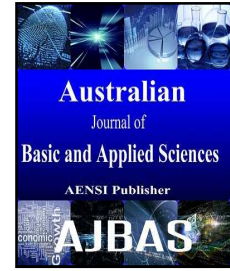




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**An Exploratory Study of Green Supply Chain Management Practices and Supply Chain Integration among Malaysia Manufacturing Firms**

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**ABSTRACT**

**Background:** Organizations are increasingly finding it challenging to balance economic and environmental performance particularly those that face competitive, regulatory and community pressure. With the increasing pressures for environmental sustainability, this calls for the new formulation of strategies by the manufacturers in order to minimize their products and services negative impact on the environment. Hence, Green Supply Chain Management (GSCM) continues to be an important research agenda among the researchers. In Malaysia, green issues are new and still developing. Constant study is needed to fully understand and update information regarding this area. **Objective:** The aim of this paper is to explore the views and level of acceptance of GSCM practices and Supply Chain Integration (SCI) among manufacturing firms in Malaysia. **Results:** Through the use of mail survey, 152 responses were obtained to generate the results of the study. The result showed GSCM practices have been practiced to somewhat to a greater extent among manufacturing firms in Malaysia and the result of SCI showed evidence of some highly progressive integration among supply chain members of these firms. **Conclusion:** In sum, the findings can be extended to study on the issues in further. Academicians and practitioners can apply this result to their research and business strategies on how to improve sustainable performance and to effectively implement GSCM practices and SCI

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**INTRODUCTION**

The increasing interest in environmental sustainability and sustainable performance is creating a pressure on firms to pay more attention to their environmental footprints. This pressure is felt more in high polluting industries. In the context of Malaysia, manufacturing industries is considered the highly pollutant industries and one of the areas employing the most personnel that having the highest footprint and impact on the external community. Given the impact of the manufacturing industry on the environment, people and economy, the industry gives new opportunities to significantly contribute to sustainability (Cagliano, Golini, & Longoni, 2010).

In Malaysia, there are only a few studies that have been carried out on green supply chain practices, This implies that the concept of green supply chain in Malaysia is still new and developing (Seman, Zakuan, Jusoh, Shoki, & Arif, 2012). Therefore, ongoing studies are really encouraged to

further strengthen and improve the existing literature on green supply chain practices in Malaysia. A notable study by Zailani, Jeyaraman, Vengadasan, and Premkumar (2012) claimed there are a lot of firms in Malaysia still at the rear and yet to adopt the green supply chain practices in their business approach. Hence, the above matters call for future studies to conduct in-depth investigation of the adoption and implementation of GSCM in Malaysia.

Meanwhile, Supply chain integration (SCI) has received massive attention as a crucial means in generating material and knowledge flows and leveraging the performance rooted in a supply chain (Narasimhan, Swink, & Viswanathan, 2010; Swink, Narasimhan, & Wang, 2007). Researchers and practitioners have put much emphasis on the potential of SCI, it is believed that certain performance can be gained through a firm's efficient internal operations and integrated supply chain networks (Olhager & Prajogo, 2012). Chen and Paulraj (2004) also added, research in supply chain

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management is increasingly based on an integrated view for both upstream and downstream integration. Therefore, SCI is an essential means to leverage the potential benefits of green practices particularly for practices that requires a strong collaboration among supply chain members.

Responding to this need, this study aims at investigating green supply chain practices in the context of the certified manufacturing firms in Malaysia. Specifically, the study tries to find out the extent of supply chain integration among these manufacturing firms, the level of adoption of GSCM practices and the actual outcomes of GSCM practices in terms of sustainable performance. The ISO 14001 manufacturing firms are of interest due to assumption that these firms have established some capabilities on environmental protection, hence they have greater potential to adopt green practices to a higher extent.

### **Literature Review And Research Hypotheses:**

#### **Green Supply Chain Management:**

Green supply-chain management stems from both Supply Chain Management literature and Environmental Management literature. In other words, by adding the 'green' component into supply chain management involves addressing the influence and relationships between supply chain and the natural environment. As Srivastava (2007) posits that with the addition of a green component, the influences and relationships between Supply Chain Management and the natural environment are intertwined. Therefore, more studies are to be called upon to investigate and further explain the concept behind this green area especially in the context of Malaysia (Eltayeb, Zailani, & Ramayah, 2011).

