

Green supply chain management

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Abstract

Purpose – Misconception of issues surrounding green supply chain management (GSCM), as well as a paucity of relevant information on the tangible benefits of GSCM practices in organizations was justification for this literature review. The paper aims to discuss this issue.

Design/methodology/approach – The study has been conducted by analyzing and critiquing secondary data obtained from numerous sources of similar subject. The research topic has been examined in detail.

Findings – The outcomes provide an overview of what GSCM practices entail, strategies successful companies have used to incorporate GSCM practices within their organizations and its impact on the industry.

Research limitations/implications – The research conducted in this study is limited to one country, i.e. Canada, and as such further research should be carried out by incorporating a larger array of participants so as to obtain a more generalized conclusion.

Practical implications – The study contributes to an understanding of the importance of GSCM practices on not only the economic success of a business, but the positive effects on the environment. The results will help in the reduction in emissions of carbon dioxide and other green house gases, thus impacting on climate change.

Originality/value – Despite increasing awareness, the implementation of GSCM techniques continue to be deterred by lack of government initiatives and commitment of companies involved in the supply chain. Unless it is given precedence, the benefits of GSCM will continue to elude us. This study provides an opportunity to study a model which has met with critical success, rejuvenate it and consequently mandate its adoption in efforts to attain sustainability.

Keywords Sustainability, Industry, Supply chain

Paper type Literature review

Corrigendum

It has been brought to our attention that Zaffar Khan was not named as an author of “Green Supply Chain Management” which was published in World Journal of Entrepreneurship, Management and Sustainable Development, Volume 11, Issue 1. This occurred through an author error. The authors sincerely apologise for this. The additional author attribution for this article has now been added to the electronic version of the article.

Introduction

Green supply chains by 2020 - Put supply chains on the global political agenda by mandating efficiency and ecology (Jacoby, 2010a).

The twenty-first century has seen the evolution of supply chain management (SCM) into a system that is more cognizant of our natural environment and the potential negative impacts our activities have on it. Jacoby's article on “Green supply chains by the year 2020” emphasized that efficiency and ecology should be mandated at a global level and called for green supply chains (GSC) to be made a part of nations “political agenda” (Jacoby, 2010a).



However, despite increasing awareness, not all organizations have fully embraced green supply chain management (GSCM) due to a number of factors. As well as a lack of government initiatives, some are unaware of how to implement GSCM practices within or between their organizations, while others are slow on the uptake because of misconceptions surrounding GSCM. Indeed, the evolution of SCM into the green SCM, i.e. GSCM will require the commitment of companies involved in the supply chain, as well as the respective governments to set in motion the necessary steps to result in GSCM, as evidenced by Canada's success (Industry Canada, 2013).

Ambiguities surrounding GSCM have transpired due to lack of recent and relevant literature on the tangible benefits reaped by those companies that have successfully implemented GSCM techniques in their operations. Consequently, Industry Canada together with the Supply Chain & Logistics Association Canada (SCL) and the Retail Council of Canada worked in conjunction in order to research GSCM practices and their business benefits in Canada. Industry Canada (2013), expounded that "investments in green SCM should be supported by a legitimate business plan with the returns on investment clearly outlined." In addition, David Jacoby's input on September 2010 spoke of "credibility and blending of vision, realism and competence" in revolutionizing the SCM into a more dynamic and sustainable system.

This literature review will focus on what is GSCM, its evolution and benefits, the reasons for its lack of implementation in organizations, the strategies successful companies have used to incorporate GSCM practices within their organizations and the impact GSCM has made holistically.

What is SCM

SCM is an integration of planning, analyzing, coordinating and scheduling of every activity involved in "sourcing and procurement, conversion and logistics management activities" (Council of Supply Chain Management Professionals, 2008). It necessitates an alliance among resource suppliers, merchants, middlemen, third-party service providers, agents, distributors and customers. According to the Council of Supply Chain Management Professionals (2008), SCM is the desegregation of "supply and demand management within and across companies" into a cohesive and high-performing business model which encompasses all logistics management activities and manufacturing operations, as well as drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology.

