The attached educational project, by EMILY ANN GRAY, entitled THE DESIGN AND INTEGRATION OF GREEN SUPPLY CHAIN MANAGEMENT FOR ORGANIZATIONAL PERFORMANCE, when completed, is to be submitted to the Graduate Faculty of the University of Wisconsin-Platteville in partial fulfillment of the requirements for the (MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT) degree.

Approved: Xiaotong Liu Date: 08/10/2019

Project Advisor

Professor Xiaotong Liu, PhD

Suggested content descriptor

keywords:

Green supply chain, metrics,

operational performance,

environmental sustainability
A Seminar Paper

Submitted to

the Graduate Faculty of the

University of Wisconsin - Platteville

in Partial Fulfillment

for the Degree of

MASTER OF SCIENCE IN INTEGRATED SUPPLY CHAIN MANAGEMENT

By

EMILY ANN GRAY

Year of Graduation: Fall 2019
Abstract

This seminar research paper will focus on the design of green supply chain operations and the process of integrating green practices that add value to organizational performance metrics. Although green initiatives can be applied in many areas of the supply chain process, it will primarily be centered on eco-friendly design, green purchasing, green sourcing, green transportation, and reverse logistics. Designing and integrating green supply chain practices into an organization’s business operations offer numerous benefits on performance metrics including cost savings, reduction in waste, and increased competitive advantages. Organizations often face challenges with green supply chain initiatives due to uncertainty, lack of experience, and costs. The research and conclusion from this paper will present design methods of green supply chain practices, evidence of positive impacts on performance metrics, and measurable benefits of green supply chain implementation.
Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPROVAL PAGE</td>
<td>1</td>
</tr>
<tr>
<td>TITLE PAGE</td>
<td>2</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>3</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>4</td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>5</td>
</tr>
<tr>
<td>1. Statement of the Problem</td>
<td></td>
</tr>
<tr>
<td>2. Purpose of the Study</td>
<td></td>
</tr>
<tr>
<td>3. Significance of the Study</td>
<td></td>
</tr>
<tr>
<td>II. LITERATURE REVIEW</td>
<td>9</td>
</tr>
<tr>
<td>III. METHODOLOGY</td>
<td>13</td>
</tr>
<tr>
<td>IV. DISCUSSION</td>
<td>14</td>
</tr>
<tr>
<td>1. Definition of Green Supply Chain Management</td>
<td></td>
</tr>
<tr>
<td>2. Significance of GSCM Implementation</td>
<td></td>
</tr>
<tr>
<td>3. Obstacles of GSCM Implementation</td>
<td></td>
</tr>
<tr>
<td>4. Green Supply Chain Design</td>
<td></td>
</tr>
<tr>
<td>5. Organizational Performance</td>
<td></td>
</tr>
<tr>
<td>V. CONCLUSION</td>
<td>30</td>
</tr>
<tr>
<td>VI. REFERENCES</td>
<td>32</td>
</tr>
</tbody>
</table>
Design and Integration of Green Supply Chain Management for Organizational Performance

Emily Ann Gray

Under the Supervision of Professor Xiaotong Liu

**Introduction**

**Statement of the Problem**

In recent years, the subject of Green Supply Chain Management (GSCM) has increasingly become a hot topic issue as organizations develop operational strategies that respond to the world’s environmental challenges. GSCM is defined as “the integration of environmental considerations in supply chain management (SCM), including product design, the selection and outsourcing of materials, manufacturing process, delivery of the final product to consumers and managing the disposal of the product at the end of its life cycle” (Srivastava, 2008; Drohomerefski, Gouvea, & Pinheiro, 2014). The growing significance of GSCM can be attributed to changes in customer attitude and behavior due to news coverage on climate change, degradation of the ecosystem, the decline in raw material resource availability, overfilled waste sites, and high levels of air, water, and land pollution (Srivastava, 2007).

