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Supply chain drivers that foster the development of green initiatives in an emerging economy

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Abstract

Purpose – Sustainability and environmental issues are among the most pressing concerns for modern humanity, governments and environmentally conscious business organizations. Green supply chain management has been acknowledged as a key factor to promote organizational sustainability. Green supply chain management is evolving into an important approach for organizations in emerging economies to manage their environmental responsibility. Yet, despite their importance for easing environmental degradation and providing economic benefits, study of the drivers that influence green supply chain initiatives in an emerging economy is still an under-researched area. Using survey data collected from ISO 14001 certified organizations from Malaysia, the purpose of this paper is to propose that the drivers that motivate firms to adopt green supply chain management can be measured by a second-order construct related to the implementation of the firm's green supply chain initiatives.

Design/methodology/approach – Structural equation model was used to analyze a set of survey data to validate the research hypotheses.

Findings – The research reveals four crucial drivers of green supply chain adoption that collectively affect a firm's green purchasing, design-for-environment and reverse logistics initiatives. This study uncovers several crucial relationships between green supply chain drivers and initiatives among Malaysian manufacturers.

Originality/value – The role of the drivers is crucial in motivating these firms to adopt green supply chain initiatives and facilitate their adoption. Firms in emerging countries need to realize that green supply chain initiatives can result in significant benefits to their firms, environment, and the society at large which gives them additional incentives to adopt these initiatives.

Keywords Malaysia, Supply chain management, Sustainable development, Newly industrialised economies, Green supply chain, Green purchasing, Design for environment, Reverse logistics, Emerging economy

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1. Introduction

For years, consumers and environmental groups have been concerned about sustainability, global warming and the environmental impact of the products and

service packages they purchase in the marketplace. Senior managers in nearly every organization have come to realize that a large and increasing amount of environmental risk exists in their firm's supply chain. As the impact of business operations and global competition on the environment becomes more evident and problematic (Beamon, 1999), firms are under increasing pressure from nonprofit organizations, government agencies and stakeholders to address the environmental impacts of their operations (Boyer *et al.*, 2009; Jayaraman *et al.*, 2007; Linton *et al.*, 2007; Poirier *et al.*, 2008; Sarkis *et al.*, 2011; Vachon and Klassen, 2006; Zhu and Sarkis, 2004).

However, most green solutions reflect traditional, command-and-control or "end-of-pipe" solutions, in which a firm tries to reduce its existing adverse environmental impacts rather than adopting proactive approaches to reducing sources of waste or pollution. Traditional green initiatives suffer from many weaknesses. For example, an end-of-pipe approach cannot eliminate pollutants but merely transforms them from one form to another (Sarkis, 2006). Moreover, focusing solely on issues within the organization often exposes the firm to negative spillover effects from the poor environmental performance of its supply chain partners. For example, the poor environmental standard of small suppliers often affects the performance and image of large firms in the same supply chain (Cousins *et al.*, 2004; Christmann and Taylor, 2001). In addition, community stakeholders rarely distinguish between an organization and its supplier's inferior environmental practices (Sarkis, 2006; Rao, 2002).

In an attempt to reduce sources of waste and pollution throughout the entire supply chain, many firms have begun to adopt an externally-oriented approach to extend their green supply chain initiatives beyond their organizational boundaries. This extended responsibility comprises multiple organizations, both upstream and downstream, and takes different names, such as product stewardship, closed-loop supply chains and green supply chains (Jayaraman, 2006; Guide *et al.*, 2000; Vachon and Klassen, 2006; Canning and Hanmer-Lloyd, 2001). Globalization has created numerous opportunities for organizations in developing countries to adopt superior environmental policies and guidelines from their clients and competitors in developed countries (Christmann and Taylor, 2001).

In this research study, we focused our attention on environmental issues facing manufacturing firms in Malaysia. Scarcity of resources and the increased focus on environmental issues have caused the Malaysian Government to enforce environmental incentives and regulations to address these issues. Recently, the Malaysian Government instituted the Prime Minister's Hibiscus Award, Malaysia's premier private sector environmental award, to motivate organizations in Malaysia to offer innovative ways to tackle environmental problems (Kaur, 2011). Award winners serve as role models for other firms in the implementation of successful environmental management systems. Zhu and Liu (2010) suggest that through modes of operation such as joint ventures and strategic partnerships, organizations in such emerging economies may implement green supply chain initiatives such as green purchasing and design for the environment by imitating their parent companies and then diffuse their learning to other similar enterprises.

In this research, we examine the role of specific drivers that foster the development of green supply chain initiatives for organizations that take a proactive approach towards environmental management. Prior literature considers green supply chain management as it pertains to organizational strategy and performance. However, very little empirical research exists that uncovers bundles of drivers that may precede the

adoption of green supply chain initiatives and thereby foster the development of organizational capabilities. Hence in this paper, we conceptualize a new second-order construct (green supply chain), to measure a firm's key drivers of green supply chain adoption. To the best of our knowledge, this is the first study that investigates supply chain drivers that foster green initiatives in Malaysia.

We propose a research model to empirically test the premise that several factors collectively drive green supply chain adoption among manufacturing firms and that these drivers influence three specific initiatives of green supply chain adoption. This study contributes to the literature by linking these drivers to the adoption of green supply chains initiatives. In the following section, we provide a rationale for the emergence of the green concept and green supply chain management. Next, we summarize relevant literature and conceptualize the drivers of green supply chain adoption. We develop a set of hypotheses, describe the research design, sample and scale validation. We then present our analysis and results for a survey-based study of ISO 14001 certified manufacturing firms in Malaysia. Finally, we discuss the managerial and practical implications of the research findings and conclude with the research limitations and future opportunities for this study.

2. Theoretical background and literature review

Sustainability and environmental pollution are global concerns that affect both large and small firms in developed and developing countries. According to Beamon (1999, p. 332), "waste generation and natural resource use, primarily attributed to manufacturing, contribute to environmental degradation." These growing global issues indicate an urgent need for business firms to change their strategies and operations to responsibly incorporate environmental concerns into their organizations. Greening business operations help address environmental problems; otherwise, there will be devastating environmental, economic and social consequences (Moffatt, 2004).

2.1 Green supply chain management

A supply chain is a set of business entities that directly involves in the upstream or downstream flows of products, services, and information from a source to a customer. This definition sets the consumer at the end of the supply chain and reflects a linear production paradigm that assumes constant inputs of natural resources and an unlimited capacity to assimilate waste (Geyer and Jackson, 2004). Unlike traditional models, a green supply chain considers the environmental impacts of the production process as goods flow through the supply chain. Thus, a green supply chain extends:

> [...] the traditional supply chain to include activities that aim at minimizing environmental impacts of a product throughout its entire life cycle, such as green design, resource saving, harmful material reduction, and product recycle (Beamon, 1999).

The definition of both the traditional and green supply chains reveals how a green supply chain attempts to "close the loop" by including the reuse, remanufacturing, and recycling of products and materials by a common forward supply chain (Wells and Seitz, 2005). The goal is to minimize adverse environmental impacts (e.g. air, water, and land pollution) and wasted resources from the acquisition of raw materials, up to the final use and disposal of products (Eltayeb and Zailani, 2007). These green supply chains deal with environmental effects in both forward supply chains,

which deliver goods and services to end customers, and in reverse supply chains, which recycle used products for reuse, remanufacture, or reprocessing into raw materials.

The purpose of green supply chain drivers is multidisciplinary. First, they divert used products from landfills by collecting them for economic value recovery. Second, they employ secondary resources to reprocess used products to replace primary resources in a forward supply chain. In this respect, green supply chains have both environmental and business benefits (Sarkis *et al.*, 2011; Rao and Holt, 2005; Zhu and Sarkis, 2004). Third, a transaction cost economics perspective suggests that suppliers are more likely to adopt green supply chain practices if their information seeking, bargaining, and enforcement costs are minimized (Tate *et al.*, 2011). Therefore, a supplier's voluntary adoption of green supply chain practices may be driven by a reduction in transaction cost.

2.2 Green supply chain initiatives

A firm may undertake a set of endeavors to minimize the negative environmental effects associated with the entire life cycle of its products or services, starting from design to acquisition of raw materials to consumption and product disposal (Zsidisin and Siferd, 2001). Although the concept of a green supply chain has evolved beyond a firm-specific or end-of-pipeline green solution, such initiatives are not widespread despite their environmental benefits (Zhu *et al.*, 2007a). Green supply chain initiatives appear costly and offer uncertain returns (Linton *et al.*, 2007; Vachon and Klassen, 2006; Bowen *et al.*, 2001; Min and Galle, 2001). Firms also must confront a potential lack of green resources, expertise and capabilities (Rao, 2006), and the complexity of green supply chain relationships (Matos and Hall, 2007). Rao (2002) and Zhu *et al.* (2005) argue that the lack of agreement among scholars regarding green supply chain initiatives reflects the novelty of this area of study.

Green supply chain management literature has addressed a variety of initiatives ranging from organizational practices (Hall, 2000) to prescriptive models that evaluate green supply chain practices and technology (Sarkis *et al.*, 1995).

