargy, L. (2014). Empirical Investigation of Green Supply Chain Management Practices and Their Impact on Organizational Performance. *The IUP Journal of Supply Chain Management, XI*(4), 25–42.

Ahi, P., & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production*, *52*, 329–341. http://doi.org/10.1016/j.jclepro.2013.02.018

Al-sheyadi, A. K. A. (2014). Antecedents and Consequences of the Complementarities between Green Operations Management Practices : An Empirical Investigation in Oman Thesis Submitted to the University of Nottingham. *PhD Thesis*.

Ansari, Z. N., & Kant, R. (2016). A state-of-art literature review reflecting 15 years of focus on sustainable supply chain management. *Journal of Cleaner Production*. http://doi.org/10.1016/j.jclepro.2016.11.023

Beske-Janssen, P., Johnson, M. P., & Schaltegger, S. (2015). 20 Years of Performance Measurement in Sustainable Supply Chain Management – What Has Been Achieved? *Supply Chain Management: An International Journal*, *20*(6), 664–680. http://doi.org/10.1108/SCM-06-2015-0216

Brundtland, G. H. (1987). *Our Common Future: Report of the World Commission on Environment and Development*. *Medicine, Conflict and Survival* (Vol. 4). http://doi.org/10.1080/07488008808408783

Chiou, T. Y., Chan, H. K., Lettice, F., & Chung, S. H. (2011). The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in

Taiwan. *Transportation Research Part E: Logistics and Transportation Review*, *47*(6), 822–836. http://doi.org/10.1016/j.tre.2011.05.016

De Giovanni, P., & Esposito Vinzi, V. (2012). Covariance versus component-based estimations of performance in green supply chain management. *International Journal of Production Economics*, *135*(2), 907–916. http://doi.org/10.1016/j.ijpe.2011.11.001

Eltayeb, T. K., Zailani, S., & Ramayah, T. (2011). Green supply chain initiatives among certified companies in Malaysia and environmental sustainability: Investigating the outcomes. *Resources, Conservation and Recycling*, *55*(5), 495–506. http://doi.org/10.1016/j.resconrec.2010.09.003

Eltayeb, T., & Zailani, S. (2009). Going green through green supply chain initiatives towards environmental sustainability. *Operations and Supply Chain …*, *2*(2), 93–110. Retrieved from http://journal.oscm-forum.org/file/Vol 2 No 2 paper3.pdf

Esfahbodi, A., Zhang, Y., Watson, G., & Zhang, T. (2016). Governance pressures and performance outcomes of sustainable supply chain management – An empirical analysis of UK manufacturing industry. *Journal of Cleaner Production*, 1–13. http://doi.org/10.1016/j.jclepro.2016.07.098

Gimenez, C., Sierra, V., & Rodon, J. (2012). Sustainable operations: Their impact on the triple bottom line. *International Journal of Production Economics*, *140*(1), 149–159. http://doi.org/10.1016/j.ijpe.2012.01.035

Gimenez, C., & Tachizawa, E. M. (2012). Extending sustainability to suppliers: a systematic literature review. *Supply Chain Management: An International Journal*, *17*(5), 531–543. http://doi.org/10.1108/13598541211258591

González-Benito, Ó., & González-Benito, J. (2008). Implications of market orientation on the environmental transformation of industrial firms. *Ecological Economics*, *64*(4), 752–762. http://doi.org/10.1016/j.ecolecon.2006.07.012

Govindan, K., Kaliyan, M., Kannan, D., & Haq, A. N. (2014). Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process. *International Journal of Production Economics*, *147*(PART B), 555–568. http://doi.org/10.1016/j.ijpe.2013.08.018

Green, K. W. ;, Zelbst, P. J. ., Meacham, J., & Bhadauria, V. S. . (2012). Green supply chain management practices: impact on performance. *Supply Chain Management: An International Journal*, *17*, 290–305. http://doi.org/10.1108/13598541211227126

