

GREEN SUPPLY CHAIN MANAGEMENT PRACTICES: EVIDENCE FROM MALAYSIA

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ABSTRACT

This study examines the green supply chain management (GSCM) practices found in a manufacturing firm operating in Malaysia. The findings indicate that by integrating ISO 14001 modules as the framework, the case firm has initiated several environmental management practices within the supply chain phases. The findings also indicate that the case firm's inbound logistics, internal supply chain/production and outbound logistics processes conform to green management practices. However, reverse logistics practice, a key phase in GSCM is not practiced by the case firm. The present study besides adding knowledge to current literature, will also contribute in promoting environmental practice among companies operating in Malaysia, particularly on the effects that these practices have on the environmental, operational & financial performance. This work provides a starting-point for further research in GSCM in Malaysia.

Introduction

In a global market scenario, competitive advantage and environmental sustainability are believed to co-exist (Beamon, 1999). Therefore to gain competitive advantage, Hart (1995) suggests that companies need to undergo a 'paradigm shift' towards their environmental obligations. In order to fulfill environmental obligations, organizations recognize that they cannot work in isolation. Since companies have often been

charged for the environmental liabilities of their suppliers (Rao, 2008), there has been an urgency to integrate environmental initiatives, not only within the walls of the company, but across the entire supply chain in order to ensure the company's sustainability (Cote, Lopez, Marche, Perron, and Wright, 2008). As such environmentally conscious organizations, besides integrating sustainability into their strategies, have to extend environmental issues beyond the four walls of their organizations by including their supply chain partners (Sarkis, Darnall, Nehman, and Priest, 1995). These organizations realize that 'industrial ecosystem' can only be maintained through a green supply chain management (Trowbridge, 2001) – a concept though not new (Reese, 2008) is gaining widespread recognition in the Asian region (Rao, 2008).

Green supply chain management (GSCM) is defined as 'the integration of environmental thinking into the supply chain management (SCM), including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life' (Srivastava, 2007, p. 54-55). GSCM is related to environmental improvement by means of reducing the environmental risks and impact of the firm and its supply chain partners while enhancing and balancing the firm's economic, operational and environmental performance (Zhu, Sarkis, and Lai, 2008a).

Previous studies show that GSCM practices in developed nations, such as Japan, Germany and other northern European countries are very advanced (Gutowski, Murphy, Allen, Bauer, Bras, Piwonka, Sheng, Sutherland, Thurston, and Wolff, 2005). However, in developing countries like Malaysia (the focus of the current study), GSCM is a relatively new concept both in practice and in research (Rao, 2002). Given this issue, there is an imminent need to understand how Malaysian companies deal with GSCM practices. This initial study, therefore investigates how a Malaysian case firm incorporates GSCM practices in its supply chain.

Review of the Literature

Dimensions of GSCM Practices

By referring to Sarkis's (1999) framework of an integrated supply chain, Rao (2008) suggested that in general, there are four phases in a supply chain of any manufacturing company: inbound logistics, production/internal supply chain, outbound logistics, and reverse logistics (Figure 1). Greening the supply chain or GSCM will therefore mean addressing/minimizing the environmental impacts of all activities linked to all these phases of the supply chain. However, in markets (such as Malaysia) where there is no regulation for reverse logistics, this fourth phase in the supply chain is the least implemented in Asia. Figure 1 presents the Integrated Supply Chain framework as proposed by Sarkis (1999).