2.2.1 Green supply chain initiatives in Malaysia. Malaysia went through a rapid economic development over a short period of less than two decades. However, the downside to this is a host of environmental pollution problems which are now of serious public concern. In response, the Malaysian Government developed and instituted environmental laws and policies to give more power to its environmental programs. The thrust of environmental administration was a shift from relying solely upon regulatory control to instituting preventive measures to proactively avert environmental degradation. Recognizing that businesses are the principal source of investment and economic growth, and are hence a key player in environmental protection, the Malaysian Government has instituted several green incentives to stimulate business and industry initiatives in assuming a proactive role in environmental protection. Environmental awareness is building up in Malaysia and with the Ninth Malaysia Plan 2006-2010 (2007), the Malaysian Government has placed further emphasis on preventive measures (MIDA, 2007).

These measures are in place to mitigate and minimize negative environmental effects at source (including supplier evaluation and environmental certification of suppliers), to intensify and reward efforts for organizations that have products that are free from any hazardous substances and to ensure a sustainable development by closing the loop with a focus on recycling, remanufacturing and disposal initiatives. The Malaysian

Government is promoting the ISO 14001 international environmental management standard through the Standard and Industrial Research Institute of Malaysia (SIRIM), and disseminating environmental information through the Environmental Management and Research Association of Malaysia (ENSEARCH). Among the several environmental drivers that SIRIM and ENSEARCH focus on, specific importance has been placed on three fundamental green initiatives: green purchasing, design for the environment and reverse logistics. In the context of emerging Malaysian manufacturers, each initiative represents the extent to which each organization in Malaysia engages in green supply chain practices. While the three initiatives are not just unique to Malaysia and are prevalent in other emerging economies including China and India, they represent a strong commitment that the Malaysian Government had made through its Ninth Malaysia Plan 2006-2010 (2007) to focus on such initiatives to foster green supply chain management in Malaysia.

While green purchasing focuses on creating external linkages with suppliers to ensure that they are practicing sound environmental management activities, design for the environment focuses on internal and external collaboration on both product and process design. Reverse logistics focuses on closed-loop systems with an aim to reuse, recycle and remanufacture materials. Kopczak and Johnson (2003) refer to these three initiatives as key temporal phases of supply chain management operations. While green purchasing (the first phase) focuses on what needs to be in place before conducing supply chain management operations, design for the environment (the second phase) focuses on what the firm has to have in place during supply chain management operations. The third phase (reverse logistics) forms the post-operational practices that should enable an organization to focus on adding value while minimizing any harm to the environment. We now describe the three initiatives within the umbrella of green supply chain management and their growing importance in Malaysian manufacturing organizations.

2.2.1.1 Green purchasing (GREENPUR). Green purchasing ensures that purchased items possess desirable ecological attributes, such as reusability, recyclability, and nontoxic materials (Zhu *et al.*, 2007a; Rao, 2006; Min and Galle, 2001; Preuss, 2001). Additionally, green purchasing can also address issues such as waste reduction, material substitution through proper sourcing of raw materials and waste minimization of hazardous materials. Supplier involvement is crucial to achieving environmental goals. Rao and Holt (2005) argue that environmentally proactive companies are increasingly managing their suppliers' environmental performance to ensure that purchased materials are environmentally friendly and have been produced by environmentally conscious processes.

The most prominent guideline for green purchasing in the electronics industry is the Electronic Industry Code of Conduct. Leading multinational corporations operating in Malaysia including Sony and Matsushita have all instituted green procurement policies with local suppliers. Green purchasing revolves around evaluation of suppliers' environmental performance and providing advice to suppliers to improve their performance. Environmentally proactive organizations often encourage their suppliers to obtain environmental management certification such as the ISO 14001. Hines and Jones (2001) suggest that the mentoring role within green supply chain management is an emerging concept that can provide a significant relationship between the customer and the supplier. The Malaysian Government has encouraged all

organizations that conduct business in Malaysia to hold environmental awareness seminars for suppliers, setting up environmental teams that are dedicated to guide suppliers in their environmental development initiatives and initiate frequent visits to the supplier's facility to provide assistance and recommendation in the setup of environmental programs.

2.2.1.2 Design for the environment (ECODESN). Design for the environment aims to reduce environmental impacts of products during their life cycle (Zhu *et al.*, 2007a; Beamon, 1999; Sarkis, 2006). While the emphasis was initially on technical improvements that can be undertaken to both products and processes with an aim to reduce environmental costs, environmentally proactive organizations have now recognized that it is critical to develop a healthy working relationship with consumers, suppliers and governmental authorities in order for design for environment to truly become an integral part of green supply chain initiatives (Walton *et al.*, 1998). A major pre-requisite for initiating design for the environment is the external coercive, normative and socio-cultural pressure that needs to be exerted on the organization. Any success with design for environment requires cross-functional cooperation among units both within and outside the organization.

In an emerging economy such as Malaysia, the external pressure for international regulatory compliance has forced the government to ensure that all firms have built-in design for the environment requirements in their operations. Malaysia is home to some large electrical and electronics manufacturers who supply to the US and Japanese markets. Hence the Malaysian firms have to comply with the strict legislation that are already in place in the USA and Japan. Some of these compliance issues range from life cycle assessment of all products, reduction in material and energy consumption use and ensuring that packaging materials are not only reusable but also have a significant portion of recyclable contents. For example, Hewlett-Packard introduced a program for producing energy-efficient, hazardous free and recyclable products while Nokia Corporation developed a design for the environment program to ensure that new products contain no restricted materials, low energy consumption and high recyclability. Dell Corporation developed an environmental stewardship program for designing energy-efficient products and took a conscious decision to promote upgradeability, reuse and recycling.

2.2.1.3 Reverse logistics (REVLOGIS). Reverse logistics is the task of recovering discarded products (cores), and may also include packaging and shipping materials and backhauling them to a central collection point for either recycling or remanufacturing (Jayaraman and Luo, 2007; Alvarez-Gil *et al.*, 2007; Zhu *et al.*, 2007b; Murphy and Poist, 2003; Jayaraman *et al.*, 2003). Handling the mechanics of reverse logistics require significant attention by logistics professionals. Firms desiring to do business in many European countries must deal with backhauls to handle the waste packaging in their warehouses and to resolve customer satisfaction issue of recoverable products. Competitive pressures are forcing many firms in the USA to adopt such practices at home. While the environmental issues to date have not been a serious concern, it is expected to become a major concern as competition increases and more stringent regulations are passed. There is already a transportation packaging law in Germany that requires the manufacturers to take-back all the pallets, cardboard boxes, stretch and shrink wrap and strapping used to protect the products during shipment (Livingstone and Sparks, 1994). In addition to prohibiting land filling with

electronics products and major consumer appliances, Germany and The Netherlands also prohibit firms from shipping waste to countries where land filling is still allowed. Other European countries are expected to adopt similar legislation in the coming years. As landfills in the USA continue to reach capacity, the US Congress continues to pursue legislation on recycling and remanufacturing.

A study by the Council of Logistics Management reports that there are three key issues affecting reverse logistics:

(1) the structure of the network;

(2) the planning for material flows; and

(3) the classification and routing of materials (Sarkis *et al.*, 1995).

A key aspect to recognize the reverse flows is that collection of goods from the marketplace is a "supply-driven flow", rather than a demand-driven flow as seen in a forward flow logistics system. This supply-driven flow creates a great deal of uncertainty with respect to the quantity, timing and condition of items (Guide *et al.*, 2003; Linton and Jayaraman, 2005).

Reverse logistics has received much less attention in Malaysia due to a lack of focus on waste management policies and absence of any closed-loop infrastructure. However, in the last three years, the Malaysian Government has focused on levying taxes on companies that use non-renewable resources such as coal and natural gas. The shift from governmental subsidies to a penalty-based system in addition to the pressure from competitors, suppliers and customers has forced many organizations in Malaysia to adopt environmentally conscious practices.

3. Theoretical and hypotheses development

Delmas and Toffel (2004) and Hoffman (2001) suggest several drivers that encourage firms to adopt green supply chain initiatives, most of which reflect the pressures of stakeholders such as government, community, investors, customers, suppliers and employees. An organizational culture and moral desire to do the right thing also encourages firms to adopt these initiatives (Carter and Jennings, 2002). Institutional theory provides an overarching theme as to how organizations respond to institutional pressures within their environment (Scott, 2001; DiMaggio and Powell, 1983; Meyer and Rowan, 1977).

Institutional theory suggests that in the pursuit of legitimacy and social fitness, firms adopt homogeneous, institutionalized structures and practices that conform to the mandate of their institutional environment (Oliver, 1997; Suchman, 1995; DiMaggio and Powell, 1983; Meyer and Rowan, 1977). Proactive firms strive not only for scarce resources and customers, but also for power and legitimacy as well as economic health and well-being.