As a result of evolving environmental issues and consumer behavior, organizations have recognized the importance of establishing competitive advantages through a robust design and integration of GSCM practices that have a positive impact on operational performance (Rao & Holt 2015; Srivastava, 2007). Economic globalization has also prompted firms to cultivate inter-organizational collaboration to gain advantages due to heightened risks in global supply chains (Lee, Kim, & Choi, 2012) and disparate environmental regulations and policies between regions and countries. In addition, stricter laws along with severe penalties is a driving force for
companies to implement GSCM initiatives which vary from a reactive management approach to changing regulatory requirements to a more proactive management approach that is focused on reducing waste, reusing material, refurbishing products, recycling, remanufacturing, and reverse logistics (Srivastava, 2007).

**Purpose of the Study**

The primary purpose of this research project is to motivate organizations to begin examining their current (or lack of) green supply chain management initiatives, what strategies must be implemented to become a greener organization, the approaches that should be taken to link the strategies into the organizational performance metrics, and how to measure the significance of its impacts. The contribution of this study should significantly influence how organizations think about green supply chain management and its substantial value to the organization’s competitive advantages and bottom line as well as the support that it needs from top management for the implementation to be successful. “[E]stablishing inter-organizational collaboration is essential to gain competitiveness, especially as the risk in firms’ global supply chain have been amplified…” (Choi, Kim & Lee, 2012, p. 1149). Creating a framework and managing a green supply chain is an important topic for any industry. This seminar paper aims to present a valid argument for the necessity to understand the relationship between successful GSCM implementation and company performance.

**Significance of the Study**

The significance of this study is to bring attention to the importance of designing and implementing a robust green supply chain management into the organizational strategies that has a positive impact on performance metrics for the company. Yu, Chavez, Feng, and Wiengarten (2014) suggest that cross-functional integration of an organization and the cooperation with
suppliers and customers on implementing responsible and environmentally sustainable operational initiatives is critical to attaining profitable performance outcomes. A study conducted by Rao and Holt (2015) on identifying correlations between GSCM and economic performance suggested that environmentally responsible practices on all levels of the supply chain resulted in a favorable effect on competitiveness and operational performance. Green, Zelbst, Meacham, and Bhaduria (2012) also propose that a well-designed and strategically executed GSCM approach such as green procurement, collaborative efforts with customers, eco-design, and resource recovery will boost economic performance which will, in turn, generate a desirable outcome in areas of operational and organizational achievements that lead to business success.

The fundamental basis for designing and integrating a robust green supply chain that appropriately aligns with key performance metrics is considerably complex and requires a high level of awareness. The foundation of activities for GSCM design involves 1) the ability to appropriately measure added value that exhibits favorable effects on key business objectives, 2) examining customer attitudes towards environmental sustainability, 3) closely monitoring regulatory changes and updated requirements to ensure the firm is abiding by local, state, federal, and international environmental laws, 4) fostering and supporting upstream and downstream suppliers that promote green supply chain initiatives, and 5) creating an organizational culture that incorporates GSCM at all stages of its operations.

Considering that designing and integrating GSCM that translates into positive performance measurements is time-consuming and quite burdensome, many organizations find themselves unenthusiastic or simply taking reactive approaches to green supply chain (GSC) strategies. There are multiple obstacles that an organization must overcome in order to embrace GSCM practices, such as cost of implementation, technological barriers, and supplier
qualifications (Drohomeretski et al., 2014). Additionally, the various complexities and uncertainties that exist in implementing an inter-organizational and cross-functional integration of GSCM can be amplified when the organization’s management and employees express their apprehension with its adoption (Zhu, Sarkis, & Lai, 2011). To reap the benefits from GSCM implementation, there must be full commitment from executives and managers as well as combined efforts and partnership from suppliers and customers. Hervani, Helms, and Sarkis (2005) also claim that regionally and globally located suppliers, manufacturers, and distributors face multiple challenges in identifying stages in the supply chain and specific operational activities that resulted in a positive impact on performance. Moreover, measuring performance becomes increasingly complicated at the inter-organizational level when there is an absence of standardized data and technological integration, differences in geography and culture, discrepancies in organizational policies, and when management is unable to reach an agreement on critical metrics and recognize the importance of performance measurements (Hervani et al., 2005).