#### **Supply Chain Integration:**

Supply chain integration (SCI) has received considerable attention as an essential means of generating material and knowledge flows and leveraging the core competencies embedded in a supply chain (Narasimhan et al., 2010; Swink et al., 2007). Researchers and practitioners have put much prominence on the potential and benefits of SCI as a competitive advantage and for performance improvement. The potential benefits of SCI can be achieved through a firm's efficient internal operations and solid supply chain networks (Olhager & Prajogo, 2012). Therefore, many companies tend to work closely with their supply chain members to gain exceptional synergies and benefits through integration practices, such as accurately identifying customer demand and promoting a mutual exchange of information with suppliers (Allred, Fawcett, Wallin, & Magnan, 2011; Koufteros, Rawski, & Rupak, 2010).

SCI could be defined as the collaboration of a firm with its supply chain members to manage both intra- and inter-organizational environmental practices and could be divided into internal and

external integration (Wu, 2013). Internal integration focuses on removing cross-functional barriers, enhancing firms' environmental capabilities and encouraging employees to learn about environmental initiatives (Wu, Ding & Chen, 2012). On the other hand, external integration involves co-operation between suppliers and customers to mutually manage cross-firm environmental issues (Vachon & Klassen, 2008). As indicated by Flynn, Huo, and Zhao (2010); external and internal integration have been proven to effectively improve performance. This is because each type of integration represents an important aspect of supply chain integration. Therefore, the effects of each type of integration need to be examined as a whole (Koufteros, Vonderembse, & Jayaram, 2005; Wong, Boon-itt, & Wong, 2011 ).

#### **Sustainable Performance:**

With respect to GSCM, Pagell and Gobeli (2009) suggested that for firms to be sustainable, firms should plan and adopt such initiatives that can improve the environmental and social impacts of their internal process, as well as to improve the impact of their supplier's and customer's processes. As indicated by Seuring and Müller (2008), sustainability in supply chain management is about managing the flow of material, information and capital as well as cooperation between companies along the supply chain, taking into account the objectives of each dimensions of sustainability. The dimensions of sustainability consist of economic, environmental, and social dimensions whereby the dynamic interactions between these dimensions are really essential for firms to achieve sustainability.

Sustainable performance can be defined as the firm's ability to perform not just on the economic performance but also on the environmental and social performance (Elkington, 2004). From a business perspective, this definition suggests not only a focus on economic aspects of one's business, but also a need to focus on the sustainment of nature's resources and the societies the firms serve (Winter & Knemeyer, 2013).

Therefore, to achieve sustainable performance, firm should consider adopting green practices in their business operations as the way to be sustainable and find ways on how to collaborate with their supply chain members to effectively sustain in the business without neglecting its environment and social performance.

#### **Research Methodology:**

##### **Sampling size:**

The sampling size of this study will be the Malaysian manufacturing companies that are certified in MS ISO 14001, according to SIRIM and FMM directory in 2013, there were about 728 companies in Malaysia that are certified in ISO 14001. The reason why these companies are selected

because they represent the largest sector in terms of sales, employment and contribution to the economy while certification in ISO 14001 as a proof that the companies are involved in implementing GSCM practices and are aware with the requirement of environmental procedures and standards.

In addition, the manufacturing sector has been debated as a tremendous contributor to the quality and environmental problems in Malaysia. Thereby, any effort to improve environmental performance of this sector can produce substantial benefits. For this reason, this sector is therefore a natural choice to study the effect of green practices on sustainability performance.

#### **Questionnaire Design:**

In this study, green supply chain management practices have three dimensions: eco-design, green purchasing, and reverse logistics. Following similar studies on green supply chain management practices of Eltayeb *et al.* (2011), and Vachon and Klassen (2006), the study uses a 5-point Likert scale for all dimensions of green supply chain practices. The scale ranges from 1= "Not at all" to 5= "Very high extent".

For supply chain integration, will be determined in terms of firm's level of integration with their supply chain members that consist of first tier suppliers and first tier customers only. The reason why this study is only focusing on the first tier of supply chain is because firms usually has direct control upon their first tier supplier and customer and often the firm do not control for the impact of waste streams beyond first tier since they lack the internal process to do so (Darnall, Jolley, & Handfield, 2008). Similarly, a study by Wu (2013) on green supply chain integration among Taiwanese IT manufacturers also has limit their environmental management practices to first tier suppliers and customers and excluded second tier suppliers and customers. Hence, these justifications support the rationale of why this study will only measure the firm integration between their first tier supply chain members.