Although most scholars agree that organizations are under pressure to adapt to and be consistent with their institutional environment, the operationalization of the institutional mechanisms is far from homogeneous (Björkman *et al.*, 2007). DiMaggio and Powell (1983) conceptualize three major isomorphism types that affect organizations: coercive isomorphism, where a powerful constituency (e.g. the government) imposes certain patterns on the organization; mimetic isomorphism, where organizations in situations of uncertainty adopt the pattern exhibited by other organizations (e.g. the competitors) in their environment that are viewed as successful; and normative isomorphism, which entails the expectations in certain organizational contexts

(e.g. customers, suppliers, social groups, professional associations) about what constitutes appropriate and legitimate behavior. Researchers find that although the three isomorphic mechanisms are theoretically distinct, they are not necessarily empirically distinguishable. However, Mizruchi and Fein (1999) argue that although each mechanism involves a separate process, two or more could collaborate simultaneously, and the effects are not always clearly identifiable. Their examination of published studies that were based on the institutional theory shows that the majority of these studies had only operationalized one of the three isomorphic mechanisms, and many have also used mimetic forces to represent normative forces, or coercive to represent mimetic, and so on. Further, they find that the mimetic mechanism was used disproportionately more than the other two, and they conclude that "in virtually every case in which researchers attempted to operationalize mimetic isomorphism, the measure they used could have easily been reinterpreted in terms of either coercive or normative isomorphism" (Mizruchi and Fein, 1999, p. 677).

More recently, Scott (2001) has suggested three "pillars'" of institutional processes: regulatory (corresponding to DiMaggio and Powell's coercive), cognitive (cf. mimetic) and normative processes. Institutionalization is the process through which activities are repeated and given common meaning (Scott, 2001). Krishnan *et al.* (2004, p. 592) incorporate institutional components from DiMaggio and Powell (1983) and Scott (2001) and suggest that:

> [. . .] organizations experience pressure to conform to their institutional environments because of *coercive regulatory pressures* from political institutions, *normative pressures* from professional and occupational constituencies, and *mimetic cultural cognitive pressures* from other organizations with whom they compare themselves.

We follow Krishnan *et al.* (2004) approach to conceptualize our green supply chain drivers from three institutional pressures: coercive regulatory pressures, normative pressures, and mimetic cultural cognitive pressures.

3.1 Key drivers of green supply chain management

In this study, we defined "drivers" as motivators that encourage organizations to adopt green supply chain initiatives (Hoffman, 2001). Prior studies identified several drivers that motivate organizations to adopt environmental initiatives. These drivers generally emanate from pressures of external and internal stakeholders such as government, investors, customers, suppliers, community groups, and employees (Delmas and Toffel, 2004) as well as from organizational culture or moral values to do the right things (Carter and Jennings, 2002).

We propose a second-order green supply chain driver construct. That is, we conceptualize the drivers of green supply chain adoption as a multidimensional concept that measures the extent to which a set of motivators encourage firms to adopt green supply chains. This second-order construct measures motivations and incentives in four areas.

Institutional theory offers a plausible basis for explaining the effects of coercive and mimetic (regulatory measures and competitor pressures), normative (customer pressures) and cultural-cognitive (socio-cultural responsibility) isomorphism. It also appears most appropriate for explicating the effect of the green supply chain drivers and how they might influence specific green chain initiatives. These four constructs collectively measure latent drivers of green supply chain initiatives. Our literature

review shows that these constructs collectively motivate organizations to adopt green supply chains initiatives (Alvarez-Gil *et al.*, 2007; Kassinis and Vafeas, 2006; Rao, 2006; Buysse and Verbeke, 2003; Murphy and Poist, 2003; Min and Galle, 2001). Our application of the institutional theory to investigate drivers of supplier adoption of environmental practices is similar to Tate *et al.* (2011). However, the work by Tate *et al.* (2011) only provided theoretical propositions to analyze supplier adoption of environmental practices; in our research, we adopted a structural equation model to analyze a set of (primary) survey data to validate the research hypotheses.

3.1.1 Regulatory measures (REG). These official mechanisms take the form of standards, laws, procedures and incentives set by regulatory institutions to inspire firms to become environmentally responsible. Our literature review supports the idea that requirements imposed by government and regulatory bodies provide ultimate incentives for firms to adopt green supply chains (Bansal and Roth, 2000; Hall, 2000).

Coercive isomorphism that is developed through informal and formal pressures exerted from outside the firm through regulatory measures and incentives can enable a firm to adopt green purchasing practices. For example, government agencies form a powerful institution that may coercively influence the actions (or lack of) of an organization through fines and trade barriers (Riverta *et al.*, 2006). Kilbourne *et al.* (2002) indicate that coercive pressures are crucial to drive organizations to initiate environmental management practices such as green purchasing, design for the environment and reverse logistics. Sarkis *et al.* (2011) discuss how in developed countries such as the USA, coercive pressures through laws and regulations improve environmental awareness, and thus drive environmental management practices. Clemens and Douglas (2006) also show that regulations in developed countries cause an increase in institutional pressures for firms in developing economies to improve their environmental activities. In many instances, such pressures have forced firms in emerging economies to institute environmental activities that have surpassed expectation. Zhu and Sarkis (2004) have shown how a developing country such as China had enacted strict environmental regulations that exceeded local and global requirements and how this has driven manufacturers to implement green supply chain practices that effect business performance. Therefore, our regulatory measure construct includes environmental regulations and incentives imposed on organizations by regulatory bodies.

3.1.2 Competitor pressures (COMPRE). Large and successful firms in an industry usually face intense scrutiny from competitors and external environmental activists (Zhu and Sarkis, 2007). Hence many organizations work in an environment that includes pressures from their competitors that induce organizations to adopt green initiatives to combat competition and gain competitive advantages (Canning and Hanmer-Lloyd, 2001; Carter and Ellram, 1998). Heese *et al.* (2005) emphasize that a firm can often gain a competitive edge over their competitors by introducing product take-back. Using its market acuity, reputation, superior access to original parts, and potential to efficiently refurbish used products in-house, a manufacturer that takes back and resells refurbished products creates an additional source of income (Zhu *et al.*, 2008a, b). Hart (1995) suggests that firms should focus on cooperative actions in order for green initiatives to gain sustained competitive advantages. Hart's study emphasizes that a cooperative orientation in pollution prevention, product stewardship, and sustainable development strategies is required to achieve sustained competitive advantage.

Environmental pressure from competitors is intense in Malaysia and has motivated organizations to self-regulate. Even though green purchasing behaviors of Malaysian consumers lag those of European and Japanese consumers, younger Malaysian consumers are developing a heightened environmental awareness and in many instances prefer green products. Many large firms in Malaysia that work with leading firms in developed countries have been forced to not only evaluate their immediate suppliers but their second-tier and third-tier suppliers (Eltayeb and Zailani, 2007). Many Malaysian firms have now adopted green purchasing practices that include an appropriate selection of suppliers that can help them to identify and exploit relational capabilities. By taking a proactive approach on green purchasing practices, firms can address current and evolving environmental challenges. Additionally, many organizations that are subject to constant pressure from their competitors are now forced to incorporate design for the environment requirements in their role as supply chain partners (Yalabik and Fairchild, 2011). However, the success of such design requires cross-functional cooperation within a firm (within teams and across different functional units) and cooperation with external partners (Zhu *et al.*, 2005). Thus, many Malaysian companies that work with their European and US counterparts are forced to comply with material bans and design requirements to successfully serve these markets.

On the outbound side of the green supply chain, competitive pressure is forcing many organizations in Malaysia to invest in reverse logistics activities such as recycling, refurbishing and remanufacturing. The Malaysian Government, in order to address the environmental impacts of packaging, has instituted legislation and programs that aims to minimize the amount of packaging that enters the waste stream. Recycling and reuse are now key strategies that have been adopted by several organizations in Southeast Asia with an objective of reducing packaging for household goods. For instance, in Thailand and Malaysia, Amway has instituted a reverse logistics system to bring back the empty plastic containers that it uses to deliver detergent and other household cleaning products to customers. Amway's action has forced its competitors to devise appropriate reverse logistics strategies to compete in the marketplace.

3.1.3 Customer pressures (CUSTPRE). Consumers are beginning to question the environmental effect of the goods that they buy, and expect firms to pursue a minimum green standard in their product and process designs (Tate *et al.*, 2010). The extant literature also indicates that pressures from downstream supply chain members and consumers force firms to adopt green supply chains (Christmann and Taylor, 2001; Blumberg, 1999; Wolf, 2011) initiatives. From an institutional theory perspective, normative pressure causes organizations to confirm and be perceived as more legitimate and trustworthy (Sarkis *et al.*, 2011). This pressure is exerted by external stakeholders such as customers who have a vested interest in the firm (Vachon *et al.*, 2009).

For Malaysian manufactures, customer requirements form the core normative pressure to adopt green supply chain initiatives (Eltayeb *et al.*, 2010). Given that Malaysia exports a large portion of its goods to the USAandEurope, customers in these developed countries indirectly force Malaysian manufacturers to choose environmentally conscious suppliers. Additionally, these customers also exert pressure on Malaysian manufacturers to take an environmentally conscious approach to product design, to minimize adverse environmental impacts of the product throughout its product life, and to promote recycling and reuse of the product and its packaging (Hitchcock, 2012).

Similar to other developing economies, manufacturers in Malaysia face a diverse range of waste disposal challenges. The lack of waste management legislation leads to an often confused and unregulated means to dispose waste (Lee and Klassen, 2008). To address this issue, several consumer and nonprofit organizations in Malaysia attempt to promote the concept of industrial ecology where a closed-loop approach is encouraged to recover all the waste through proper recycling and reuse.