There have been various studies on GSCM, its design and implementation, and its effect on organizational performance. In addition, there are several reviews that critically examine GSCM related research in areas of the trade-off between environmental practices and economic competitiveness, compatibility between sustainability and profitability, and the drivers/barriers of GSCM (Green et al., 2012; Tachizawa, Gimenez, & Sierra 2015). It is an emerging field that requires further research and analysis to make a definite conclusion as to which GSCM strategies are the most effective on operational performance and success in their respective industries. As society becomes increasingly concerned about sustainability and mindful of environmental impact, it highlights the significance of continuing GSCM related studies.
While there are multiple demanding challenges that a firm must overcome in GCSM design and implementation that corresponds to favorable operational performances, organizational survival is highly dependent on its successful adoption. The exploration of GSCM practices and its relationship to organizational performance is imperative to a company’s long-term sustainability. Efficient and effective product and process management must include sustainable principles that are apparent throughout the supply chain levels. Therefore, GCSM practices must be built into all supply chain activities from purchasing, sourcing, and life cycle management while establishing a closed loop supply chain, a critical factor to attaining impactful environmental outcomes (Drohemeretksi et al., 2013). Companies that are environmentally conscious in their supply chain activities, organizations that establish policies that embrace social responsibility and sustainable development will undoubtedly achieve competitive advantages and become resilient to complex environmental issues and changing customer demands. If an organization is unable to recognize and adopt GSCM initiatives, it will become impossible to align organizational goals with its performance, thus diminishing the company’s chances of business survival.

**Literature Review**

In a study conducted by Drohomerteski et al. (2013), the key driver for companies to implement GSCM practices was linked to cost reduction, changing consumer market demands, and meeting environmental regulatory laws. Some industries, such as oil and chemical, must be environmentally conscious and keep a high profile since their supply chain decisions are constantly scrutinized due to its heavy impact on the environment (Preuss 2001). When companies implement GSCM practices, their attention is focused on reorganizing internal
processes, eco-design, management of packaging material, and waste from the production process (Drohomerteski et al., 2013).

The growing interest and significance of GSCM have had a great effect on research in this field. Linton, Klassen, and Jayaraman (2007) examine the relationship between supply chains and sustainability which helped shift the attention from environmental management and operations at a local level to a more encompassing view of the entire supply chain from design, production, consumption, customer service and disposal upon the end of the product life. In a conceptual framework investigated by Yu et al. (2014) on correlations between the three dimensions of integrated green supply chain management (iGSCM) and dimensions of operational performance, they found that internal GSCM and GSCM with customers and suppliers had a considerable positive impact on performance metrics. The research concluded that coordination between internal GSCM, upstream and downstream suppliers, and customers have a favorable impact on flexibility, on-time delivery, product quality, and cost (Yu et al., 2014). It was also concluded that there is empirical evidence that shows a correlation between successful performance metrics and well-coordinated GSCM practices between internal and external supply chain (Zhu et al., 2012). The role of SCM can expand upstream and downstream through the supply chain by the “green multiplier effect” that results in synergy and collaboration between the supply chain partners (Preuss 2001).

In a study conducted by Green et al. (2012) where 159 manufacturing managers were examined by applying a structural equation modeling methodology, it was concluded that in order to successfully implement GSCM practices into its supply chain, it must first be supported by executives and managers as a strategic imperative by integrating environmental sustainability as an organizational objective. Managers must also continually enforce the message to build
processes and products that are conscious of environmental impacts. Implementing GSCM practices is not only management’s responsibility, but the employees must commit to the organizational objective as well (Lee et al., 2012). When employees are highly involved with cost reduction, minimizing environmental impact, and increasing customer value, business performance has a positive impact on operational efficiency (Lee et al., 2012).

