



Implementing green supply chain management practices in organizations in Thailand: A review in search for key factors in GSCM implementation

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Abstract

There is a growing importance in the research of Green Supply Chain Management (GSCM) as it aims at an environmental innovation and integration of environmental concerns into supply chain management. GSCM has gained popularity with both academic and practitioners. In this research, we aim to study the various findings of the research conducted in the manufacturing organizations of Thailand. The purpose of the paper is to briefly review the recent literatures of the GSCM research especially in developing countries such as Thailand in order to identify the key factors for adopting and implementation of GSCM practices in manufacturing industries and also to provide the importance and guidelines for future research direction in Thailand's manufacturing organizations. Even though this paper has limitation, as it is based only on review of literatures available on various secondary sources, the implications of this paper are expected to be beneficial in academic and organizations. Result of performance evaluation from GSCM operations can be used to improve both economic and environmental performance of the organization. The results from the review have extracted three key factors of GSCM practices implementation as: 1) green manufacturing technology practice; 2) green logistics practice and 3) green sourcing strategy. Green manufacturing practice and the green logistics practice were strongly correlated with financial performance. Cost and complexity appeared to be the major obstacle to implementation of a successful GSCM.

Keywords: green supply chain management, environmental, key factors, implementation

Article history: Received 22 March 2017, Accepted 30 November 2017

1. Introduction

In the last few years, there is a growing research of Green supply chain management (GSCM) by researchers, practitioners and organizations due to their growing interest and awareness of environmental sustainability issues such as global warming and climate change. Environmental problems caused by wastage and emissions of different activities of the supply chain have compelled the industries towards responsible green supply chain management practices. Companies, therefore, have to be prepared for providing answer to questions about how green their manufacturing processes and supply chain practices relating to environmental sustainability [1]. Sustainability can be increased throughout the supply chain, starting with the concept and development then continuing through all stages of production and at last with customer distribution. Supply chain is the movement of materials as they move from their source to the end customer. Supply chain produce value in the form of products and service to the end customers through different processes and activities, which are performed by the network of organizations. Green supply chain management (GSCM) is about making the entire supply chain more environmentally sustainable. Companies may choose to adopt GSCM for many different reasons such as due to the

prevailing laws and regulations, to distinguish oneself in a competitive industry by being environmentally friendly. With increasing customer awareness and regulatory norms, organizations with greener supply chain management practices have a competitive advantage over companies without GSCM. Green supply chain management (GSCM) can be generally defined as the practice of improving environmental performance by integrating into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life operations management, and customer relationships [1].

In order to go good business with higher profits, it is important to implement GSCM practices. The practices of GSCM are beneficial to an organization's environmental and financial performance. Many business organizations can use GSCM as a strategic approach to earn profits and competitive image in the market [2]. Among the many initiatives of GSCM, it can be defined into the range as from reactive to proactive practices implemented through various Re-s such as reduce, re-use, rework, refurbish, reclaim, recycle, remanufacture, reverse logistics, etc. Roots of the GSCM can be traced both in the supply chain

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management and environmental management literature. Studies show that investments in greening can eliminate wastages, save resources and improve productivity. In the case of developed and developing countries, such as Japan, South Korea, Australia, Germany, Portugal, Italy, Sweden, Canada and Singapore etc, there is a marked difference in the development of GSCM., GSCM are practiced majorly, while in developing countries, especially in Asian region e.g., India, China, Philippines, Brazil, Chile, Argentina, Indonesia, Malaysia, Thailand, Bangladesh, Pakistan and Sri Lanka, GSCM practices are in a nascent stage. Most firms or organizations in developing countries adopt GSCM to reduce the environmental impact of various business activities rather than a proactive attitude to reduce the sources of wastage or pollution. Most organizations have multiple objectives as to enhance brand image, competitiveness, optimum resources utilization, better customer service, environmental competitiveness, optimum resource utilization, better customer service, environmental and social friendly image, increased profitability and many more and GSCM is adopted as a strategy to achieve these objectives [3].