3.1.4 Socio-cultural responsibility (SOCCUL). A firm may perceive a voluntary obligation to society in order to achieve harmony with social expectations, norms and codes of conduct that dictate acceptable business behaviors (Jones, 1999). Research has noted that multinational corporations have a sense of responsibility towards the society in which they operate (Murphy and Poist, 2003). These firms therefore adopt green practices to establish a socially acceptable image that is consistent with the obligations and values of the society in which they function. Additionally, researchers have also noted that firms are obligated to meet their corporate objective of social responsibility through developing environmentally friendly products. Our literature review in the business ethics field concurs that socio-cultural responsibility refers to the belief that good citizenship requires firms to support the welfare of the society and not harm it (Florida and Davison, 2001). Therefore, our socio-cultural responsibility construct includes the firm's moral obligation to the society.

According to institutional theory, cultural-cognitive isomorphism is due to a firm's rational desire to imitate behaviors that it perceives as technically valuable. Preuss (2001) shows that socio-cultural responsibility has significant effect on green supply chain initiatives including green purchasing and reverse logistics. Many companies in Malaysia, especially the multinational corporations, have socio-cultural responsibility objectives that foster them to engage in green supply chain initiatives. Consider the case of General Mills that uses palm oil as a key ingredient in its manufacturing processes (Parmigiani *et al.*, 2011). More than 90 percent of this palm oil comes from Indonesia and Malaysia where deforestation is a major concern. Schwartz (2010) indicates that key stakeholders in developed countries such as the USA are forcing General Mills to seek more sustainable sources of this key ingredient. Hence, organizations in Malaysia want to paint a positive image and are now forced to consider the socio-cultural responsibility in all of its operations.

Switching to environmentally friendly components to minimize the environment impact or instituting efficient ways to verify sourcing of raw materials is now considered a crucial task by manufacturers. Due to the intense global competition, manufacturing firms operating in Malaysia now have opportunities to learn from their overseas customers and competitors. The pressure of socio-cultural responsibility has motivated firms in Malaysia to produce products with reduced material consumption and energy during use. It has also created awareness among supply chain members to institute channels to return products for recycling and remanufacturing.

3.2 Relationships between green supply chain drivers and initiatives

The conceptual research model in Figure 1 postulates that the second-order green supply chain driver can be measured by four environmentally focused drivers of green supply chain adoption. This driver motivates organizations to pursue green purchasing, design for the environment and reverse logistics. Managers often track these initiatives to assess their green performance (Zhu *et al.*, 2007a; Min and Galle, 2001; Preuss, 2001).

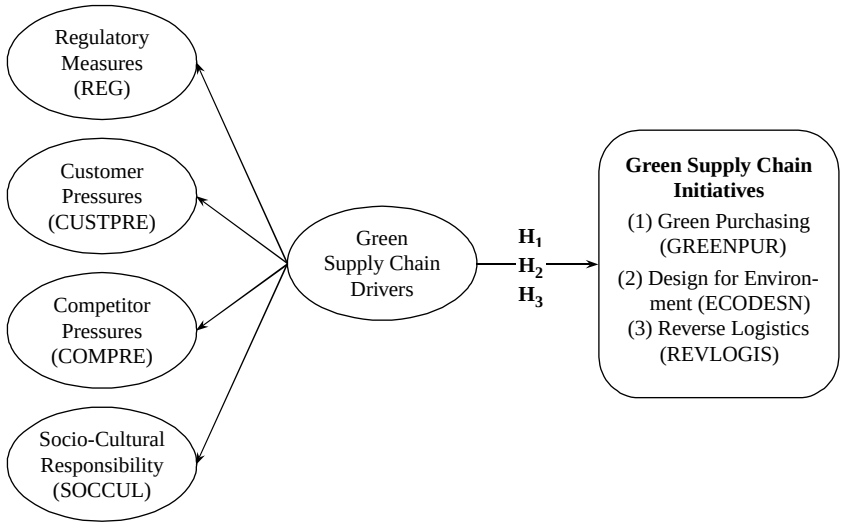

Figure 1.
Conceptual framework and research hypotheses

In this study, the initiatives are evaluated independently via separate structural equation models to facilitate a thorough examination of the impact of the second-order driver on each green supply chain initiative (Hult and Ketchen, 2001). This method is preferable to the traditional approach that assesses the effect of antecedents on composite outcome measures.

In line with our literature review, we rely on institutional theory to explain the effect of the second-order drivers and determine how green supply chain initiatives diffuse across firms. Prior empirical studies support the use of institutional theory to understand drivers of green supply chain initiatives (Zsidisin *et al.*, 2005; Ketokivi and Schroeder, 2004; Jennings and Zandbergen, 1995). According to Riverta *et al.* (2006) "literature on voluntary environmental programs shows a growing consensus consistent with institutional theory that gives external pressures a significant role in determining the adoption of these initiatives." Hence we hypothesize:

- H_1. The second-order green supply chain driver positively affects a firm's adoption of green purchasing initiatives.
- H_2. The second-order green supply chain driver positively affects a firm's adoption of design for environment initiatives.
- H_3. The second-order green supply chain driver positively affects a firm's adoption of reverse logistics initiatives.

4. Methodology

4.1 Research setting: Malaysia

The global trend towards offshore outsourcing by multinational corporations has created some of the worst environmental problems in developing countries. Markandya and Halsnaes (2004) estimate that at least 90 percent of the developing world suffers negative effects of climate change compared to less than 1 percent in the developed world. The physical damage in some densely populated developing

countries is severe. Although products increasingly are being recycled and reused in developed countries (Geyer and Jackson, 2004), the traditional practices in many developing countries continue to send used items to landfills, which entails considerable costs and damage to the environment. Furthermore, green supply chain initiatives are not widespread in developing countries (Zhu *et al.*, 2007a).

We chose Malaysia as our study setting due to the general trend among Asian countries toward industrialization and manufacturing. Moreover, Asia is the world's largest manufacturing base and likely will soon become the world's largest market. In Malaysia, industrialization trends are obvious; the country has moved away from an agriculture-based economy to an industrialized economy that focuses on electronics and heavy industry (Rao, 2004). The Malaysian manufacturing sector contributed 32 percent of the gross domestic product in 2007, and exports of manufactured products accounted for 75 percent of its total exports (MIDA, 2007). Increased industrialization also amplifies environmental concerns, including land, water, and air pollution and degradation of natural resources. Thus, it is important for Malaysia to balance an increased standard of living with environmental protections. Despite concerted efforts to promote reuse, conservation, and recycling, the amount of solid waste recycled in Malaysia remains at less than 5 percent of total waste disposed (MIDA, 2007). The incidence of environmental problems has changed with Malaysia's economic progress, but increased revenues among Malaysian organizations have not yet translated into improved economic conditions. This makes an emerging country such as Malaysia a good candidate for further investigation.

4.2 The survey

In this phase of the study, we decided to administer a survey to obtain primary data – the unit of analysis is the individual firm and the population is all EMS ISO 14001 certified manufacturing firms in Malaysia. We chose ISO 14001 certified firms because they are likely to have undertaken some green supply chain initiatives (Darnall *et al.*, 2008; Zhu *et al.*, 2008a, b). Sroufe (2003) found a strong positive relationship between EMS adoption and environmental design, recycling and waste practices.

To obtain the sampling frame of all ISO 14001 certified firms in Malaysia, we consulted SIRIM and the Federation of Malaysian Manufacturers (FMM, 2007) directory. SIRIM provided a list of all 396 manufacturing firms it had certified prior to 2007, and the FMM directory consisted of 261 ISO 14001 certified firms. While the SIRIM list contains all the firms it certified, the FMM list comprises only those firms certified by bodies that voluntarily provided the information to FMM. The two lists were combined and cleaned of duplicates, resulting in a final sampling frame of 569 certified firms. Experts from SIRIM and FMM agreed that it was close to the population of all EMS ISO 14000 certified firms in Malaysia.

This study seeks information on green supply chain drivers and initiatives of a firm; hence, the target respondents must be knowledgeable in both areas. In Malaysia, SIRIM usually appoints an environmental management representative (EMR) from each firm as the primary contact person. This person is very knowledgeable about the environmental initiatives that have been pursued by his firm and is typically a senior manager. The EMR may come from any department, but the operations, quality control, or environmental health and safety departments are the most common. The EMR maintains all documentation regarding green issues and updates

certification authorities on any environmental progress by the firm. Hence, EMRs are chosen as the target respondents for this study to minimize the threat of common method bias (Miller and Roth, 1994; Phillips, 1981).

4.3 Instrument development and survey administration

The survey instrument was developed on the basis of our literature review. We pretested the questionnaire for content validity and reliability. First, academics familiar with green supply chain survey study assessed the face validity of each indicator in terms of its readability, clarity and general adequacy for representing the concepts. Next, we distributed the questionnaire to 16 randomly selected EMRs of certified manufacturing firms, who provided feedback about the items and general structure of the questionnaire.

We mailed the revised questionnaire to the remaining 551 EMRs (569 total – three interview firms – 16 pretest firms) in our sampling frame. After two reminder letters, sent two weeks apart, we received 132 usable questionnaires, for a response rate of 24 percent. A unique characteristic of this study is that the data consists of 24 percent of the total population of all Malaysian organizations that are ISO 14001 certified. Table I summarizes the respondents' profiles.