Supply chain integration comprises of supplier integration, internal integration and customer integration. The study follows similar measurement of supply chain integration as proposed by Wu (2013) and Vachon and Klassen (2006) and Zhu *et al.* (2007), this study also adopted similar scales of a 5-point Likert scale for all dimensions of supply chain integration Wu (2013). The scale ranges from 1= "Very low" to 5= "Very high".

For sustainable performance, the performance is defined as the actual impacts of green supply chain practices adoption on environmental, economic and social performance of the firm. Measurement items for the performance were developed from previous studies. For these three types of performance, this study adopts five-point Likert scale that ranges from

'1=Not at all" to "5=Highly significant", with statements signifying the performance actually realized by a firm during the last three years.

#### **Results:**

##### **Demographic Profile:**

This study surveyed manufacturing firms with ISO 14001 certification, which encompasses various sector and industries, sizes, age and ownership status. Table 2 summarizes the profiles of responding firms. Based on the response obtained, E&E industry appears to be the highest proportion responded to the survey, while the food and beverages industry is the least. This is consistent with the fact that E&E industry is the highest group that implements environmental management practices as this group is subjected to scrutiny from Western Nations in term of environmental management and social compliance (Eltayeb, 2009). Overall, the data shows that the composition of response according to industry follows as descending order; that is from highly scrutinized sector to the least one. Hence, this represents the targeted population of ISO 14001 manufacturing firms, where industries that are exposed to stringent environmental policy share a greater portion of total population.

In addition, the data indicates that more than 70 percent of the responding firms are large and medium firms. The result is parallel with report from previous studies that ISO 14001 certification is more common in large firms, due to huge investment involved (Eltayeb, 2009; Melnyk *et al.*, 2003). In term of firm age, the results show that the majority comes from the firms which have been established for more than ten years. This group alone composed 84.2 percent of the total, while the firms with establishment less than ten years are at the lower ranks. Finally, ownership status signifies that majority of them belongs to foreign ventures. Apparently, it is consistent with other studies (Abumonzhi & Kanda, 2005; Eltayeb, 2009) that multinational companies are more involved in green practices, as opposed to local firms.

##### **Descriptive Statistics:**

Table 3 shows the summary of mean value and standard deviation of all the variables. As depicted in the table, among the three practices in green supply chain management practices, mean value of eco design is the highest (3.85), followed by green purchasing (3.62) and reverse logistics (3.40). This indicates that responding firms pay more attention towards eco design and less attention to reverse logistics. This finding revealed that GSCM practices that involve external relationship with suppliers and customers (green purchasing and reverse logistics) have comparatively lower adoption than internally-focused practice (eco design) which involves less external relationship.

Table 1: Construct and Measures.