What is GSCM

Wang and Gupta (2011) established that supply chains can truly become green when it is integrated throughout every aspect of the value chain. GSCM is the coadunation of the regular SCM with environmental awareness, an emphasis on green productivity and decrease in environmental impact during each link in the value chain by:

- (1) reducing energy consumption;
- (2) reducing consumption of natural resources;
- (3) reducing pollution-related problems; and
- (4) increasing recycling to harness the further use of raw material and supply.

Generally, GSCM should augment the activities of reverse logistic management, i.e. integration of all aspects of environmental management into its domain, (Wang and Gupta, 2011).

GSCM, according to Industry Canada (2013) “includes introducing technical and innovative processes into materials sourcing and selection, delivery of the final product to consumers, and end-of-life product management.” Essentially, GSCM should be accomplished from the initial phase of product design and raw material acquisition, continue throughout the various manufacturing stages, the delivery and distribution of the end-product to the customer and until the final stage, i.e. disposing of the used product.

Evolution of SCM to GSCM

Over the past few decades SCM has proven to have potential for reduction in cost while adding value in the supply chain via green initiatives. GSCM developed as a result of escalating prominence of environmental concerns, evolving mainly from the desire of industries to incorporate extended production responsibility within their operations (Wang and Gupta, 2011). Opportunities arose for reviewing processes, materials, and operational concepts from a different perspective.

GSCM practices, inadvertently, have been implemented in several arenas since the 1980s (refer to Figure 1). Case in point, the development of environmentally friendly goods in 1988 saw the initiation of GSCM practices. In the drive toward sustainability three areas were given focus:

- (1) dematerialization;
- (2) detoxification; and
- (3) Decarbonization.

which lead to the derivation of the 4R's, i.e. reduce, reuse, recycle and redesign.

Also in the 1980s, the international organization for standardization developed the ISO 14020 and ISO 14024 which prescript environmental labels and declarations that certifiers and eco-labellers utilize. Standards were established geared toward the

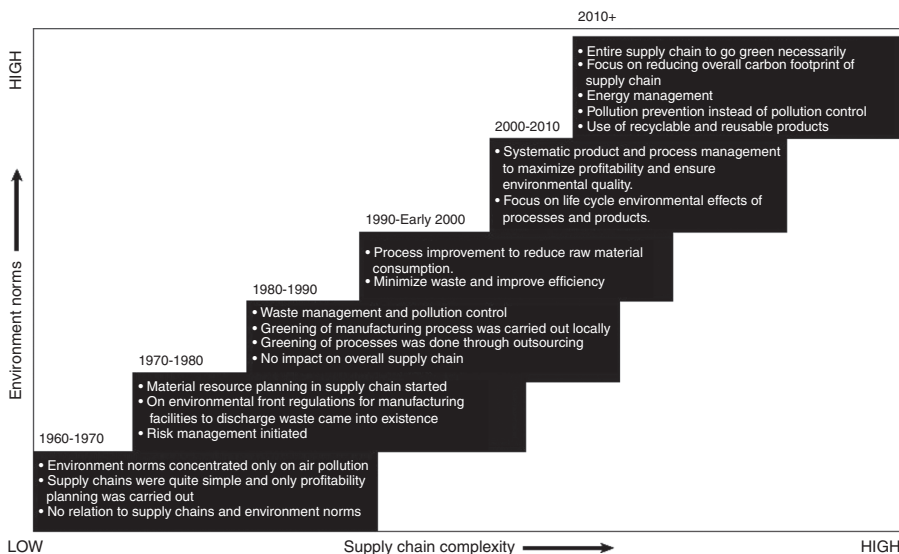


Figure 1.
Evolution of the green supply chain

Source: Wang and Gupta (2011)

decrease of carbon and greenhouse gas (GHGs) emissions such as the restriction of hazardous substances, end-of-life vehicle and the waste electrical and electronic equipment standards (Wang and Gupta, 2011).