To ensure that the responses adequately represent the sample firms, we tested for non-response bias using Armstrong and Overton's (1977) procedure. We considered the 59 responses received before we sent the first reminder as early responses; the late responses are the 73 received after the first reminder. Table II shows that the χ^2 test across the 12 firms and respondent characteristics reveals no significant differences between early and late responses; thus, non-response bias is not a concern for this study.

4.4 Measures

To ensure a high degree of validity, we used multiple indicators to measure each construct and adopt measurement items relevant to the construct, based on prior literature. Table III summarizes the measurement items for each of the drivers of green supply chain adoption. The survey used a five-point Likert scale (1 – "strongly disagree," 5 – "strongly agree").

To measure the coercive mechanisms imposed on firms that require them to perform specific practices, we developed six items to reflect "regulatory measures" and six measures to capture "competitor pressures". The items for regulatory measures were adapted from Zhu *et al.* (2007a), Darnall (2006) and Carter and Carter (1998). The items to measure competitor pressures came from Bowen *et al.* (2001), Scott (2001), Haunschild and Miner (1997), and DiMaggio and Powell (1983). To measure the normative isomorphic pressure exhibits by a firm, we developed five items to measure "customer pressures". These items were adapted from Darnall (2006), Carter and Carter (1998), and Carter and Ellram (1998). To measure cultural-cognitive isomorphism, we developed six items to measure the "socio-cultural responsibility" construct. The six-item "socio-cultural responsibility" scale was adapted from Carter (2005) to measure the firm's desire to adopt green initiatives that contribute to safety, welfare and social health.

Following similar studies on green supply chain initiatives (Zhu *et al.*, 2007a; Vachon and Klassen, 2006), we used a five-point Likert scale to measure green supply chain initiatives. The scale ranges from 1 – "does not exist at all" to 5 – "exists to

Description	Categories	Frequency	%
Type of industry	Electrical and electronics	68	51.5
	Chemicals	19	14.4
	Rubber and plastics	14	10.6
	Metals and machinery	24	18.2
	Others	7	5.3
Age of the firm	≤15 years	32	24.2
	>15 years	100	75.8
No. of employees	Less than 100	10	7.6
	100-250	31	23.5
	251-500	37	28.0
	501-1,000	17	12.9
	More than 1,000	37	28.0
Type of products	Consumer products	56	42.4
	Industrial products	76	57.6
Number of suppliers	≤10 suppliers	32	24.2
	More than ten suppliers	100	75.8
Supplier relationship length	One to five years	10	7.6
	More than five years	122	92.4
Customer relationship length	One to five years	4	3.0
	More than five years	128	97.0
Source of inputs	Domestic	37	28.0
	Regional/Asian	30	22.7
	Global	65	49.2
Ownership status of the firm	Malaysian fully owned	39	29.5
	Local and foreign joint venture	18	13.6
	American-based company	16	12.1
	Japanese-based company	46	34.8
	European-based company	10	7.6
	Other (Korean/Taiwanese)	3	2.3

Note: $n = 132$

Table I.
Respondent profile information

a very high extent." Table IV summarizes the measurement items for each green supply chain initiative construct.

The green purchasing construct ensures that purchased items meet the firm's environmental objectives. It consists of items adapted from Zhu *et al.* (2007a), Hamner (2006), and Carter *et al.* (1998). The items to measure design for the environment pertain to environmentally conscious design to curtail adverse environmental effects during the production and consumption of goods and were adapted from Zhu *et al.* (2007a) and Sarkis (1998). The reverse logistics construct, which includes the reuse, remanufacture, and recycling of products and packaging materials, consists of six items adapted from Rogers and Tibben-Lembke (2001) and Carter and Ellram (1998).

5. Analyses and results

Regarding the quality of the measures, we used confirmatory factor analysis (CFA) to evaluate the psychometric properties of the questionnaire. Figures 2 and 3 show the measurement models, and Table V provides the zero-order correlation matrix for the seven latent variables. The correlation matrix reveals that all correlations are

Description	Categories	Responses Early = 59	Late = 73	χ^2 value	Sig.
Type of industry	Electrical and electronics	33	35	8.220	0.314
	Chemicals	7	12		
	Rubber and plastics	4	10		
	Metals and machinery	14	10		
	Others	1	6		
Age of the firm	≥15 years	7	25	8.900	0.285
	<15 years	52	48		
No. of employees	Less than 100	6	4	1.183	0.881
	100-250	13	18		
	251-500	17	20		
	501-1,000	7	10		
	More than 1,000	16	21		
Type of products	Consumer products	27	29	0.487	0.485
	Industrial products	32	44		
Ownership status	Malaysian fully owned	18	21	8.204	0.145
	Joint venture	6	12		
	American-based	3	13		
	Japanese-based	26	20		
	European-based	5	5		
	Others	1	2		
Green participation	Yes	34	38	0.409	0.523
	No	25	35		
Job title	Manager	24	38	3.564	0.468
	Assistant manager	6	10		
	Supervisor	10	8		
	Officer	11	8		
	Engineer	6	6		
	Non-response	2	3		
Department attached to	R and D	0	5	4.652	0.325
	Quality control	12	13		
	Operations	14	17		
	EHS	20	25		
	Administrative	11	10		
	Non-response	2	3		

Table II.
Test of non-response bias

statistically significant ($\alpha = 0.05$) and exhibit the expected positive relationships in preliminary support of the relationships in Figure 1.

Through a series of reliability analyses, we obtained the Cronbach's α, AVE, and CR values, to assess whether the indicators for each construct attain internal stability and consistency. Tables III and IV show that the Cronbach's α value for the constructs range from 0.802 to 0.931 thus suggesting the scales are sufficiently reliable (Bollen, 1989). The CR statistics range from 0.8991 to 0.9460, in excess of the threshold value of 0.60; the minimum AVE of 0.6035 also exceeds the threshold value of 0.50. Thus, all constructs are sufficiently reliable (Podsakoff and Organ, 1989; Fornell and Larcker, 1981).

To assess the unidimensionality of each construct, we tested the measurement models for convergent and discriminant validity. In Figures 2 and 3, the CFA shows that each indicator loads significantly on the expected construct, in support of convergent

	(A) Regulatory measures (REG): $\alpha = 0.802$, CR = 0.8991, AVE = 0.6035
A1	Through adopting green supply chain initiatives, my firm tries to reduce or avoid the threat of current or future government environmental legislations
A2	My firm's parent company sets strict environmental standards for my firm to comply with
A3	There are frequent government inspections or audits on my firm to ensure that the firm is in compliance with environmental laws and regulations
A4	Financial incentives offered by the Malaysian Government, such as grants and tax reductions, are significant motivators for my firm to adopt green supply chain initiatives
A5	Financial incentives offered by international organizations, such as United Nations, are significant motivators for my firm to adopt green supply chain initiatives
A6	There are a large number of environmental regulations or restrictions imposed by the government on my firm's industry
	(B) Customer pressures (CUSTPRE): $\alpha = 0.891$, CR = 0.9179, AVE = 0.6938
B1	Our major customers frequently require us to adopt green supply chain initiatives
B2	Our major customers would withhold the supply contract if my firm did not meet their environmental performance requirements
B3	Our major customers have a clear policy statement regarding its commitment to the environment
B4	Consumer associations require us to be a more environmentally conscious firm
B5	My firm's major customers frequently encourage us to adopt green supply chain initiatives
	(C) Socio-cultural responsibility (SOCCUL): $\alpha = 0.859$, CR = 0.9114, AVE = 0.6938
C1	My firm believes that green supply chain initiatives are the right thing to do to promote societal welfare
C2	My firm believes that it can prevent environmental problems such as global warming by adopting green supply chain initiatives
C3	Health and safety of the society is a major concern in my firm
C4	My firm's behavior is affected by how the society wishes it would behave
C5	My firm pays considerable attention to the reaction of the society to its behavior
C6	My firm's major customers frequently require us to adopt green supply chain initiatives
	(D) Competitor pressures (COMPRE): $\alpha = 0.867$, CR = 0.9460, AVE = 0.7474
D1	A large number of firms in my firm's industry adopted green supply chain initiatives
D2	Green supply chain initiatives are generally considered in my firm's industry as having considerable marketing benefits
D3	Green supply chain initiatives are generally considered in my firm's industry as having considerable operational benefits
D4	Green supply chain initiatives are generally considered in my firm's industry as an important thing to improve organizational image
D5	There is a general belief in my firm's industry that green supply chain initiatives have benefits that outweigh their costs
D6	There is a general belief in my firm's industry that green supply chain initiatives are the most right thing to do to achieve business objectives

Table III.
Survey instrument – assessment of green supply chain drivers

Notes: α – Cronbach's α; CR – composite reliability, AVE – average variance extracted; $CR = (\rho_c) = (\Sigma\lambda)^2/[(\Sigma\lambda)^2 + \Sigma(\theta)]$, $AVE = (\rho_v.) = (\Sigma\lambda^2)/[\Sigma\lambda^2 + \Sigma(\theta)]$, where λ – indicator loadings and θ – indicator error variances