Firms that do not have resources to successfully implement GSCM initiatives must heavily rely on building partnerships with suppliers in order to gain competitiveness (Pfeffer & Salancik 2009). Lee et al. (2012) introduce the resource dependence theory (RDT) as a method to decrease uncertainty in the supply chain by establishing formal and semiformal linkages with other organizations. As described by Pfeffer and Salancik (2009), the four primary benefits of formal linkages are 1) offering information and activities to the focal organization that can influence business objectives, 2) keeping an open communication channel, 3) receiving support and commitment to business objectives, and 4) validating the focal organization’s values and importance. Semiformal linkages are also significant because establishing a trust-based relationship creates a social connection between interdependent suppliers. As described by Lee et al. (2012), “[b]y cultivating such relationship-specific capabilities that become superior to what the organizations may possess on their own, firms can obtain sustainable competitive advantages and improved organizational performance” (p. 1150).

It is often argued that organizations are hesitant to implement GSCM practices due to their high cost of implementation and lack of financial benefits (Eltayeb & Zailani, 2009). There is also reluctance due to high costs of eco-design, its material, and lack of resources to adopt GSCM initiatives and even less focus on GSCM practices at small-sized firms compared to medium and large firms (Al-Ma’aitah 2018). The challenges of implementing GSCM become
more apparent when there is a lack of availability of second and third-tier supplier. Additionally, the challenges are amplified when large companies are in substantial control of the market as the purchaser of goods from multiple suppliers (Preuss 2001).

It should be noted that the majority of GSCM research has focused on developed countries while paying less attention to developing countries. The disparity may be attributed to the major difference between developed countries and developing countries on how GSCM practices are approached. In countries such as India, customers and competitors do not find environmental sustainability awareness as being an important factor when designing a supply chain (Mitra & Datta 2013). Furthermore, companies that design environmental sustainability into their supply chain avoid sourcing from countries such as China and India where green initiatives are not a priority even if it meant cheaper material and labor (Wu & Pagell, 2011).

Roehrich, Hoejmose, and Overland (2015) provide a theoretical and empirical analysis of green supplier selection (GSS) activities that positively impact GSCM performance metrics and drives continuous improvement initiatives of these performances which are dependent upon self-determination theory (SDT) of autonomy and one’s aptitude. Roehrich et al. (2015) also suggest that GSS and value internalization are a critical aspect of GSCM performance in the upstream process of the supply chain while GSCM initiatives of first-tier suppliers are driven by downstream pressures to implement green practices.

In an integrated decision-making framework for GSCM developed by Cabral, Grilo, and Cruz-Machado (2012), they present lean, agile, resilient and green (LARG) paradigms that are the best fit for SCM practices that help improve an organization’s LARG performance. Gunasekaren et al. (2001) offer an overview of the importance of performance measurements, its growth, and changes in scope. In order to implement a successful supply chain performance
measurement, the entire organization must work together towards the common goal. Instead of taking a traditional approach on cost accounting methods, the focus should be on supply chain perspectives where each stakeholder is measured and consistently improving towards the organization’s objectives.

Brewer and Speh (2000) suggest that there are various concerns that arise when applying performance measurement tools across the supply chain. These problems include 1) a lack of understanding by managers who only deal with internal operations, 2) difficulties controlling and measuring performance metrics that are not within an organization or management’s scope, 3) misalignment of organizational goals and objectives, 4) inadequate information systems for gathering performance data, 5) an absence of standardized performance measures, 6) challenges with correlating performance metrics to added customer value, and 7) issues with the initial kick-off stages due to uncertainty with boundaries and limits. Although tackling these obstacles is an overwhelming task, with guidance, leadership, and collaboration through communication and transparency among all of the supply chain partners, the challenges will not seem so daunting or impossible (Hervani & Helms, 2005).