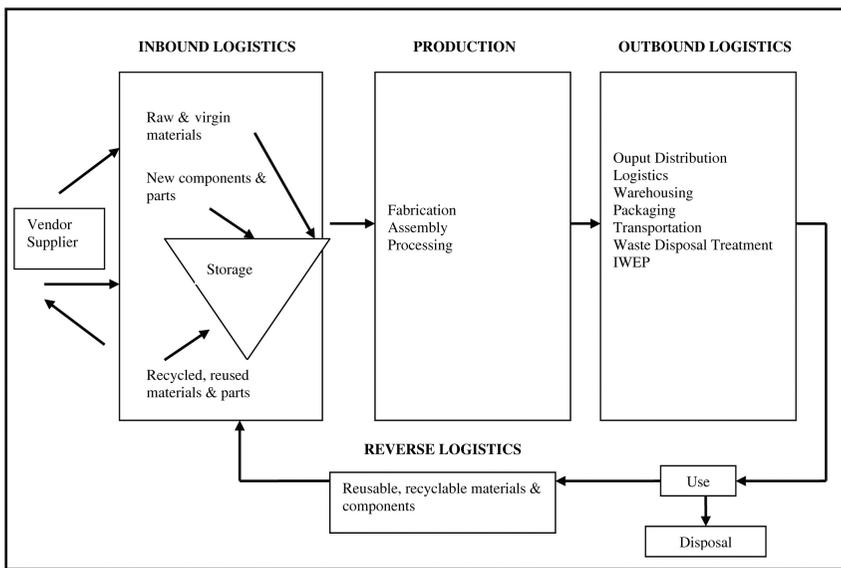


Figure 1: An Integrated Supply Chain (Source: Sarkis, 1999)

In Figure 1, the inbound logistics include incoming materials together with the process, workers, suppliers and vendors involved. Greening the inbound logistics or Green Purchasing will focus on the upstream or inbound cooperation which involves working on environmental initiatives with the suppliers and vendors (Zhu and Sarkis, 2004; Zhu, Sarkis, and Lai, 2008b;

Rao, 2008; Prime Minister Hibiscus Award (PMHA)). The initiatives may include providing design specifications for suppliers that include environmental requirement for the purchase items, environmental audit and supplier's ISO 14001 certification to screen suppliers for environmental performance (Zhu and Sarkis, 2004, 2006; Zhu, Sarkis, and Geng, 2005; Zhu, Sarkis, and Lai, 2007a, 2007b), frequent face-to-face planning/communication with suppliers about environmental issues and performance expectations, setting standards or control list to prevent/reduce use of hazardous materials (Pagell, Krumwiede, and Sheu, 2007), reducing the purchase volume of difficult to dispose materials, sourcing more recycled or recyclable materials, sourcing materials that promote cleaner production, encouraging suppliers to use less packaging, promoting environmental consciousness among suppliers by conducting awareness seminars and extensive training to assist them in the EMS implementation (Rao, 2008).

Manufacturing and assembly are the usual activities in the production/internal supply chain phase. Green manufacturing is a manufacturing mode designed to minimize the impact of the manufacturing process on the environment (Chien and Shih, 2007). The green manufacturing activities include incorporation of closed loop manufacturing to reduced/minimized emission (Rao, 2008) and solid and liquid waste (Pagell et al., 2007), use of environmental-friendly raw materials, substitute environmentally questionable materials, and cooperation/discussion with suppliers for environmental performance during the production phase (Rao, 2008; PMHA), cooperation with customers for cleaner production (Zhu and Sarkis, 2004, 2006; Zhu et al., 2005; Zhu et al., 2007a, 2007b), and application of green product standards (Chien and Shih, 2007).

In greening the production phase, manufacturing firms should also go for green design or design for environment (DfE) or eco-design (Rao, 2008) which is meant to address product functionality while at the same time minimizing life-cycle environmental impact (Zhu et al., 2008b). Eco-design is a tool that enables business to improve its environmental performance through the reduction of environmental impact of their products, processes and services (PMHA, n.d.). The design stage of a product is most critical since this is the stage when materials and processes are determined thus, shaping the impact on the natural environment. Hence, designing the product concurrently with the supply chain is a GSCM best practice (LMI, 2005).

Eco-design involves eco-design cooperation with customers (Zhu and Sarkis, 2004, 2006; Zhu et al., 2005; Zhu et al., 2007a, 2007b), design of products for reduced consumption of material/energy, design of products for reuse, recycle and recovery of materials and component parts, and design of products to avoid/reduce use of hazardous materials/manufacturing process (Chien and Shih, 2007; Zhu and Sarkis, 2004, 2006; Zhu et al., 2005; Zhu et al., 2007a, 2007b).