What GSCM practices entail

Jacoby conveyed that “for decades, companies have been doing everything possible to improve efficiency both within and between organizations” (2010). He supported his claim with the fact that some trucking companies had outfitted their fleet with global positioning systems to facilitate “the reduction of empty miles through more scientific routing” (Jacoby, 2010a,b). This led to an upsurge in economic growth among those companies.

However, more could be accomplished in alternative arenas of the supply chain in efforts to enhance its sustainability. As Jacoby conversely affirmed, the same measures undertaken by trucking companies and the shipping industry had “reached a point of diminishing returns in optimizing their own network” (Jacoby, 2010a,b) which was further compounded by energy inefficiencies and pollution woes.

Ideally, GSCM should commence at the very start of the supply chain, i.e. from the procurement of raw materials, and continue throughout every phase including the afterlife or discarding of the product. Together with an increase in product recycling, Wang and Gupta espouse that “GSCM should augment the activities of reverse logistic management” (2011) to incorporate due diligence in every dimension of the product life cycle. Manufacturers now make sure that components are where they are needed on the production line no longer than necessary and just in time for when they are to be utilized.

Wang and Gupta (2011) put forward a framework of a GSC (see Figure 2) which illustrates the linkages between forward and reverse activities together with their corresponding directives.

The model clearly indicates that GSCM begins at the procurement/sourcing of raw materials phase before extending to the product development stage, and the amount of energy and material utilized in particular; as well as the amount of pollution resulting from the distribution and disposing of the product after it has run its useful course.

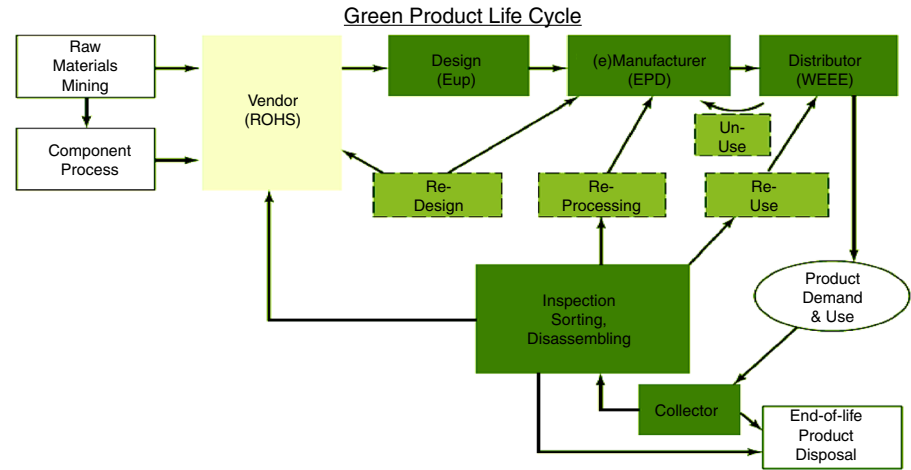


Figure 2.
Green supply chain
with linkages
between forward and
reverse activities
together with their
corresponding
directives

Source: Wang and Gupta (2011)

Industry Canada summed up the activities involved in the practice of GSCM on its web site. These activities include:

- green procurement practices;
- energy efficiency;
- reduction of GHG emissions;
- water conservation or processing;
- waste reduction;
- reduced packaging/increased use of biodegradable packaging; and
- product and packaging recycling/re-use (Industry Canada, 2013).

Benefits of GSCM

Why is implementing GSCM practices important? Companies that do employ sustainability in and within their supply chains stand to attain a multitude of benefits. Stakeholders including consumers, employees, society, and government, etc. are subjected to the advantages of GSCM. Benefits can be categorized under two main headings; Environmental and Business.

Environmental benefits

- improvement in energy reduction;
- waste reduction;
- decrease in GHG emissions;
- reduction in pollution;
- less packaging in distribution activities;
- water conservation;
- increased energy efficiency;
- improved processing operations; and
- reduced toxic chemical released into waterways.