Grimm, J. H., Hofstetter, J. S., & Sarkis, J. (2014). Critical factors for sub-supplier management: A sustainable food supply chains perspective. *International Journal of Production Economics*, *152*, 159–173. http://doi.org/10.1016/j.ijpe.2013.12.011

H.Hu, A., & Hsu, C.-W. (2010). Critical factors for implementing green supply chain management practice. *Management Research Review*, *33*(6), 586–608. http://doi.org/10.1108/09574090910954864

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). Partial least squares structural equation modeling (PLS-SEM). *Sage Publisher*, 1–329. http://doi.org/10.1108/EBR-10-2013-0128

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). *Multivariate Data Analysis*. *Prentice Hall*. http://doi.org/10.1016/j.ijpharm.2011.02.019

Hair, J. F. J., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). *A Primer on Partial Least*

Squares Structural Equation Modeling (PLS-SEM). *Long Range Planning* (Vol. 46). http://doi.org/10.1016/j.lrp.2013.01.002

Holt, D., & Ghobadian, A. (2009). An empirical study of green supply chain management practices amongst UK manufacturers Diane. *Journal of Manufacturing Technology Management*, *20*(7), 933–956. http://doi.org/http://dx.doi.org/10.1108/MRR-09-2015-0216

Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, *28*(5), 430–441. http://doi.org/10.1016/j.jom.2010.01.001

Klassen, R., & Laughlin, M. (1996). The impact of environmental management on firm performance. *Management Science*, *42*(8), 1199–1214. http://doi.org/10.2307/2634452

Kleindorfer, P., Singhal, K., & Van Wassenhove, L. (2005). Sustainable operations management. *Production and Operations Management*, *14*(4), 482–492. http://doi.org/10.1111/j.1937-5956.2005.tb00235.x

Laari, S., Töyli, J., Solakivi, T., & Ojala, L. (2016). Firm performance and customer-driven green supply chain management. *Journal of Cleaner Production*, *112*, 1960–1970. http://doi.org/10.1016/j.jclepro.2015.06.150

Lee, S., Kim, S. T., & Choi, D. (2012). Green supply chain management and organizational performance. *Industrial Management & Data Systems*, *112*(8), 1148–1180. http://doi.org/10.1108/02635570710734262

Lee, V.-H., Ooi, K.-B., Chong, A. Y.-L., & Seow, C. (2014). Creating technological innovation via green supply chain management: An empirical analysis. *Expert Systems with Applications*, *41*(16), 6983–6994. http://doi.org/10.1016/j.eswa.2014.05.022

López-Gamero, M. D., Molina-Azorín, J. F., & Claver-Cortés, E. (2010). The potential of environmental regulation to change managerial perception, environmental management, competitiveness and financial performance. *Journal of Cleaner Production*, *18*(10–11), 963–974. http://doi.org/10.1016/j.jclepro.2010.02.015

Mitra, S., & Datta, P. P. (2014). Adoption of green supply chain management practices and their impact on performance: an exploratory study of Indian manufacturing firms. *International Journal of Production Research*, *52*(7), 2085–2107. http://doi.org/10.1080/00207543.2013.849014

Paulraj, A. (2011). Understanding the Relationships Between Internal Resources and Capabilities, Sustainable Supply Management and Organizational Sustainability*. *Journal of Supply Chain Management*, *47*(1), 19–37. http://doi.org/10.1111/j.1745-493X.2010.03212.x

Pullman, M. E., Maloni, M. J., & Carter, C. R. (2009). Food for thought: Social versus environmental sustainability practices and performance outcomes. *Journal of Supply Chain Management*, *45*(4), 38–54. http://doi.org/10.1111/j.1745-493X.2009.03175.x

R.O.a, L., & C.b, G. T. (2011). Drivers of green supply management performance: Evidence from Germany. *Journal of Purchasing and Supply Management*, *17*(3), 176–184. http://doi.org/10.1016/j.pursup.2011.04.006