Internal Environmental Management (IEM) or environmental management refers to how organizations address and mitigate the adverse impact of its operations on the environment (Rao, 2008). It may include Environmental Management System (EMS) – a structured approach to green the operation in an organization which is vital not only to improve environmental performance but also the overall performance (Melnik, Sroufe, and Calantone, 2003). By preventing pollution at the source, EMS is a management system that drives organizations towards continual improvement in environmental performance, compliance and productivity (Rao, 2008). EMS, ISO 14001 and European Eco Management and Audit Scheme (EMAS) are not synonymous (Rao, 2008). However, in South East Asia most companies use the ISO14001 framework to develop their EMS (Rao, 2008). Besides EMS, IEM may also include higher-order learning and advanced continuous improvement activities such as total quality environmental management (TQEM), environmental compliance and auditing programmes (Zhu & Sarkis, 2004, 2006; Zhu et al., 2005; Zhu et al., 2007a, 2007b), and environmental accounting and life cycle analysis (LCA) (PMHA, n.d.).

The third phase of the supply chain is distribution and outbound logistics which involve transportation, packaging design, delivery, warehousing, inventory management, and waste disposal practices (Rao, 2008). Activities for greening this supply chain phase include green marketing such as eco-labeling (PMHA) and providing consumers with information on eco-products and/or green process (Rao and Holt, 2005); environmentally friendly packaging such as use of biodegradable packaging materials (Rao, 2008) and cooperation with customers for green packaging (Zhu and Sarkis, 2004, 2006; Zhu et al., 2005; Zhu et al., 2007a, 2007b); environmentally friendly transportation such as cooperation with customers for less energy during product transportation (Zhu and Sarkis, 2004, 2006; Zhu et al.,

2007a, 2007b); and environmentally friendly waste management such as the industrial waste exchange programme (IWEP) and the use of waste suppliers (Rao, 2008). Drawing on the works of Sarkis (1999) and Rao (2008), this initial study examines the GSCM practices found in the selected case firm.

Research Methodology

The case firm chosen for this case study is a manufacturing company serving various customers in Malaysia and abroad. This firm was chosen since it provided a good illustration of the key issues that may reflect the implementation process of the GSCM. Despite the limitations in terms of statistical generalization, the case study offers opportunities for in-depth observations and analysis of the supply chain management (SCM) processes. All issues were addressed mainly through the use of semi-structured interviews supplemented by the reviews of important company documents and field notes of the researchers. The interviews served as a means to elicit in-depth information on the GSCM practices based on the informants' views, beliefs and actions at their disposal regarding the practices carried out by the company. The qualitative data were analyzed through a process of reflection, going back and forth between the data, the literature and the company. When analyzing the data, a number of emergent themes relating to the implementation of green supply chain management were used.

Findings

Case Company A¹

Under the classification of the Malaysian Industrial Development Authority, Company A is a foreign owned manufacturer of electrical components whose business function is broadly categorized as 'Business to business' (B2B). As a B2B entity, they act as providers of semiconductor devices to other manufacturers. Company A has been awarded the ISO 14001 and has a proper Environmental Management system in place, thus authenticating the firm's stand and commitment to environmental issues.

1 To maintain confidentiality the actual name of the case firm is withheld

Evolution of GSCM at Company A

In the 1990's, due to global concern for environment issues, the top management at Company A incorporated strategic environmental management initiatives within their organization. Among the initiatives, Company A integrated sustainability in its business strategies and further extended its environmental commitment by including its supply chain partners. Its aim was to ensure better environmental and business performance while demonstrating corporate environmental responsibility. The company's development was in line with the recommendations of the Earth Summit held at Rio de Janeiro in 1992 (Rao, 2001, 2007).

In order to meet the demands for green products by its customers, Company A works closely with its suppliers to ensure that its 'green' venture is a success. As commented by one of the managers, 'for the GSCM to be a success and to ensure customer satisfaction, there is a strong need to maintain cooperation between the firm and its suppliers and customers'. Due to this increasing requirement by its downstream customers, the company has also introduced several initiatives to green both its inbound and outbound logistics phase. Among the initiatives to green its suppliers include, environmental audit performed on 1st tier suppliers.

Greening the Supply Chain- Integrated Supply Chain Framework

The remaining of this paper will draw on Sarkis's (1999) integrated supply chain framework (Figure 1) to discuss the case findings. The case evidence shows that with the exception of the reverse logistics phase, the other three phases, *viz* inbound logistics, production/internal supply chain, and outbound logistics, are present in the case firm's supply chain process (Figure 1). From an environmental perspective, green initiatives are thus implemented only in the supply chain phases of inbound logistics, production/internal supply chain, and outbound logistics. From the interviews it is learned that instead of using reverse logistics, Company A adopts investment recovery activities. According to Zsidisin and Hendrick (1998) investment recovery which consists of finding alternative uses for scrap items can help reduce the amount of wastes that are disposed of in landfills. The details of these findings will be presented and discussed in the subsequent sections.