2. Methods and objectives

The present paper is based on secondary sources of data available in printed form, electronically or other sources. It is descriptive method, describing facts as it is from the review of the available literatures. The objective of this paper therefore, is to review the literature available from all sources with a focus on green supply-chain management research integrating environmental thinking into supply-chain management, and thereafter, to find out the practices or factors for adopting it and successful implementation of GSCM which will help to identify gaps, issues and opportunities for further study and research relating to GSCM's implementation. A literature review seems to be a valid approach, as it is a necessary step in structuring a research field and forms an integral part of any research conducted. This helps to identify the conceptual content of the field and guides towards theory development for further study.

This paper aims to find out the following objectives as:

2.1 To identify the key factors for adopting and implementation of GSCM practices in manufacturing industries in Thailand.

2.2 To provide the importance and guideline for industrial sectors who want to implement GSCM successfully.

2.3 To find the limitations in implementing GSCM in organizations in Thailand.

2.4 To suggest or recommend directions for further research and implementation of GSCM.

3. Importance of green supply chain management

Green Supply Chain Management is an emerging research area [4-8]. Now- a – days, there is a growing customer demand for products and services that are environmentally sustainable and created through environmentally sustainable practices. This is in response to governmental environmental regulations. As manufacturing and production operation processes are perceived and viewed as the agents in harming the environment, in the forms of waste generation, ecosystem disruption, and depletion of natural resources [9], many manufacturing organizations have begun to implement green supply chain management (GSCM) practices [10, 11].

The implementation of GSCM practices is expected to result in improved environmental performance as measured by reductions in air emissions, effluent waste, solid waste, and the consumption of toxic materials. In brief, success at the supply chain level leads to success at the organizational level [12]. Since customers and governmental entities have begun to demand that processes, products, and services to be environmentally friendly, it is important that managers identify and implement environmental sustainability practices that extend throughout the supply chain. Therefore, Linton et al. [13] states that the focus of environmental management has moved from the organization level to the supply chain level.

Choi and Hwang [4] states that the implementation of GSCM practices can improve both environmental and financial performance of an organization. As an important new strategy, GSCM allows organizations to achieve financial and market share goals by lowering their environmental costs while ensuring environment friendly operations. Implementing GSCM can benefit the organization as it can be a revenue driver.

4. Green supply change management practices in Thailand

Kamolkitiwong and Phruksaphanrat [14] aimed to identify factors that are critical to the implementation of the GSCM strategy in the electronics industries in Thailand. According to them, manufacturing industries in Thailand focuses study on green supply chain (GSCM) because of the growing pressure from the government and presence of environmental consciousness among customers. The electronics industry plays a significant role in Thailand's economy because electronic industry is highly an export item to international market. There were more than 2,055 electronics companies. Revenues from exporting electronics parts to the international market are 8,143.97 million USD (Industry Economics Situation Report, Thailand, January 2014). The major export markets of Thailand are the United States, European Union (EU), Japan and China, etc. This made many manufacturing organizations to implement GSCM in order to respond to the current

environmental concern and create an enduring competitive advantage [15]. The Ministry of Industry is the primary agency in Thailand who has set strategies for industrial development. The Ministry of Industry has launched a Green Industry to promote the growth and development of industries. Companies who enroll in this project will be certified and evaluated about green considerations in their organizations. As a result, these industries will have a good image of credibility and public trust. Moreover, the creation of a green economy will result in higher gross domestic product [16]. The green industry levels of firms or organizations are divided into five levels as: 1) *Green commitment* 2) *Green activity* 3) *Green system* 4) *Green culture* 5) *Green network* [16].