Ramakrishnan, R., Andrew, B. ;, Prithwiraj, N., & Luc, M. (2010). Impact of environmental regulations on innovation and performance in the UK industrial sector. *Management Decision*, *48*(10), 1493–1513. http://doi.org/http://dx.doi.org/10.1108/BIJ-10-2012-0068

Roa, P., & Holt, D. (2005). Do green supply chains lead to competitiveness and economic performance? *Journal of Small Business and Enterprise Development*, *12*(4), 564–578. http://doi.org/10.1108/02656710210415703

Rossi, S., Colicchia, C., Cozzolino, A., & Christopher, M. (2013). The logistics service providers in eco-efficiency innovation: An empirical study. *Supply Chain Management: An International Journal*, *18*(6), 583–603. http://doi.org/10.1108/SCM-02-2012-0053

S.L.a, G., & C.D.b, S. (2013). A meta-analysis of environmentally sustainable supply chain management practices and firm performance. *Journal of Supply Chain Management*, *49*(2), 78–95. http://doi.org/10.1111/jscm.12006

Sierra, E. M. T. C. G. V. (2015). Green supply chain management approaches: drivers and performance implications. *International Journal of Operations & Production Management*, *35*(11), 1546–1566. http://doi.org/http://dx.doi.org/10.1108/09564230910978511

Skinner, L. R., Bryant, P. T., & Richey, R. G. (2008). Examining the impact of reverse logistics disposition strategies. *International Journal of Physical Distribution & Logistics Management*, *38*(7), 518–539. http://doi.org/10.1108/09600030810900932

Vachon, Stephan ; Klassen, R. (2006). Extending green practices across the supply chain The impact of upstream and downstream integration. *International Journal of Operations & Production Management*, *26*(7), 795–821. http://doi.org/http://dx.doi.org/10.1108/09564230910978511

Vanalle, R. M., Ganga, G. M. D., Godinho Filho, M., & Lucato, W. C. (2017). Green supply chain management: An investigation of pressures, practices, and performance within the Brazilian automotive supply chain. *Journal of Cleaner Production*, *151*, 250–259. http://doi.org/10.1016/j.jclepro.2017.03.066

Wong, C. W. Y. (2013). Leveraging environmental information integration to enable environmental management capability and performance. *Journal of Supply Chain Management*, *49*(2), 114–136. http://doi.org/10.1111/jscm.12005

Yang, M. G., Hong, P., & Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics*, *129*(2), 251–261. http://doi.org/10.1016/j.ijpe.2010.10.017

Yu, W., & Ramanathan, R. (2014). An empirical examination of stakeholder pressures, green operations practices and environmental performance. International Journal of Production Research, 53(July), 1–18. http://doi.org/10.1080/00207543.2014.931608

Zailani, S., Jeyaraman, K., Vengadasan, G., & Premkumar, R. (2012). Sustainable supply chain management (SSCM) in Malaysia: A survey. *International Journal of Production Economics*, *140*(1), 330–340. http://doi.org/10.1016/j.ijpe.2012.02.008

Zhu, Q., & Sarkis, J. (2004). Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. *Journal of Operations Management*. http://doi.org/10.1016/j.jom.2004.01.005

Zhu, Q., & Sarkis, J. (2006). An inter-sectoral comparison of green supply chain management in China: Drivers and practices. *Journal of Cleaner Production*, *14*(5), 472–486. http://doi.org/10.1016/j.jclepro.2005.01.003

Zhu, Q., & Sarkis, J. (2007). The moderating effects of institutional pressures on emergent green supply chain practices and performance. *International Journal of Production Research*, *45*(18–19), 4333–4355. http://doi.org/10.1080/00207540701440345

Zhu, Q., Sarkis, J., Cordeiro, J., & Lai, K. (2008). Firm-level correlates of emergent green supply chain management practices in the Chinese context☆. *Omega*, *36*(4), 577–591. http://doi.org/10.1016/j.omega.2006.11.009

Zhu, Q., Sarkis, J., & Lai, K. (2013). Institutional-based antecedents and performance outcomes of internal and external green supply chain management practices. *Journal of Purchasing and Supply Management*, *19*(2), 106–117. http://doi.org/10.1016/j.pursup.2012.12.001

APPENDIX A: QUESTIONNAIRE

Assessing the Impact of Sustainable Practices on Organizational Performance

Concordia University

1515 Rue Sainte-Catherine O,
Montréal, QC H3G 2W1

This questionnaire is part of a research project to assess the Impact of Green Supply Chain Management (GSCM) practices on organizational performance.