Construct	Items	Source
Green Purchasing	<p>Provides design specifications to suppliers that include environmental requirements for purchased items.</p> <p>Requires your suppliers to develop and maintain an environmental management system (EMS).</p> <p>Requires your suppliers to have a certified EMS such as ISO 14001.</p> <p>Uses a questionnaire to collect information about your suppliers' environmental aspects, activities and/or management systems.</p> <p>Makes sure that your purchased products must contain green attributes such as recycled or reusable items.</p> <p>Makes sure that your purchased products must not contain environmentally undesirable items such as lead or other hazardous or toxic materials.</p> <p>Evaluates your suppliers based on specific environmental criteria.</p> <p>Evaluates the environmental aspects of your suppliers.</p> <p>Makes sure that your suppliers meet its environmental objectives.</p>	<p>Eltayeb et al. (2010)</p> <p>Tritos et al. (2013)</p>
Eco Design	<p>Produces products that have reused or recycled materials in their contents such as recycled plastics and glass.</p> <p>Uses life cycle assessment to evaluate the environmental load of your products.</p> <p>Produces products that are free from hazardous substances such as lead, mercury, chromium, and cadmium.</p> <p>Makes sure that your products have recyclable or reusable contents.</p> <p>Produces products that reduce the consumption of materials or energy during use.</p> <p>Makes sure that product's packaging has recyclable contents.</p> <p>Makes sure that product's packaging is reusable.</p> <p>Minimizes the use of materials in product's packaging.</p> <p>Avoids or reduces the use of hazardous materials in product's packaging.</p>	<p>Eltayeb and Zailani (2009)</p> <p>Tritos et al. (2013)</p>
Reverse Logistics	<p>Collects back used products from customers for recycling, reclamation of materials, or reuse.</p> <p>Collects back used packaging from customers reuse or recycling.</p> <p>Requires suppliers to collect back their packaging materials.</p> <p>Returns back its products to suppliers for retaining of materials, or remanufacturing.</p> <p>Returns back its packaging to suppliers for reuse and recycling.</p> <p>Returns back the products from customers for safe refill.</p>	<p>Eltayeb and Zailani (2009)</p> <p>Rogers and Tibben-Lembke (2001)</p> <p>Carter and Ellram (1998)</p>
Supply Chain Integration	<p><b>Supplier Integration</b></p> <p>Collaborating with suppliers to set up environmental goals.</p> <p>Implementing environmental audit for suppliers' internal management.</p> <p>Providing suppliers with environmental design requirements related to design specifications and cleaner production technology.</p> <p>Requiring suppliers to implement environmental management or obtain third-party certification of environmental management system (e.g., ISO 14001).</p> <p>Selecting suppliers according to environmental criteria.</p> <p>Collaborating with suppliers to set up environmental goals.</p> <p><b>Internal Integration</b></p> <p>Senior and middle managers are committed to GSCM practices.</p> <p>Cross-functional cooperation for environmental improvements.</p> <p>Environmental issues are well communicated among departments.</p> <p>Environmental compliance and auditing programs are implemented.</p> <p>Environmental knowledge is accumulated and shared across departments.</p> <p>An environmental management system exists.</p> <p><b>Customer Integration</b></p> <p>Achieving environmental goals through joint planning.</p> <p>Cooperating with customers to reduce environmental impact of your products.</p> <p>Cooperating with customers for cleaner production, green packaging or other environmental activities.</p> <p>Sharing our know-how and experience with customers for environmental management and find solutions to environmental challenges.</p>	<p>Wu (2013)</p> <p>Vachon (2003)</p>
Economic Performance	<p>Decrease of cost for materials purchasing.</p> <p>Decrease of cost for energy consumption.</p> <p>Decrease of fee for waste treatment.</p> <p>Decrease of fee waste discharge.</p> <p>Decrease of fine/ penalties for environmental accidents.</p>	<p>Zhu, Sarkis and Lai (2007)</p> <p>Rao (2002)</p>
Environmental Performance	<p>Reduction of air emission.</p> <p>Reduction of waste water.</p> <p>Reduction of solid wastes.</p> <p>Decrease of consumption for hazardous/ harmful/ toxic materials.</p> <p>Decrease of frequency for environmental accidents.</p> <p>Improvement of a firm's environmental situation.</p>	<p>Zhu, Sarkis and Lai (2007)</p> <p>Rao (2002)</p>
Social Performance	<p>Employees' health and safety.</p> <p>Incentives and engagement for local employment.</p> <p>Development of economic activities.</p> <p>Improvement of community health and safety.</p> <p>Reduction of the negative impact of products and processes on the local community.</p>	<p>Rao (2002)</p> <p>Kassinis and Soteriou (2003)</p>

In term of supply chain integration, mean value of internal integration is the highest (4.0); which indicate that responding firms are put more effort in internal coordination among the functional units within the organization while implementing green practices. Whereas, external integration such as supplier integration and customer integration are found to be less imperative, with supplier integration has the lowest level of integration (3.45), followed by customer integration (3.72). This point out that most of the responding firms are put more focus on internal capabilities rather than external.

As for sustainable performance, mean value of environmental performance is the highest (3.86),

followed by social performance (3.80) and economic performance (3.73). This indicates that these green firms are performing better in environmental performance and social performance rather than economic performance.

#### **Discussion And Conclusion:**

In general, the results of the descriptive analysis showed that manufacturing firms in Malaysia are receptive towards GSCM practices and aware that good integration among supply chain members has potential in generating better sustainable performance. This study showed that Supply Chain Integration (SCI) such as internal integration is

important to facilitate the effectiveness of GSCM practices towards sustainable performance.