**Methodology**

The primary method for gathering data on this project is through secondary data analysis and research published in international journals on green supply chain management strategies and performance metrics. In order to present and support the objective of this project, data that is specific to green design, green purchasing, green operations as well as literature that highlights the significance of green supply chain management and initiatives will be utilized. Case studies, academic sources, and scholarly publications will also be presented to validate and verify the statements made in this paper. The multitude of resources will be critically reviewed and
analyzed into a literature review to strengthen the arguments made that a robust design of green supply chain management that ties into organizational performance is critical to a company’s survival in the 21st century.

**Discussion**

**Definition of Green Supply Chain Management**

The term GSCM encompasses a wide range of activities within the supply chain including eco-design, green sourcing, green purchasing, green manufacturing, and reverse logistics. In the past, the major determinant for organizations to integrate GSCM initiatives were due to regulatory compliance, legislation, and cost savings, but this is no longer the case. Firms have recognized that in order to enhance their competitiveness, performance improvements must be made through environmental management that not only complies with changing regulatory requirements, but also responds to rising concerns of environmental consequences from products and services. Over the past few decades, GSCM integration has emerged as a firm’s strategic supply chain management system that is comprised of upstream and downstream suppliers that decrease the environmental impact of forward and reverse flows of material and finished goods (Yu et al., 2014).

There are multiple definitions of GSCM in journals and publications. Srivastava (2007) defines GSCM as “integrating environmental thinking into supply-chain management, including product design, material sourcing, and selection, manufacturing processes, delivery of the final product to the customer as well as end-of-life management of the product after its useful life” (p. 55). Chavez, Yu, Feng, and Wiengarten (2016) describe GSCM as “the intra- and inter-firm management of the upstream and downstream supply chain aimed at minimizing the overall environmental impact of both the forward and reverse flows” (p. 207). Carter and Rogers (2008)
characterize GSCM as “the strategic, transparent integration and achievement of an organization’s social, environmental and economic goals in the systematic coordination of key interorganizational business processes for improving the long-term economic performance of the company and its supply chain” (p. 368). GSCM can also be considered as multiple stages that include external and internal vantage points (Zhu et al., 2012), and it can suggest how an organization can respond to their influences on the environment. Generally, the purpose of designing and integrating GSCM practices is to decrease the negative impacts on the environment within the supply chain by increasing efficiency and removing wasteful practices.

Hervani et al. (2005) define GSCM as:

\[
\text{Green Supply Chain Management (GSCM)} = \text{Green Purchasing} + \text{Green Manufacturing/Materials Management} + \text{Green Distribution/Marketing} + \text{Reverse Logistics}
\]

Figure 1. depicts the GSCM equation in its entirety as a process map from vendor selection, inventory management, product and process designs, production, outbound logistics, and finally reverse logistics, also known as “closing the loop.” This illustrates an organization’s internal and external supply chain, its links to suppliers, and environmentally-friendly practices in areas of sourcing (recycled, reused material and parts), production (demanufacturing, source reduction), logistics operations (transportation, packaging), customer use (green marketing) and disposal (recycling, remanufacturing).
Significance of GSCM Implementation

GSCM is a vital strategic objective for an organization that strives to gain from the various benefits of its practices including cost savings, stronger brand recognition, and competitive advantage (Roehrich et al., 2017). Implementing GSCM initiatives is critical to an organization’s success due to consumers becoming increasingly aware of how their consumption is impacting the environment. Modern global problems such as climate change, usage of a toxic substance, and diminishing natural resources are being scrutinized from every angle. Protecting the environment is everyone’s responsibility; ensuring that environmental preservation is being practiced at the highest level, and where possible, the negative impacts are minimized, and existing damages are repaired or completely reversed. Environmental sustainability is a good business approach because an efficient supply chain will allow for cost savings. By establishing
a business partnership with organizations that are environmentally-conscious and value GSC approaches, it will have a beneficial impact on the efficiency of the organization in areas of increased competitor differentiation and improved organizational reputation. A GSCM approach that differentiates the organization from others will lower the risk of being labeled as a company that is indifferent to global and climate issues. In addition, firms will be more likely to adopt GSCM initiatives if they are able to specify financial and operational benefits from its implementation (Bowen, Cousins, Lamming, & Faruk, 2001).