Your responses are important in determining the most effective methods of GSCM in practice. The answers from your questionnaire and others will be used as the main input data set for my research project.

The questionnaire should take you about five minutes to complete. If you wish to add further comments, please feel free to do so. The information you provide will be kept anonymous.

If you have any questions or would like further information, please do not hesitate to contact me by phone: 647-- or by email: mina.jafari66@gmail.com

Thank you for your time and help.

Industry Sector:	
Automotive industry	
Automotive components industry	
Electronic components industry	
Food and beverage industry	
Industrial material and machinery industry	
Petrochemical and chemicals industry	
Transportation and logistics industry	
Textile industry	
Other	

Your current Position title: -----------

Years of experience in current position: -------------

Name of the Company: -----------

Internal environmental management Practices

1. Considering the Internal environmental management practices, please indicate the extent to which your organization is applying each of the following:

(Five-point scale: 1= no implementation; 2= planning to consider implementation; 3= currently considering implementation; 4 =initiating implementation; 5 = implementing fully)

Top management is committed to implement GSCM practices	1 2 3 4 5
Mid-level management is committed to implement GSCM practices	1 2 3 4 5
Engagement in cross-functional activities for TQEM implementation	1 2 3 4 5
Implementing an internal EMS	1 2 3 4 5
Performing in accordance to ISO 14000/ EMAS guidelines	1 2 3 4 5

Green design and product development Practices

2. With regard to sustainable design and product development, please indicate the extent to which you perceive that your company is implementing each of the following:

(Five-point scale: **1**= no implementation; **2**= planning to consider implementation; **3**= currently considering implementation; **4** =initiating implementation; **5** = implementing fully)

Performing Life Cycle Assessment during product/process design	1 2 3 4 5
Considering use of recycled/ refurbished/remanufactured components during the design process	1 2 3 4 5
Considering quick disassembly during product/process design	1 2 3 4 5
Considering reduction of material usage during product/process design	1 2 3 4 5
Considering reduction of hazardous material usage during product/process design	1 2 3 4 5

Green Procurement/ purchasing /sourcing Practices

3. In terms of green procurement and purchasing activities, please indicate the extent to

which you perceive that your company is implementing each of the following:

Five-point scale: **1**= no implementation; **2**= planning to consider implementation; **3**= currently considering implementation; **4** =initiating implementation; **5** = implementing fully)

Assessing suppliers' environmental performance through evaluation (questionnaire/ Audits)	1 2 3 4 5
Requiring suppliers to implement Environmental management system	1 2 3 4 5
Providing environmental awareness seminars and/or training for its suppliers	1 2 3 4 5
Participating in joint planning sessions with its suppliers to resolve environmental related problems	1 2 3 4 5

Green packaging, transportation and distribution Practices

4. While performing packaging, transportation and distribution practices, please indicate the extent to which your company is implementing each of the following:

(Five-point scale: **1**= no implementation; **2**= planning to consider implementation; **3**= currently considering implementation; **4** =initiating implementation; **5** = implementing fully)

Collaborating with its customers in order to use less energy during product transportation	1 2 3 4 5
Using high-tech freight logistics transportation systems (Such as reducing container weight and improving refrigeration)	1 2 3 4 5
Using rout optimizing technology in order to perform its transportation/ distribution activities	1 2 3 4 5
Using environmentally-friendly packaging (such as bio-degradable packaging, low density packaging)	1 2 3 4 5