(E) Green purchasing (GREENPUR): $\alpha = 0.895$, CR = 0.9243, AVE = 0.6729	
We explain that green purchasing is an environmentally-conscious initiative that aims at ensuring that purchased items meets environmental objectives of the firm such as reducing or eliminating hazardous items, reducing sources of waste, and promoting recycling and reclamation of purchased materials	
E1	Provides design specs to suppliers that include environmental requirements for purchased items
E2	Requires its suppliers to develop and maintain an environmental management system
E3	Requires its suppliers to have a certified EMS such as ISO 14001
E4	Makes sure that its purchased products must contain green attributes such as recycled/reusable items
E5	Makes sure that its purchased products must not contain environmentally undesirable items such as lead or other hazardous or toxic materials
E6	Evaluates its suppliers based on specific environmental criteria
(F) Design for environment (ECODESN): $\alpha = 0.931$, CR = 0.9394, AVE = 0.6926	
We explain that design for environment is an environmental-conscious design of a product that aims at minimizing negative environmental impacts of the product throughout its useful life to promote positive environmental practices such as recycling and reusing of the product or its packaging	
F1	Produces products that have recycled materials in their contents such as recycled plastics and glass
F2	Uses life cycle assessment to evaluate the environmental load of its products
F3	Makes sure that its products have recyclable or reusable contents
F4	Produces products that reduce the consumption of materials or energy during use
F5	Makes sure that its packaging has recyclable contents
F6	Makes sure that its packaging is reusable
F7	Minimizes the use of materials in its packaging
(G) Reverse logistics (REVLOGIS): $\alpha = 0.914$, CR = 0.9214, AVE = 0.6626	
We explain that reverse logistics is the return or take-back of a product or packaging, after use, for the purpose of reuse, recycling or reclamation of materials from the product or packaging	
G1	Collects used products from customers for recycling, reclamation, or reuse
G2	Collects used packaging from customers for reuse or recycling
G3	Requires suppliers to collect their packaging materials
G4	Returns products to suppliers for recycling, retaining of materials, or remanufacturing
G5	Returns its packaging to suppliers for reuse or recycling
G6	Returns the products from customers for safe refill

Notes: α – Cronbach's α; CR – composite reliability, AVE – average variance extracted; $CR = (\rho_c) = (\Sigma\lambda)^2/[(\Sigma\lambda)^2 + \Sigma(\theta)]$, $AVE = (\rho_v.) = (\Sigma\lambda^2)/[\Sigma\lambda^2 + \Sigma(\theta)]$, λ = indicator loadings and θ = indicator error variances

Table IV.
Survey instrument – assessment of green supply chain initiatives

validity (Bagozzi and Yi, 1988). In Tables III and IV, the AVE statistics in excess of 0.50 indicate that the seven constructs exhibit excellent convergent validity. The test for discriminant validity examines the correlation between each pair of latent variables (Anderson and Gerbing, 1988); if two latent variables are distinct, their correlation should be unidimensional and significantly less than one. Table V shows that all of the correlation coefficients are significant and less than 0.5, in support of discriminant validity. Nomological validity is supported by the various measurement model fit indices. The fit indices in Figures 2 and 3 show that the measurement models reproduce the population covariance matrices (Steiger, 1990), indicating an adequate level of construct validity.

We also assessed the validity of the green supply chain construct as a second-order factor. Figure 4 shows that regulatory measures ($\gamma = 0.50$, $t = 3.67$), competitor

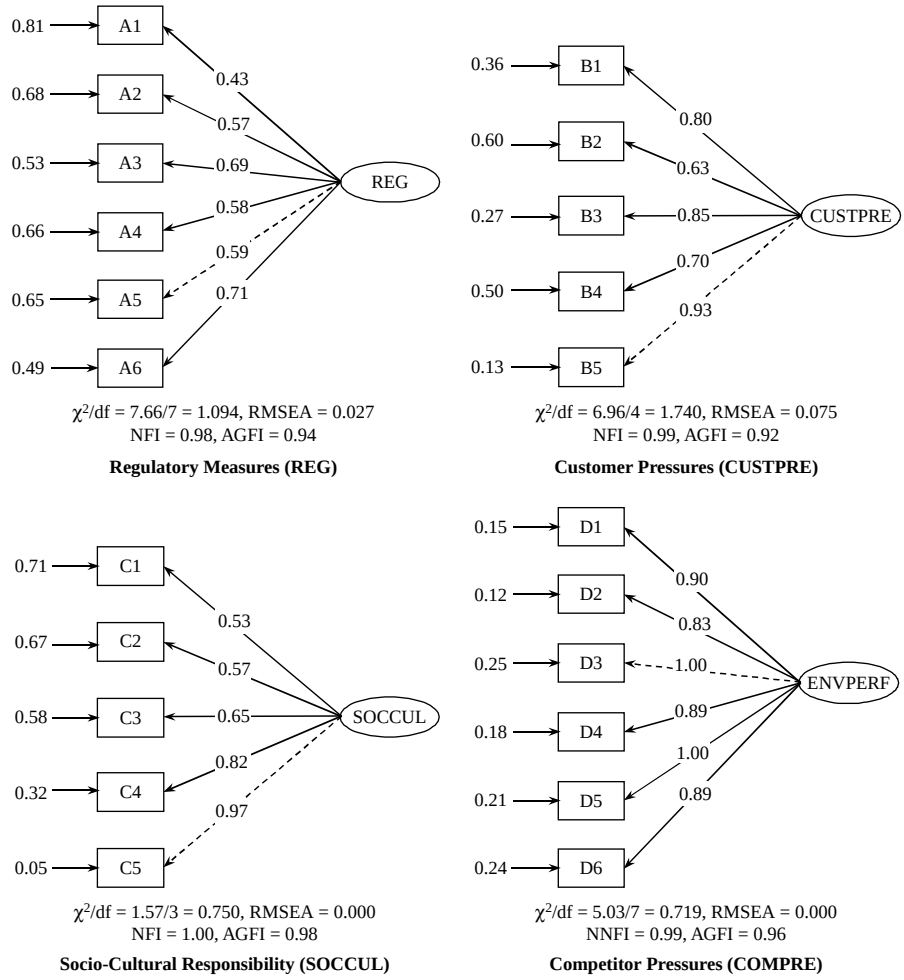

Figure 2.
Measurement models of the second-order green supply chain driver construct

pressures ($\gamma = 0.87$, $t = 5.62$), customer pressures ($\gamma = 0.62$, $t = 5.28$) and socio-cultural responsibility ($\gamma = 0.22$, $t = 2.11$) are all significant first-order factors ($p < 0.01$) of the second-order construct, in support of excellent convergent validity. The CR and AVE statistics of 0.8593 and 0.6385, respectively, show that this construct attains excellent construct validity.

To evaluate the impact of the drivers on green supply chain initiatives, we estimated a separate structural equation model for each initiative (Hult and Ketchen, 2001). Model 1 in Table VI shows the result of the green purchasing initiative model. The result supports an excellent model fit ($\chi^2/\text{df} = 2.00$, non-normed fit index (NNFI) = 0.91, confirmatory fit index (CFI) = 0.92, root mean squared error of approximation (RMSEA) = 0.088). Moreover, the first-order factors (regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility) all load significantly

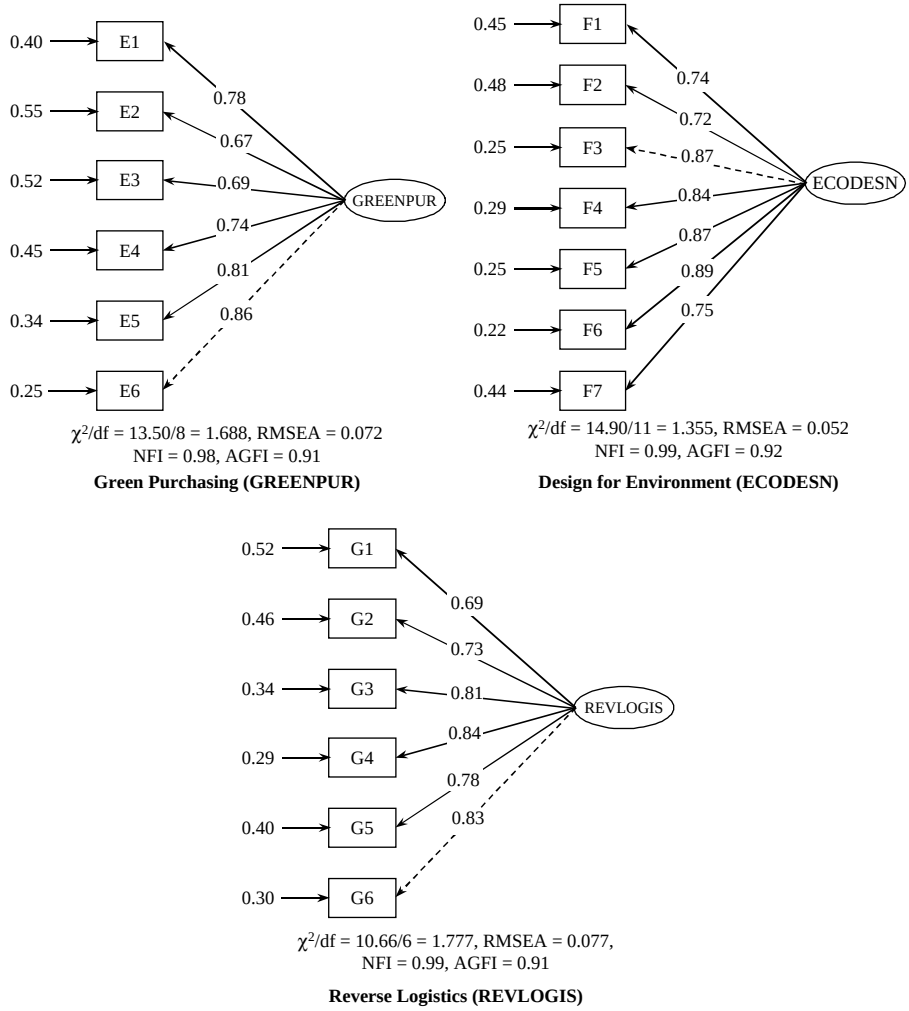

Figure 3.
Measurement models of green supply chain initiatives

on the second-order construct. This model thus reveals that the green supply chain driver positively affects green purchasing ($\beta = 0.68$), in support of H_1.