Greening the Inbound Logistics/Green Purchasing

Based on the framework in Figure 1, Table 1 summarizes the case firm's green practices within the inbound logistics phase. As shown in Table 1, in an effort to green the inbound logistics Company A has introduced four green activities.

Table 1: Greening the Inbound Logistics

No.	Green Activities	Company A
1.	Requirement for suppliers to be ISO 14001 certified	Compulsory for suppliers to directly use materials for producing products (Critical bill of material). Time is given for suppliers to get the certification
2.	Annual environmental audit on suppliers /annual suppliers' performance evaluation	Consolidated environmental audit under corporate, on 1 st tier suppliers, & conducted regionally
3.	Provide suppliers with green purchasing guideline / require supplier to declare compliance in ensuring purchase of environmentally friendly materials	Provide supplier with green purchasing guideline only. (This guideline is based on the case firm's customer requirements and corporate directive)
4.	Frequent face-to-face planning / communication with suppliers about environmental issues and performance expectations	Weekly or monthly teleconference with suppliers

As indicated in Table 1, Company A requires its suppliers of direct materials to be ISO 14001 certified. If the main suppliers are not certified ISO 14001, Company A allows them a certain period of time to get the certification. In addition, Company A performs an annual environmental audit on its 1st tier suppliers, to ensure that its suppliers are trusted collaborative green partners. Company A also provides its suppliers with green purchasing guidelines in ensuring that the inbound materials are of green substances. As a way to increase environmental awareness among suppliers, Company A frequently communicates and plans with them on environmental issues and performance expectations.

Greening the Production / Internal Supply Chain

Table 2 summarizes the green practices found within the internal supply chain of Company A. In the production/internal supply chain phase, Company A extracts soil and groundwater within its own compound. To minimize the use of this natural resource, Company A uses recycled water for its production purposes. In meeting the customers' and marketing requirements, Company A uses 'green compound' or eco-friendly materials to substitute environmentally questionable materials abiding to the green product standards.

The firm works closely with its main supply chain partners in greening the production phase. Company A practices simultaneous cooperation and/or discussion with both suppliers and customers in producing 'green products'. Teleconferences are held between the respective supplier, customer and Company A discuss green products. As discussed earlier, Company A works closely with its suppliers to meet customers' requirements, and for cleaner production. There are also instances where Company A will assist its supplier for some required 'green materials' by sending the technical people to be stationed at the suppliers' premise for a period of time and run content analysis of the required green materials in the lab.

As part of its internal environmental management, Company A adopts the EMS that is ISO 14001 certified. This conforms to Rao's (2008) suggestion that South-East Asian companies commonly use EMS that falls under the ISO 14001 framework. ISO 14001 provides a framework for a structured approach to green the operation which aims for continuous environmental improvement. The EMS that is put in place is built around five modules - environmental policy, planning, implementation and operation, checking and corrective action, and management review. This is also consistent with PMHA (n.d.) where the ISO 14001 framework is integrated into the PMHA Environmental Performance Model and assessment criteria.

The firm's Environmental, Health and Safety (EHS) Committee headed by the Facilities Department is entrusted with the responsibility for environmental management. As part of its EMS, Company A practices internal environmental training and communication by means of the EHS committee. Awareness programmes such as waste battery recycling and

‘Green Day’ are conducted and environmental housekeeping programmes such as paper recycling and proper disposal by means of separate bins are also in place. As independent third parties, the Department of Environment and the subsidiary of the Standards and Industrial Research Institute of Malaysia, SIRIM QAS International Sdn. Bhd., conduct the environmental audit on Company A. The company is also being audited by both the existing and potential customers with respect to its environmental practice.