Their paper studied the main drivers for the implementation of GSCM from 6 experts of the certified electronics factories who obtain a green culture and green network levels in the green industry project. They have found the main factors that influence the implementation of GSCM in the electronics industry in Thailand. According to them, **regulatory is one of the most critical initiating factors for the development of environmental strategy**. The electronics firms possess more experience of international business and faces higher regulatory pressure to initiate green supply chain management than other businesses. So, government should promote the green industry project to create the business opportunities by improving people, increasing knowledge-based, technology, innovation and creativity based on the concept of environmentally-friendly manufacturing industries. This is followed by the second important **factor of getting support from top management in implementation of GSCM** because the attitude of top management toward environmental issues and visions directly affect the organization policy. Thus, top management should be committed to implement environmental policies, encourage employees to be aware of green knowledge, and provide resources for the sanctioning and implementation of environmental projects. The **third factor is market or consumer awareness** which can be increased only through proper education of being environmentally friendly by all concerned individuals. Therefore, innovation, especially green product innovation, should be adopted to meet market demand and gain a competitive advantage. **Another important factor is organization strategy** which is necessary for supporting the implementation of GSCM. In addition, economic benefit, competitors, cost reduction, social/stakeholder, reverse logistics and supplier are the other levels, which are important factors in the implementation of GSCM.

Tippayawong *et al.* [17] made a study on influencing factors of adopting GSCM practices on Thai electronics firm's financial performance using factor analysis and multiple regression analysis for

verifying negative or positive economic impacts. According to them, the GSCM practices concept is introduced for measurement of a firm's competence involving management on environmental performance which is based on combination of green thinking such as green procurement, green design, green manufacturing, green logistics, green consumption and green recycling [18 - 20]. Implementation of GSCM practice is especially necessary in the case of Thai electronics industry with its aim of expanding the opportunities of market share growth in international trade. In addition, it will help in fostering the organization's function effectively so as to meet the customer needs completely, creating a good corporate image as corporate social responsibility (CSR) and so on. Finally, as a result of it, Thai electronics manufacturing firms can cope with challenges from competitors efficiently. Result of performance evaluation from GSCM operations can be used to improve both economic and environmental performance of the organization. In this work, correlation between GSCM practices and financial performance of Thai electronics firms was investigated, based on evaluation of the firms' current operational performance. A survey questionnaire was used as a self-assessment tool designed within the context of Thai electronics industry considering five main areas of supply chain activities (i) procurement, (ii) manufacturing, (iii) transportation and distribution, (iv) reverse logistics, and (v) greening process. The results of their study have extracted three key factors of GSCM practices implementation as: 1) green manufacturing technology practice; 2) green logistics practice and 3) green sourcing strategy.

1) Green manufacturing technology practice is the most important factor for the successful implementation of electronics industry in Thailand as it affects operating achievement based on green supply chain. It emphasizes importance to an organization's component in setting systematic manufacturing and technology in order to reduce the waste production or fulfill its highest capability along with steps to create a friendly environment.

2) Green logistics practice is the second key factor where reverse logistic will concentrate on properly receive raw material back from customers due to hazardous and durable wastes control. Electronics industry products are related to metal, lead, iron, colorant and chemicals which are persistent and threat to environment. In order to improve the procedure in green supply chain management, eco-design should be involved in every step of activities inside the factories or organizations and so on.

3) Green sourcing strategy is the least important factor in Thailand. In this factor, all details in manufacturing process will be regarded beneficial to procurement with focus on raw material acquirement and packaging which can be recycled or reused. It was found that both the green manufacturing practice and

the green logistics practice were strongly correlated with financial performance, but the green sourcing was not. Cost and complexity appeared to be the major obstacle to implementation of a successful GSCM. As a result, more cost effective and easier-to-implement solutions are still needed for future economic and environmental sustainability of the industry.

Ninlawan *et al.* [21] made a study by surveying current green activities in computer parts' manufacturers in Thailand so as to evaluate green supply chain management. They have selected 11 manufacturers for case studies with in - depth interview about green procurement, green manufacturing, green distribution, and/or reverse logistics. They have used questionnaire which aimed to investigate GSCM practices, measure, performance, and pressure or driving factors within Thai electronics industry. Their green activities can be discussed as:

1) Green procurement

Green procurement is defined as an environmental purchasing activities such as reduction, reuse and recycling of materials in the process of purchasing. Green procurement is a solution for environmentally concerned and economically conservative business, and a concept of acquiring a selection of products and services that minimizes environmental impact [22]. Their findings with regard to the green procurement activities of Thai manufacturers are presented as:

1.1 Supplier selection: (1) purchase materials or parts only from "Green Partners" who satisfy green partner environmental quality standards and pass an audit process in following regulations for the environment-related substances (2) consider suppliers who acquire ISO14000, OHSAS18000 and/or Restriction of Hazardous Substance Directive (RoHS) directives (3) select suppliers who control hazardous substances in company's standard lists and obtain green certificate achievements.