Companies have the opportunity to diminish the amount of GHG emissions, wastage energy as well as materials used by executing simple environmentally friendly applications such as investing in LEED-certified or BREEAM-certified green buildings. This can subsequently attain those organizations Carbon credits which can be profitable as well.

Business benefits

- increased profitability;
- competitive advantage;
- reduced cost – production, operation and distribution costs;
- improved value to operations;
- greater distribution of goods and services;
- increased product and service differentiation;

- access to foreign markets;
- improved customer service and retention;
- enhanced risk mitigation and management of environmental, social and market risks;
- improved distribution efficiency;
- optimize utilization of assets;
- reduction in transit times;
- improved inventory;
- increased innovation and reliability;
- alliances and alignments between suppliers and customers;
- improved continuity of business;
- refined reverse logistics;
- enhanced reputation;
- successful compliance processes;
- lowered compliance cost;
- avoidance of payment of non-compliance penalties and fees; and
- enhancement of relationship with legal and government agencies.

Environmental conservation can be harmonious with achieving the triple bottom line. Like a closed-loop, as more consumers become environmentally conscious, they will tend toward products of those companies which practice GSCM, thus giving such companies the competitive advantage, increased profitability and enhancing their corporate image. This will consequently impel other businesses to undertake sustainable practices.

Examples of successful GSCM practices

The myriad of benefits to be gained, both in the short-term and long-run, can be realized by undertaking planned and supported methodologies. The following are true success stories of companies that support and utilize green SCM practices.

Simpson and Samson (2008) claimed that organizations have introduced “greening” prerequisites to “both upstream and downstream activities in the supply chain” thus forcing them into sustainable SCM implementation. For example, “Ben and Jerry’s require raw material suppliers to meet guidelines for sustainable farming” (Simpson and Samson, 2008), which impelled these suppliers and farmers to adopt green initiatives from early stages of SCM.

Dell transformed the way people bought and were able to customize computers. Hewlett Packard (HP) reduced the size of their packaging in order to “reduce transport cost, better utilize shelf space, and reduce carbon footprint” (Jacoby, 2010a,b). HP, Kodak and Xerox roles in GSCM was to increase their respective investments in recycling of their products, creating and managing systems which were responsible for both the retrieval of waste and used products from customers for remanufacturing purposes. In return, this helped the companies, Xerox in particular, to save hundreds of million dollars annually.

Schlumberger adopted the strategy of providing its products and services in a single package. Through its acquisition of Smith International the consequence of the bundling strategy was to increase the value offered to customers as opposed to how either product would have done as stand-alone.

GSCM drivers and adoption

Increasing global awareness of climate change, pollution and other environmental impacts as a result of our industrial activities has been an impetus toward implementing green initiatives within the SCM. In addition, the volatile state of the global economy can contribute to companies going green. Businesses will be driven to embrace GSCM techniques that ultimately “confer both a positive Net Present Value (NPV) and environmental benefits” Industry Canada (2013). That is, they will strive to minimize cost as well as maximize profit via sustainable measures.

Some manufacturers called for GSCM mandates to be made by the government and to be implemented within the industry in Canada, while others encouraged GSCM practices within their organizations under their own impetus. These mandates were responsible for encouraging businesses to ameliorate their operations by becoming more energy efficient, reducing wastage and pollution, decreasing GHG emissions and promoting recycling and use of biodegradables in their activities.

Enhanced compliance processes and standards were also used as drivers toward GSCM among companies. Packaging regulations, together with recycling standards that were reflective of the international conventions propelled businesses to implement sustainable practices and rewrite their policies to fit.

In efforts to differentiate themselves as unique among consumers, become or retain a competitive edge both domestically and internationally, Canadian companies “continually introduced new and improved processes and technologies” (Industry Canada, 2013).

Increased cost of energy compounded by high transportation cost was responsible for the adoption of GSCM by some Canadian businesses. Nonetheless, the majority of these businesses belong to the transportation sector, i.e. the logistics and transportation service providers who are impacted negatively by high costs associated with transportation (Industry Canada, 2013).