**Table 2:** Profile of the responding firms.

Variables	Categories	Frequency	%	Total
Sector	Electrical and electronic	50	32.9	
	Textile	6	3.9	
	Paper products	15	9.9	
	Food and beverages	3	2.0	
	Petroleum	15	9.9	
	Rubber & plastic products	10	6.6	
	Basic metal	28	18.4	
	Others	25	16.4	100
Number of employees	Less than 5	3	2.0	
	5 to 75	36	23.7	
	76 to 200	45	29.6	
	More than 200	68	44.7	100
Age of firm	less than 10 years	24	15.8	
	10 - 25 years	64	42.1	
	26 - 50 years	59	38.8	
	more than 50 years	5	3.3	
Ownership type	Multinational Company	58	38.2	
	GLC	3	2.0	
	Local Company	64	42.0	
	Joint Venture (JV)	18	11.9	
	Foreign own	4	2.6	
	Private Ltd	4	2.6	
	Japanese based	1	0.7	100

**Table 3:** Descriptive Statistics of Variables.

Construct	Mean	Std. Deviation
Green Purchasing	3.62	0.67
Eco Design	3.85	0.64
Reverse Logistics	3.40	0.81
Supplier Integration	3.45	0.83
Internal Integration	4.00	0.76
Customer Integration	3.72	0.75
Economic Performance	3.73	0.77
Environmental Performance	3.86	0.67
Social Performance	3.80	0.72

The result of SCI in Malaysia showed evidence of some highly progressive integration among the manufacturing firms. Due to a growing demand for environmental protection in today's industrial activities, firms need to cooperate with their supply chain members in order to effectively handle the green related activities in their business operations. Besides, supply chain integration appears to be a useful resource or capability for organizations to consider and incorporate into their business strategy in order to produce reliance and long-term relationships with members of the whole supply chain; not only within departments of the same organization, but also with other groups in the supply chain, including suppliers and customers that the organization has to communicate with. SCI also appears to be able to improve sustainable performance (Suansawat, 2013). Realizing the benefits encounter from SCI, many firms are putting more attention towards better integration with their supply chain members.

The result of each dimension of SCI showed that internal integration has been the most adopted, slightly at the high level. This result is not surprising as Pietro (2012) suggests that improving internal

environmental management functions is the first step in greening the whole supply chain before improving external environmental management functions. Furthermore, internal integration can facilitate SCI within a firm, as internal environment initiatives are conducted better than external ones (Pietro, 2012). This arguments is also in agreement with Suansawat (2013), claims that internal integration facilitate the interaction with all supply chain members because if internal stakeholders (e.g. managers, employees) take the environmental criteria into consideration, then they work jointly to reduce the environmental impact, not only in the organization but also in supply chain activities. Given this argument, it is possible that these concerns influence the higher level of internal integration among Malaysian manufacturing firms to improve their sustainable performance.

The result of supplier integration and customer integration showed at moderate level with customer integration showing slightly higher than supplier integration. As suggested by Chi, Abdul Hamid, Rasli, and Tat (2013) effective customer integration ensures continued growth and competitiveness in the market in terms of value creation. Many firms view a

close relationship with customers, in turn, build on the operational capability of the firm. Tan (2002) and Li et al. (2005) also accentuated that the relationship between an organization and its customers is a way to achieve competitive advantage and business performance. Therefore, when it comes to green supply chain management, customers appear to be the main interest as the demand for green products and services usually created by the customers. For instance, a firm must cooperate with its customers by taking into account issues such as eco-design, cleaner production, and environment-friendly packaging. Hence, in order to stay competitive and improve the sustainable performance, firm must actively engage with their customers.

As for supplier integration, green supply chain management requires firms to cooperate with other organizations in order to establish commitment, long-term relationships, and trust. Further, interaction between supply chain members, such as suppliers is able to make the work flow more effective and improve communication. For this purpose, a business needs to collaborate with suppliers and persuade them to be concerned about environmental issues and evaluate their environment-friendly practices, encourage suppliers to receive ISO 14001 certification, and provide design specifications on environmental requirements. Similarly, Zhu and Sarkis (2004) also suggest firms should integrate with suppliers in order to achieve common environmental goals; monitor their suppliers using internal audits, especially around enforcing environmental policy; and persuade them to adopt an environmental management standard, such as ISO 14001 certification. The close collaboration linkages with suppliers are essential for the GSCM implementation of the firm particularly for green practices that require supplier cooperation such as green purchasing. Additionally, Lee and Billington (1992) reported that supplier integration could offer a new opportunity to improve internal operational competencies. The strategic task of a supply relationship positively affects the capability of profit making and the integral supply chain, as well as the manufacturer's competitive capability (Locke & Romis, 2007).

In sum, SCI is needed to tie the whole supply chain together in order to reduce perpetual green supply chain challenges such as functional silos, poor transparency of knowledge and information and the inadequate formation of appropriate customer and supplier relationships. As such, SCI plays an essential role for effective green supply chain management practices and improving sustainable performance of the firm.

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