1.2 Rs in procurement process: (1) reuse or recycle – paper, parts container (plastic box/bag) (2) order via email (paperless).

2) Green manufacturing

Green manufacturing is defined as production processes which use inputs with relatively low environmental impacts, are highly efficient having generated little or no waste or pollution. Green manufacturing can lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image [23]. The findings in green manufacturing activities of Thai manufacturers are presented as:

2.1 Hazardous substance control: (1) lead free – replace other substances such as bismuth, silver, tin, gold, copper (2) rinse parts with clean water instead of using chemicals and reuse water (3) quality control in inputs at vendor site and recheck before processing.

2.2 Energy-efficient technology: (1) reduce power consumption in products such as ramp load/unload technology in HDD (2) increase product life-span resulting in higher efficiency and productivity (3) improve machine uptime (4) improve machine performance, (5) design product, for example compact design with improved features yet using fewer resources to produce.

2.3 Res and waste minimization: (1) promotes reuse/ recycle of parts (2) enhance environmental consciousness through 3Res activities (3) reduce indirect materials such as epoxy glue.

3) Green distribution

Green distribution consists of green packaging and green logistics. Packaging characteristics such as size, shape, and materials have an impact on distribution because of their effect on the transport characteristics of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and in the trailer, and this led to reduce the amount required of handling. The findings in green distribution activities of Thai manufacturers are presented as:

3.1 Green packaging: (1) downsize packaging; (2) use "green" packaging materials; (3) cooperate with vendor to standardize packaging; (4) minimize material use and time to unpack (5) encourage and adopt returnable packaging methods; (6) promote recycling and reuse programs [24].

3.2 Green logistics/transportation: (1) deliver directly to user site; (2) use alternative fuel vehicles; (3) distribute products together (4) change to modal shift.

4) Reverse Logistics

Reverse logistics is the process of regaining the product from the end consumer for the purposes of controlling value or getting rid of it properly [1]. The findings in reverse logistics of stakeholders are presented:

4.1 Used computer stores: (1) get computer parts 50% from import (e.g. China, Japan and Korea), 30% from auction in organizations, and the rest from household (2) generally be small shops with purchase volume up to 40 used computers per month (3) the five most reused parts: ram, LCD monitor, CD Rom, CRT monitor and main board (4) waste parts treated in different ways: 44% to waste collectors, 26% to walk-in buyers, 26% to store in shop or warehouse, and the rest 4% to garbage.

4.2 Waste collectors gather EOL (End of Life) computers from community, private/public organization, and used computer store then inspect, select and sort initially to get used parts which are shipped to disassembly/recycle plants. There is lack of obvious database about quantities and value provided in this stage.

4.3 Disassembly/recycle plants collecting used computers and parts.

4.4 Final treatment or landfill company. The facility has industrial waste treatment and disposal systems for computer waste by secured landfill or stabilization and solidification systems (a process of detoxification and converting waste into a solid form before disposal in the landfill).

In addition from their survey findings, it is found that Thai electronics supply chain enterprises carry out to some degree of GSCM practices' adoption with mean values over 4.00 for the five GSCM factors; especially for environmental management systems exist with the highest mean value of 4.43. Electronics enterprises have experienced significant pressures and incentives to implement GSCM, with mean values over 4.00 for the two driver factors. Pressure from environmental regulations is the highest with a mean value of 4.11. Export pressure is the second important driver for Thai electronics supply chains to implement GSCM. All GSCM performance dimensions are ranked from higher to some degree to relatively significant, with mean values consistently within the 3.00 and 4.00 ranges. Both environmental and positive economic are in relatively significant. The survey was also extended to study in-depth in each type of computer parts. For GSCM practice, semiconductor, hard disk drive, and print circuit board are three products with carrying out from some degree to full adoption. Hard disk drive and print circuit board reveal relatively significant in GSCM performance.