Impact of GSCM on industry

As a result of being ratified by a growing number of countries and organizations worldwide, GSCM has impacted on several facets of the industry, not just on the tactics and administrative aspects, but on the type and level of interactions between customer, supplier, company and manufacturer.

Wang and Gupta explained that the potential impact of a product on the environment throughout its life can be assessed using life-cycle assessment (LCA) (2011). The main purpose of LCA is to help “identify the measures that ensure the components and design of the product satisfy environmental standards” (Wang and Gupta, 2011). This resulted in the collaboration of companies involved in the production of various components of a product (e.g. motor vehicles) in creating international standards, which must be met by each supplier in its value chain.

Silicon Valley, famous for its electrical and electronics industries has been influenced to introduce standards specific to the “control of use of several hazardous materials” (Wang and Gupta, 2011). However, standards which are made in the USA tend to differ to those from the UK as well as Europe, etc. Hence, an international technical standard, SS-00259, was developed by SONY so as to ascertain a fixed

value was adhered to by all parties in the value chain, regardless of its country of location. The industry itself has responded to GSCM practices by encouraging the certification of suppliers who conform to regulations and standards.

GSCM has also left its mark on industrial administration. Internet technology plays an increasingly immense part on the management of each system, regardless of it being information management, process operating systems or verification of work, etc.

In order to better understand the customer's needs and wants there is now increased interaction between the customer and the supplier. This helps save cost and "provides an opportunity for future product development" (Wang and Gupta, 2011). This has also lead to an enhancement of innovative efforts, as well as collaboration between the company and supplier responsible for creating the product to ensure that it conforms to the environmental standards.

With increased environmentally friendly practices being implemented in organizations, a body or agency which can conduct green audits to ensure standards are being kept would need to be established.

Challenges – why GSCM not more greatly implemented

As a result of GSCM adoption and globalization, the competition has become fierce. While many industries are recognizing and embracing the smorgasbord of opportunities made possible because of green initiatives, others are having difficulty endorsing GSCM. Five major challenges were identified as to why GSCM is not more greatly implemented (refer to Figure 3).

Despite the overall benefits of GSCM, the global economic crisis has set a spoke in the wheels where GSCM implementation is concerned. Not all companies found GSCM attractive due to the high costs of monitoring and managing green SCM practices, particularly for businesses with branches in multiple locations (Industry Canada, 2013). Industries are compelled to make stringent decisions about their day-to-day operations and have put GSCM on the back burner, deterring any investment in implementing green initiatives. However, as will be elucidated later, GSCM does not necessarily require a high investment. Also, as Jacoby stipulated "Governments need to take the next step in revolutionizing the supply chain either by mandating efficiency or by supporting GSCM through aggressive subsidies and tax breaks" (Jacoby, 2010a,b). In addition, supply chains will need to become more flexible in order to combat cost volatility.

Although the age of the internet has allowed for greater connectivity and abundance of information, a lack of visibility still exists as a challenge to GSCM practitioners. This is because of "incompetent use of information, lack of collaboration due to

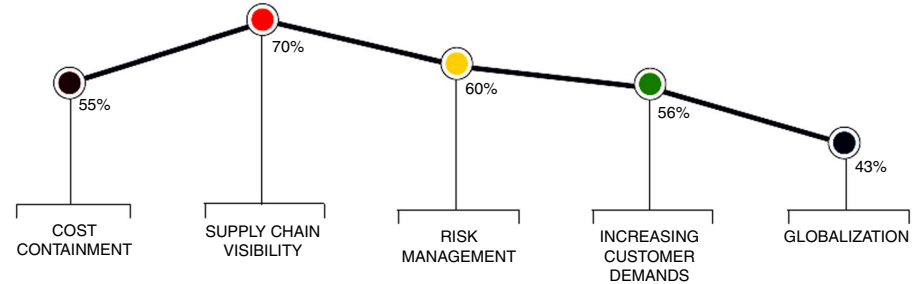


Figure 3.
Five challenges
facing GSCM
implementation

Source: IBM (2013)

companies being too busy to share relevant information or because of intellectual property concerns” (IBM, 2013). Another source of hindrance to sharing of information is limited internet speed and access. This has resulted in the “impediment of the spread of wireless optimization technologies such as active RFID tracking and yard management” (Jacoby, 2010a,b).