Tracking and monitoring emissions caused in product distribution (e.g., carbon footprint)	1 2 3 4 5

Closed loop supply chain (reversed SC) Practice

5. With regard to reverse logistics, please indicate the extent to which your company performs each of the following dispositioning practices:

(Five-point scale: 1= no implementation; 2= planning to consider implementation; 3= currently considering implementation; 4 =initiating implementation; 5 = implementing fully)

Destroying (scrapping and dumping)	1 2 3 4 5
Recycling (material reclaim)	1 2 3 4 5
Refurbishing/ Remanufacturing (repairing or upgrading)	1 2 3 4 5
Reuse (Repackaging of returned products)	1 2 3 4 5

Investment recovery Practices

6. With regard to investment recovery options, please indicate the extent to which your company performs each of the following practices:

(Five-point scale: 1= no implementation; 2= planning to consider implementation; 3= currently considering implementation; 4 =initiating implementation; 5 = implementing fully)

Sale of excess inventories or materials	1 2 3 4 5
Sale of scrap and used materials or by-products	1 2 3 4 5
Sale of excess capital equipment	1 2 3 4 5

Socially Sustainable Practices

7. With regard to Corporate Social Responsibility (CSR), please indicate the extent to which your company performs each of the following practices: (Five-point scale: 1= no

implementation; 2= planning to consider implementation; 3= currently considering implementation; 4 =initiating implementation; 5 = implementing fully)

Ensuring worker quality of life	1 2 3 4 5
Ensuring worker job satisfaction	1 2 3 4 5
Ensuring worker skill develop (in-house education and vocational training)	1 2 3 4 5
Fair compensation to all employee (Statement on normal working hours, maximum overtime & fair wage structures)	1 2 3 4 5
Equal opportunity statements and implementation plans	1 2 3 4 5

Financial performance

8. With regard to financial performance, please indicate the extent to which you perceive that your company has achieved each of the following as a result of sustainability practices: (Five-point scale: 1 = not at all; 2 = a little bit; 3 = to some degree; 4 = relatively significant; 5 = significant)

Decrease of fee for waste treatment	1 2 3 4 5
Decrease of fine for environmental accidents	1 2 3 4 5
Decrease cost of raw material purchase	1 2 3 4 5
Decrease cost of energy consumption	1 2 3 4 5
Decrease fee of waste discharge	1 2 3 4 5

Environmental performance

9. Considering environmental performance, please indicate the extent to which you perceive that your company has achieved each of the following as a result of sustainability practices: (Five-point scale: 1 = not at all; 2 = a little bit; 3 = to some degree; 4 = relatively significant; 5 = significant)

Reduced waste (solid, liquid, air emissions)	1 2 3 4 5
Reduced the frequency of environmental accidents	1 2 3 4 5

Reduced the consumption of hazardous/toxic material	1 2 3 4 5
Improved in enterprise's environmental situation	1 2 3 4 5
Reduced input energy consumption considering the volume of production	1 2 3 4 5

Drivers for Environmental Practices Implementation

10. Pleas indicate the extent to which you perceive that your company has adopted green practices due to each of the following as a result of sustainability practices (Five-point scale: 1 = not at all; 2 = a little bit; 3 = to some degree; 4 = relatively significant; 5 = significant)

Customers	1 2 3 4 5
Competitors (e.g. to gain competitive edge)	1 2 3 4 5
Society (e.g. NGOs, public pressure)	1 2 3 4 5
Government, regulatory agencies	1 2 3 4 5
Financial institutions (banks, insurance companies, investors)	1 2 3 4 5

Barriers to Environmental Practices Implementation

11. Which of the following categories would you consider as the main barrier to GSCM successful implementation in your company

Barriers	
lack of new technology, material and processes	
lack of effective environmental measures	
complexity of design for re-use or recycle	
high cost associated with initial investment	
high cost of environmental friendly material	
high cost of hazardous waste disposal	
Other (specify):	