Wallerius and Zakrisson [20] consider the environmental maturity to be low in Thailand where there is no awareness of the personal or a business effect to the environment. However, the price and delivery are an important aspects when placing orders or choosing subcontractors in Thailand. Therefore, the concept of SCM is rarely known among TEEI (Thai Electrical and Electronics Industry). Even though SME education and implementation of SCM is spreading but still it does still not affect the majority of companies. As a result, GSCM is hardly known or implemented in Thailand. They have suggested some measures for the improvement such as: legislations in the area of environmental effecting procedures, increasing the general awareness and understanding of the importance of green activities, both from customers and companies. Education is another key for this. To motivate companies to implement GSCM, environmental awareness and awareness of GSCM concept along with successful examples from those around the world and in Asia today who have gained advantage from GSCM such as in matter of setting the rules for companies with respect to accepted emission, waste handling etc. are required General awareness of environmental problems will lead to better understanding of the importance of green activities, both from customers and companies. Their study presented a 5-step-model practices which the companies who follow it can seek to gain knowledge in the area of GSCM and move forward to the

maturity level, thereby guiding the way to begin the movement for a greener SCM.

5. Conclusions and suggestions

From the above reviews of the study in Thailand and elsewhere, it was found that most of the studies were undertaken to find the factors that were critical for the implementation of the GSCM strategy of the electronic or electrical industry in Thailand in order to help the newcomer in electronic industry who wants to implement GSCM successfully. This study can be used as a guideline for other industrial sectors. It is found that regulatory is one of the most critical factors, followed by support from top management, market/consumer and organization strategy. In addition, government should promote the green industry project to create the business opportunities by improving people, increasing knowledge-based, technology, innovation and creativity based on the concept of environmentally-friendly manufacturing industries. Another crucial factor is organization strategy which is necessary for supporting the implementation of GSCM. In addition, economic benefit, competitors, cost reduction, social/stakeholder, reverse logistics and supplier are the other levels, which are important factors as they may influence to the implementation of GSCM in the industries of Thailand.

GSCM practice implementation is important in the case of Thai industry with its aim of expanding the opportunities of market share growth in international trade, making the organization's function effectively to meet the customer needs completely, creating a good corporate image as corporate social responsibility (CSR) and so on so that Thai manufacturing organizations can cope with challenges from competitors efficiently. Lastly, the review have also extracted another three key factors of GSCM practices implementation as: 1) green manufacturing technology practice; 2) green logistics practice and 3) green sourcing strategy. The major limitation or obstacle in the GSCM implementation appeared to be cost and complexity. Thus, it can be concluded that result of performance evaluation from GSCM operations can be used to improve both economic and environmental performance of the industry or organization.

As general environmental awareness status in Thailand is in the nascent stage, there is no awareness of the personal or a business effect to the environment and so the concept of GSCM is rarely known. SME education and implementation of SCM is spreading but still it does still not affect the majority of companies or organizations. It can be suggested that legislations in the area of environmental effecting procedures are required along with the program and policy to bring general awareness and consideration of environment so as to better understanding of the importance of green activities, both from customers

and companies or organizations. Green education is an important key for this. More cost effective and easier-to-implement solutions are still needed for future economic and environmental sustainability of Thai industry. Generally, it is recommended that manufacturing organizations should adopt environmental sustainability as a strategic imperative and expand existing enterprise information system capabilities to monitor environmental sustainability activities and outcomes prior to implementation of GSCM practices. Further, it is also suggested that successful implementation of GSCM practices such as green purchasing, cooperation with customers, eco-design, and investment recovery will lead to improved environmental and economic performance which support improved operational and organizational performance [25]. Lastly, it can be suggested that in an increasingly competitive and dynamic global business environment, manufacturers can seek benefits from investing in GSCM by collaborating with suppliers who implement green standards. On the whole, it can be concluded that organizations that implement GSCM practices by building close relationships with their partners can obtain higher financial outcome through communication, coordination, and conflict resolution processes

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