Supply chains are collaborative ventures that require partners to share information in order to maximize efficiency within the supply chain. As Jacoby pointed out, “collaboration is important” (2010), however, individual companies, more often than not, had their own interest or benefit at heart. To deal with this issue, greater efforts at collaboration are being implemented. In addition, collaboration with strong partners who display “leadership, vision, realism and competence” (Jacoby, 2010b) is emphatically supported. Yet, few companies demonstrate these qualities simultaneously. For example, General Motors (GM) failed for decades to implement lean manufacturing due to a lack of vision of where the company was heading. True supply chain leaders adopt a risk-seeking attitude, albeit smart and well-informed, while employing the right tools and data for the job (Jacoby, 2010a,b).

Governments’ lack of proper initiative, planning and investment need to be addressed before companies implement GSCM. In accordance with Jacoby’s take on GSCM by 2020, inadequate infrastructure continues to be a key issue preventing the uptake of green SCM. In several countries and in many different ways, the infrastructure is in need of a massive overhaul and/or of being increased; it represents “a significant opportunity for supply chain optimization because of its inefficiency” (Jacoby, 2010a,b). Failure to take into account the impact of infrastructure investments on supply chains by governments can result in hindering a nation’s economic competitiveness. Traffic congestion and delays are perpetual encumbrances to the unregulated competition of imports with products that are domestically produced. Consequently, the onus is on governments and other relevant authorities to invest in enough sidewalks to enable private sector carriers and terminal operators more accessibility. The use of supply chain multipliers by government can assist them to evaluate the future infrastructure investments needed to ensure sustainability.

Along with an increase in environmental awareness, the intricacy and scale of GSC technologies have also increased (Wang and Gupta, 2011). While some countries were quick to adopt environmental protection sanctions within their respective regulatory framework, these standards vary from country to country. The lack of consistency between countries’ standards is a hindrance to employing GSCM within firms. For instance, vehicles are still manufactured according to less than substantial standard and inefficient fuel standards. Failure by companies and industries to accept these laws has resulted in a lack of cooperation to incorporate them in their original design manufacturing and original equipment manufacturing (Wang and Gupta, 2011).

A large number of small companies do not have access to the funds, tools or data necessary to manage their supply chain effectively. As a result, “customer data, shipments, routing and scheduling, and production” (Jacoby, 2010a,b) are managed using non-universal spreadsheets and incomplete and disjointed databases, thus resulting in poor SCM. A more synchronized affair needs to be initiated before these firms can truly embrace GSCM.

Strategies to implement GSCM

Opportunities exist for significant economic growth by having GSCM systems in place. However, it requires government intervention on a global scale. Generally, “governments need to set aggressive and worldwide targets for corporate average

fuel economy for oceangoing vessels, aircrafts" (Jacoby, 2010a,b), as well as other modes of transport. Appropriate and effectual incentives for companies meeting international targets, either via purchasing of efficient vehicles or employing sophisticated logistics and transportation techniques in their operations should be instigated. As Jacoby (2010a,b) stipulated "governments should provide subsidies and other tax incentives to help make supply chains truly green." Cogent incentives and tax credits should be awarded to companies that support green initiatives.

The transformation of supply chains to a more sustainable paradigm depends on "an extraordinary amount of resources, time and collaboration with customers and suppliers" according to Jacoby (2010a,b). However, it is possible to execute GSCM without necessitating intensive investment of capital or resources. Simple measures like ensuring the use of only recyclable materials in SCM can have immense repercussions; suppliers along the chain are then expedited to transform their operations to greener ones, whether by optimizing packaging or using biodegradable materials in their activities.