The second model also shows excellent model fit ($\chi^2/\text{df} = 1.94$, NNFI = 0.92, CFI = 0.93, RMSEA = 0.085). Again, regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility load significantly on the driver. This model indicates that the green supply chain driver affects design for the environment positively ($\beta = 0.63$), in support of H_2.

Finally, the reverse logistics structural equation model in Table VI illustrates great model fit with the data ($\chi^2/\text{df} = 2.02$, NNFI = 0.89, CFI = 0.91, RMSEA = 0.088). Regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility all load significantly on the driver. Therefore, the green supply chain driver positively affects reverse logistics initiative ($\beta = 0.29$), in support of H_3.

	1	2	3	4	5	6	7
1. Regulatory measures	1.000						
2. Customers pressure	0.194*	1.000					
3. Socio-cultural responsibility	0.198*	0.048	1.000				
4. Competitor pressures	0.207*	0.317*	0.152*	1.000			
5. Green purchasing	0.247*	0.370*	0.135*	0.277*	1.000		
6. Design for environment	0.222*	0.224*	0.300*	0.277*	0.369*	1.000	
7. Reverse logistics	0.141*	0.120**	0.062	0.154*	0.253*	0.397*	1.000
Mean	3.703	3.844	4.183	3.789	3.471	3.286	2.735
SD	0.618	0.744	0.556	0.561	0.774	0.882	0.886

Table V.
Inter-factor correlation

Note: Correlations are significant at: $^{*}\alpha = 5$ percent (two-tailed) and $^{**}\alpha = 10$ percent (two-tailed)

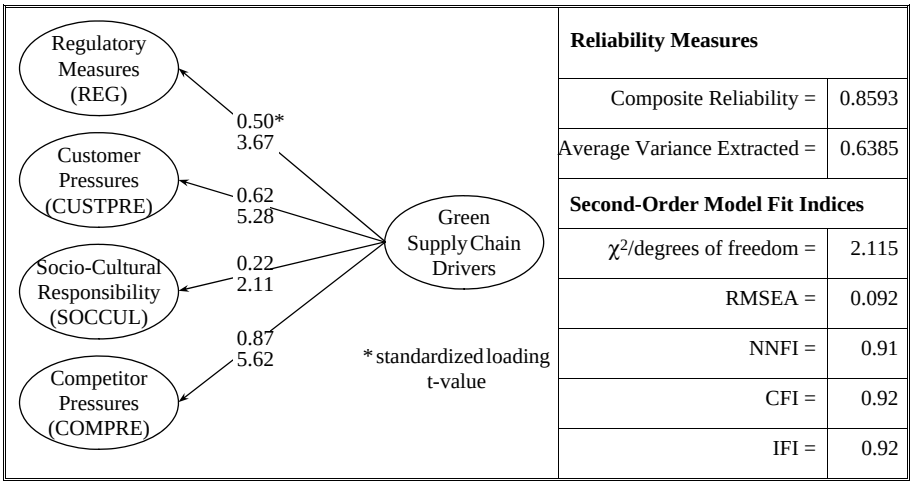

Figure 4.
Second-order model of the green supply chain driver construct

6. Discussion of findings and its relevance to Malaysia

Our findings suggest that regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility collectively measured a higher order green supply chain driver. From an institutional theory perspective, this driver serves to persuade manufacturing firms in developing countries to adopt various green supply chain initiatives. Our research also provides empirical evidence to support our conclusion that firms that perceive more pressure to adopt green supply chain initiatives are further along in their development of green supply chain organizational capabilities. The green supply chain driver causes firms to engage in green purchasing, design for the environment, and reverse logistics. According to the magnitude of the beta coefficients, the impact of the green driver is most profound for green purchasing ($\beta = 0.68$), followed by design for the environment ($\beta = 0.63$) and reverse logistics ($\beta = 0.29$).

From a theoretical perspective, we can explain the effect of the four drivers of green supply chain adoption in terms of institutional theory. New institutional sociology assumes that firms in a common environment adopt comparable practices in response

Lower-order construct	Loading on the driver	β (green SC driver → initiative)	α^2 (df)	NNFI	CFI	RMSEA
Structural equation model 1: green purchasing (H_1)						
Regulatory measures	0.54	0.68*	675.23 (337)	0.91	0.92	0.088
Customer pressures	0.72					
Socio-cultural responsibility	0.34					
Competitor pressures	0.74					
Structural equation model 2: design for environment (H_2)						
Regulatory measures	0.61	0.63*	701.50 (362)	0.92	0.93	0.085
Customer pressures	0.57					
Socio-cultural responsibility	0.33					
Competitor pressures	0.78					
Structural equation model 3: reverse logistics (H_3)						
Regulatory measures	0.54	0.29*	678.19 (335)	0.89	0.91	0.088
Customer pressures	0.62					
Socio-cultural responsibility	0.4					
Competitor pressures	0.84					

Notes: Significant at: *$\alpha = 1$ percent; df – degrees of freedom

Table VI.
Summary results of the structural equation models

to similar coercive regulatory pressures, normative pressures, or mimetic cultural-cognitive pressures. We link the four drivers of green supply chain adoption to the three basic elements of institutional theory that help diffuse organizational practices among firms. First, regulatory measures and competitor pressures are forms of coercive regulatory isomorphism, in that they use rules, laws, and persuasion and pressure from competitors to encourage compliance. Second, customer pressure is a form of normative isomorphism, based on expectations that firms should be cognizant of feedback from customers in their operations. Third, socio-cultural responsibility is a type of mimetic cultural-cognitive isomorphism that reflects the rational desire to embrace green initiatives that have proven valuable to others. Once key firms begin to behave in socially responsible ways, others may follow suit, not so much because they necessarily subscribe to the normative principles that condone such behavior but because firms often mimic what other firms in their environments do in order to curry legitimacy from them (DiMaggio and Powell, 1983). These results confirm institutional theory is appropriate for explaining the mechanisms that influence the acceptance and diffusion of green supply chain initiatives.

Our results balance well with what has occurred in Malaysia over the past two decades. The past decade of rapid economic growth and industrialization has caused serious environmental challenges in Malaysia. The most prominent at the moment are considered to be air pollution from industrial emissions, solid waste management, ensuring long-term sustainability of the water supply and sewerage services industry and overall improvements of energy efficiency to re-establish a clean Malaysia. Manufacturing firms in Malaysia have made a conscious effort to focus first on supplier selection and evaluation. One of their primary requirements is to pick and choose suppliers who have developed and maintained an environmental management system. Due to pressure from competitors and customers, more organizations in Malaysia have taken an environmentally conscious approach towards designing products that minimizes any negative environmental impacts throughout the entire life cycle of

the product. One of the objectives of the Malaysian International Chamber of Commerce and Industry and the Business Council for Sustainable Development is to motivate Malaysian organizations to devise strategies for recycling, reuse and reclamation of used products. However, some environment organizations in Malaysia remain critical of the lack of enforcement of regulations and coordination among supply chain members. Hence it is not surprising that the impact of the green supply chain driver has the least impact on reverse logistics practices among organizations in Malaysia.

In Malaysia, a further indicator of business attitudes toward their environmental impacts can be obtained from those who legally choose to exceed any emission standard because Malaysia operates a system that allows emission levels to be exceeded on receipt of a contravention license (there is a fee and abatement charge for this). However, with all the awareness that the Malaysian Government has put in place for organizations to be environmentally conscious, there has been a huge improvement among several industries who have stepped up their monitoring of any environmental impact. Markandya and Shibli (1995) indicate that the limited extent of its monitoring and enforcement capacity has been identified as a critical problem with the current environmental policy regime in Malaysia.

The results in Figure 4 also show that the green driver is a multidimensional construct that comprises various incentives and pressures that prompt manufacturers to adopt green supply chain initiatives. In Malaysia, other key motivations (e.g. monetary incentives from buyers for carbon footprint disclosure), beyond regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility may be instrumental for green supply chain adoption. However, our findings from our survey of Malaysian firms indicate that these four factors are particularly salient and distinctive first-order constructs that reveal the overall level of motivation to adopt green supply chain. Of the four dimensions, the results in Table VI show that in Malaysian manufacturing firms, competitor pressures exhibit the highest loadings on the green supply chain driver for all three models (green purchasing, design for the environment, and reverse logistics), followed by customer pressures, though only for green purchasing and reverse logistics. Regulatory measures attain the second-highest loading in the design for environment structural equation model. Socio-cultural responsibility indicates the lowest loading across the three models. Though it is significant, social-cultural responsibility does not motivate green supply chain adoption as much as the other three constructs.