Table 2: Greening the Production/Internal Supply Chain Phase

No.	Green Activities	Company A
1.	Green manufacturing	<ol style="list-style-type: none"> 1. Closed loop manufacturing is practiced by means of recycling of water for production use 2. Application of green products standard (e.g. abide the EU directives) 3. Use of ‘green compound’ or hazardous free materials to substitute environmentally questionable materials 4. Simultaneous cooperation/discussion with both suppliers and customers in producing ‘green products’ 5. Cooperation with supplier for cleaner production 6. Communicating and assisting supplier for some required ‘green materials’ (e.g. tele-conference with suppliers, having technical people stationed at suppliers’ premise for a period of time, content analysis of required green materials in own lab)
2.	Design for environment (DfE) / Eco-design	Cooperation with customer for eco-design
3.	Internal environmental management	<ol style="list-style-type: none"> 1. Certified ISO 14001 2. Environmental policy 3. Structure and responsibility 4. Internal environmental training and communication 5. Environmental housekeeping programme 6. Environmental compliance and auditing programme 7. Environmental audit by potential customers

Greening the Outbound Logistics

Table 3 summarizes the practices conducted by the case firm to green the outbound logistics. As a measure of pollution control, Company A has various licensed waste suppliers who are specialized contractors such as the waste water disposal supplier, chemical disposal supplier, and paper disposal supplier to manage its different types of wastes. As indicated in Table 3, Company A's outbound logistics encourages green practices. These practices include environmental friendly packaging, transportation and waste management.

Table 3: Greening the Outbound Logistics Phase

No.	Green Activities	Co. A
1.	Environmentally friendly packaging	Use of eco-friendly packaging materials (e.g. halogen free)
2.	Environmentally friendly transportation	Frequency of transportation minimized by optimizing each shipment/trip
3.	Environmentally friendly waste management	Various licensed waste suppliers to manage different types of wastes as a measure for pollution control

Besides greening its outbound logistics, Company A practices disposal of non eco-friendly capital investment as a method for investment recovery. Company A sells its non eco-friendly machines to its sister plant in China or as scrap.

From the above discussion, it is noted that Company A has several activities put in place within the various supply chain phases, suggesting that GSCM is already being practiced in Malaysia.

Conclusion

GSCM as a Spin-off of Environmental Management

As indicated in the literature (Sarkis et al., 1995; Hsu and Hu, 2008), greening the supply chain is a spin-off of the environmental management practices of the companies under study. The findings indicated that by integrating ISO 14001 modules as the framework, the case firm had

initiated several environmental management practices within the supply chain phases. However, as the environmental crisis becomes alarming, more stringent international regulations/directives are being enforced thus increasing the demand of downstream customers and market requirements on environmental issues, and corporate direction then becomes more focused on the environment. Therefore, the environmental initiatives have evolved and extended beyond the boundaries of the company to include the supply chain partners. In meeting the requirements of the customers and the market, the case firm worked closely with the upstream suppliers. At the same time, there were also initiatives implemented in greening the upstream suppliers, thus indicating that the greening process of the supply chain may have begun from the downstream member moving upstream along the supply chain.

Greening of the Supply Chain Phases

Rao (2008) indicated that companies within the Asian region had increasingly implemented GSCM by greening all the supply chain phases. However, little is emphasized on the reverse logistics phase. The findings of this study confirmed this where various initiatives were evidenced in the inbound logistics, internal supply chain/production and outbound logistics. Instead of practicing reverse logistics, minimal investment recovery activities were put in place.

By having an EMS, Company A had indicated its commitment in dealing with environmental issues, particularly in preventing pollution at the source. The firm's main focus was to green the internal supply chain/production, and inbound logistics phases. For instance, the company introduced green manufacturing and packaging to green the manufacturing process and green purchasing practices. However, as part of the green initiatives for the internal supply chain/production, eco-design was not practiced.

Besides pollution prevention strategies, reactive or 'end-of-pipe' strategies such as environmentally friendly waste management activities were also put in place in the outbound logistics phase. The current green practices were seen as a starting point for Company A, which planned to use GSCM on a wider scope.

Limitations

This investigation and its findings are still relatively exploratory. Hence, the findings are not conclusive due to the single method of data collection used and a single case being used. Also, due to the limited time frame and difficulty of conducting a study beyond the boundary of GSCM within the focal plant and with its immediate primary upstream supplier and downstream customer (Vachon, 2003), only the set of activities in relation to the focal plant and its immediate prime supplier and customer were examined and analyzed.

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