Jacoby pointed out the importance of partnerships, but stressed especially on strong alliances since GSCM leaders needed to portray a combination of "vision while demonstrating realism and competence" (Jacoby, 2010a,b). GE, for example, proved to be an excellent partner, because of its bold vision, smart risk-taking capabilities and using the right information and tools to accomplish the task. On the other hand, GM and Wal-Mart had difficulties in adopting GSCM practices at the onset because of lack of vision, together with unrealistic expectations of time and cost associated with employing per durability.

One of the simplest strategies of GSCM is risk minimization which is appropriate for companies just starting to undertake GSCM. On the other hand, efficiency-based strategies are more complex and based on environmental performance and efficiency through reducing the use of waste and resources in the supply chain. Although the benefits of the former are limited due to lack of uniqueness and ease of implementation, the latter strategy has the potential to reduce cost and can be readily integrated into the pre-existing organizational goals (Simpson and Samson, 2008).

Another strategy is innovation-based which is "more environmentally specific" (Simpson and Samson, 2008) than that of the efficiency-based technique. This entails a greater accounting of "comprehensive product life-cycle for consumers. According to Simpson and Samson (2008) innovation-based mechanisms require the "keeping up-to-date of environmental legislation."

Closed-loop strategies aka reverse logistics, have been more recently developed and involves the "capture and recovery of materials for re-manufacturing or recycling processes" (Simpson and Samson, 2008). According to Simpson and Samson, the "closed-loop strategy is a seamless integration of issues of economic, operational and environmental performance" (Simpson and Samson, 2008) designed to facilitate the disposal of the product.

Conclusion

With increasing global concern pertaining to environmental preservation GSCM is attracting greater attention in almost every sector. Businesses and organizations not only exist to make a profit; each is responsible for its sustainability in a manner that is environmentally aware and eco-friendly. The relationship between businesses and the environment is one of interdependency; businesses can be sustained only if the environment is sustained. Thus, implementing GSCM practices can salvage the latter which can, in turn, enable the continuance of a business.

More and more, industries are embracing the tenets of sustainability as a result of socially influenced governance, employing new technologies in the quest for green innovation. Green standards are being set throughout every aspect of the value chain and product life-cycle. Organizations are strictly adhering to these green standards to ensure the sustainability of their companies. Developed around environmental requirements and future trends, the GSCM framework has opened up novel opportunities in the industry.

Although organizations have faced many challenges in trying to adopt GSCM practices over the years, some have emerged more successful today than previously. By opting to utilize eco-friendly yet less costly techniques in the supply chain, they have increased their efficiency and improved their environmental performance, while increasing growth within their supply chain (Industry Canada). These organizations are establishing themselves as competent, confident and, moreover, visionary leaders (Jacoby, 2010a,b) as they forge the way forward in green product development; embracing the copious opportunities afforded at a global level as a result of employing GSCM.

References

- Council of Supply Chain Management Professionals (2008), *Supply Chain Management*, Council of Supply Chain Management Professionals.
- IBM Corporation (2013), *The Smarter Supply Chain of the Future Global Chief Supply Chain Officer Study.pdf*.
- Industry Canada (2013), *Logistics and Supply Chain Management Green Supply Chain Management: Retail Chains and Consumer Product Goods – A Canadian Perspective*, Industry Canada.
- Jacoby, D. (2010a), “Green supply chains by 2020”, *Logistics Digest* 34, August.
- Jacoby, D. (2010b), “Leading supply chain transformations with credibility: blending vision, realism and competence”, *Logistics Digest* 34, August.
- Simpson, D. and Samson, D. (2008), “Developing strategies for green supply chain management”, *Decision Line*, Vol. 39 No. 4, pp. 12-15.
- Wang, H.-F. and Gupta, S.M. (2011), *Green Supply Chain Management Product Life Cycle Approach*, McGraw-Hill Professional, New York, NY.

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