The nature of the sample provides another interesting future research direction. As we noted previously, our sample comes from ISO 14001 certified manufacturing firm in Malaysia, and thus, the survey targets those organizations most likely to have green supply chain initiatives, such as green purchasing, design for environment and reverse logistics. Although this type of sampling frame, the same as the population of the study, has been used widely, we cannot make any claim of external validity, especially for non-certified manufacturing firms. Future research might shed more light on the extent to which the findings from this particular setting (i.e. ISO 14001 certified organization) translates to other non-certified domains.

7. Managerial implications of findings

In Malaysia, monitoring of individual business behavior continues to find a high incidence of non-compliance. This may reflect surveillance effort rather than attitudes

to environmental responsibility, but it suggests that business acceptance of regulatory obligations needs to be strengthened before increasing the reliance on voluntary improvement initiatives. On one hand, the number of environmental offences prosecuted under the Environmental Quality Act has increased in Malaysia. On the other hand, the Environmental Quality Report has noted that non-compliance was frequently due to failures to maintain abatement equipment or to upgrade capacity with increases in production capacity. The compliance checks tend to concentrate on large enterprises, with potentially the greatest impacts, and so probably do not capture the full extent of non-compliance (Markandya and Shibli, 1995).

The four distinct dimensions of the green supply chain driver provide useful guidelines for policymakers and managers in Malaysia. First, the significance of regulatory measures suggests that policymakers in Malaysia should set appropriate policies and incentives to encourage businesses to adopt green supply chain initiatives. When properly designed, regulatory measures can encourage firms to innovate and create new solutions to become greener. Customer pressures also significantly affect green supply chain adoption. Therefore, managers should exert pressures on suppliers to initiate "green multiplier effects" and help spread green supply chain concepts across the supply chain. Ytterhus *et al.* (1999) argue that pressures from large customers are most effective for diffusing green initiatives, because large enterprises often work with thousands of suppliers that must meet environmental standards to secure their contracts.

Second, managers in Malaysia must uphold their own corporate social responsibility to ensure adherence to the law, environmental, ethical standards and international norms. Businesses should embrace their responsibility for the impact of their activities on the environment, consumers, employees and communities. An excellent reputation as a socially responsible firm can translate into inimitable competitive advantage and increased market shares derived from customer goodwill. In contrast, ignoring social responsibility could potentially be a fast track to corporate disaster. Another useful insight from this construct relates to its consistently small coefficient in all three models (Table VI), which suggests that though it is significant, socio-cultural responsibility does not motivate green supply chain adoption as much as the other three factors. Policymakers should not expect managers to embrace green supply chains without some regulatory measures or customer pressures. Educating consumers about green practices might force manufacturing firms to become responsible corporate citizens though.

Third, our results show that managers should share "success stories" of their green adoption to exploit the effect of expected business benefits. However, each success story must clearly identify the specific benefits gained by implementing green initiatives. The environment should appear to offer a business opportunity, and green initiatives should be the means to commercial success, rather than moral imperatives. For policymakers, because competitor pressures reveal the highest coefficients in all three structural equation models (Table VI), the implication is that managers should be educated about competitor's green policies to establish the most profound motivator of green supply chain adoption. Another conclusion from Table VI indicates that in Malaysia, regulatory measures, competitor pressures, customer pressures and socio-cultural responsibility affect green purchasing more than design for the environment and reverse logistics; thus, managers should exploit green purchasing as their first line of defense against pressures or regulations to be greener. Moreover,

green purchasing is easier and less costly to implement than design for the environment or reverse logistics, which likely involves significant process, product, and distribution channel redesigns (Alvarez-Gil *et al.*, 2007).

We propose a generic green supply chain management framework in Figure 5 to synthesize our results. It is crucial for managers to set corporate policies and quantitative measures for sustainability and green supply chain adoption. Effective policies communicate management's vision, which translates into strategic business plans. With a quantitative measure, it becomes possible to set goals, apply measurement strategies, and measure progress toward green supply chain adoption. This research suggests that the green supply chain driver affects corporate vision on green initiatives. The level of influence increases from a firm's perception of socio-cultural responsibility to regulatory measures, customer pressures and competitor pressures. These four factors combine to affect a firm's corporate vision and strategic plans to adopt green supply chain initiatives. First, savvy managers can adopt green purchasing relatively easily and quickly because it involves primarily internal operations. Next, by collaborating with key supply chain members and undertaking process redesign, managers can move on to implement design for the environment and reverse logistics. Design for the environment and reverse logistics should not be implemented hastily without the support of proper infrastructure. With increasing regulatory pressures and customer awareness, firms with greener supply chains will gain an inimitable competitive edge over competitors that remain hesitant to embrace green initiatives. Moreover, the focus of green supply chain management has shifted from compliance to value creation; thus, if properly managed, green supply chain initiatives can enable firms to become responsible corporate citizens, reduce total costs, and improve performance simultaneously.

Finally, critics may argue that our sampling frame limits the value of our research. Our purpose is to explore green supply chain initiatives in a developing economy, not to generalize the results across developed nations. Our findings therefore provide useful green guidelines for multinational corporations that might pursue offshore operations in developing countries.

8. Limitations and future research

This study uses survey-based quantitative analysis to test the research hypotheses. However, our approach also contains several limitations that require consideration when drawing conclusions from this study. First, though we identify four dimensions of the green supply chain driver, we acknowledge that other dimensions exist.

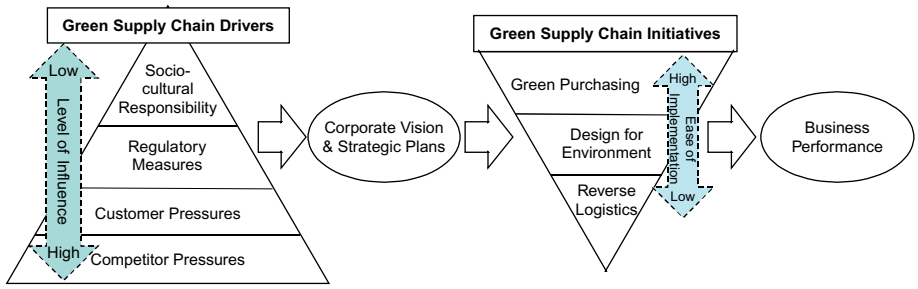

Figure 5.
A business perspective of green supply chain management

Ongoing research should investigate these potential dimensions. Second, our sample is limited to certified manufacturing firms, most of which are large. Therefore, small and medium-sized enterprises (SMEs) are poorly represented. Because SMEs often lack the resources and expertise to deal with environmental issues, they may not be able to meet emerging environmental and social standards; thus, their motivations to undertake green supply chain likely differ from those that push large, certified manufacturing firms. Further research should test our results using non-certified SMEs. Moreover, this research has been developed primarily with manufacturing firms in mind, and no consideration regarding the green supply chain behavior of service sector has been given. Services generally differ from goods in four main characteristics:

(1) intangibility, because service outputs cannot be seen, touched, and tasted;

(2) simultaneity of production and consumption, because service outputs are produced and provided as they are consumed;

(3) heterogeneity, because service outputs vary tremendously; and

(4) perishability, because service outputs cannot be stored.

Thus, future research may examine the applicability of findings from this research for service sectors. Third, our cross-sectional study measures the key variables at a single point of time, which limits our ability to discern any changes in the variables over time and thus our ability to infer causation. Longitudinal studies would be very useful in determining such causal relationships.

Another limitation of our study is the issue of single respondents. However, we believe that our results are not affected by this issue. First, the respondents chosen for the survey in Malaysia were EMRs and senior managers who were knowledgeable about their firm and their green supply chain initiatives. Credible respondents minimize the threat of common method bias (Miller and Roth, 1994; Phillips, 1981). Second, we often focused our questions on issues that were related to factual environments and not those that focused on issues such as work style and organization climate that may provide opportunity to the respondents to corrupt the survey. However, we do recognize that social desirability bias, the tendency of respondents to answer questions in a manner that will be viewed favorably by others, may exist and jeopardize the validity of this research (Fisher, 1993). The tendency poses a serious problem with conducting research with sustainability issues, such as social responsibility and environmental protections. To avoid this problem of social desirability, future study may apply indirect questioning techniques, demonstrable anonymity, and ensure data confidentiality.

Lastly, our data was collected from a single country, Malaysia. However, we collected data across a wide spectrum of ISO 14001 certified Malaysian firms. Moreover, our sampling frame is the population of the study. Future studies may examine other emerging markets to remove the effect of country level variance such as economic development, legal system and market size in an integrated fashion because such economic and institutional conditions may influence the environment in which the firms operate. Next, while we attempted to collate documents from multiple firms during the initial phases of the study, deliberate attempts were made to ensure generality of the questions across manufacturing firms in Malaysia. Furthermore, a decision to include a limited number of questions for each constructs was made in the interest of keeping the length of the questionnaire manageable.

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Further reading

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