In a GSC network, there is an aspect of “closing the loop” that is significant to what makes GSCM very unique. This refers to the integration of traditional supply chain with reverse logistics by maintaining and recovering products after it is no longer being used. A closed loop supply chain has positive effects on sustainability and increases organizational performance by generating additional revenues through selling recycled material or refurbishing products which save on material costs (Kumar, Teichman, & Timpernagel, 2012). Recycling also benefits the environment, because additional resources do not need to be extracted from the earth, therefore preserving the earth’s original condition.

**Obstacles of GSCM Implementation**

With any new supply chain process implementation comes difficult obstacles. Organizations are often cautious of GSCM practices and its implementation for reasons such as high costs, an insufficient amount of resources, and uncertainties to financial benefits, and performance improvements. Doubtfulness can also arise from a reorganization of supply chain processes in areas of eco-design, material sourcing, purchasing, and product transportation. Additionally, challenges begin to manifest itself when an organization realizes concerns with second and third-tier suppliers. These concerns are usually magnified for small companies that
do not have experiences with GSCM process implementations that require an enormous amount of resources.

In a literature review written by Baki (2018) on GSCM implementation problems, the author includes other obstacles such as:

- Unavailability of loans to finances green products and technologies
- Lack of training for GSCM applications
- Lack of knowledge on environmental issues and its impact on the firm’s operations
- Insufficient support from the local and federal government
- Lack of support from upper management and senior executives
- Limitations due to company policies

Regardless of the obstacles, it must be indicated that GSCM is an integrated system that involves multiple sub-systems. For successful integration of GSCM, every element requires rigorous review and analysis by highly-skilled supply chain managers and R&D department that have full knowledge and prior experience in implementing such a substantial initiative. In order to overcome the uncertainty and reluctant mindsets, upper management must support and fully commit to the green initiatives and its agenda.

**Green Supply Chain Design**

**Eco-design.**

Environmental conscious design (Eco-design) refers to activities that take place during the product development stage that focuses on reducing the product’s impact on the environment throughout its life cycle from material procurement, manufacturing, product utilization, and its disposal upon the end of the life cycle while still meeting the product’s performance expectations
and cost (Eltayeb & Zailani, 2009). The most optimal approach for designing products is by including the entire supply chain, both upstream and downstream. This approach can be adopted through the application of life cycle assessments, which is a tool in determining a wide scope of environmental risks of a product. By utilizing the assessment tool, design engineers can select the least onerous choice when designing new products. Kumer et al. (2014) state that the life cycle cost savings are highest at the design phase because it has the lowest direct impact on the environment.

Eco-design is the fundamental aspect of green supply chain initiatives, because this stage of the supply chain process takes into account the product design process, its effect on the environment, and flow of the product throughout the supply chain. As described by Curkovic, Melnyk, Handfield, and Calantone (2000), this is a critical step due to the fact that the larger part of environmental impacts caused by production, consumption, and disposal are linked to the decision-making process in the design phase. At this stage of the supply chain process, an organization must determine raw material specifications, select suppliers, and specify product configuration which will establish the amount of energy and resources that must be consumed in order for the product to be fabricated. Furthermore, “the durability, serviceability and energy consumption” (Eltayeb & Zailani, 2009, p. 97) of the product will be established at this stage. By implementing an eco-design process within the supply chain, it improves the operational performance of an organization, but the benefits will be evident only if green purchasing practices are built into the process (Zhu et al., 2012). It is necessary to acknowledge that a full product and process life cycle assessment and eco-design are fundamental components for GSCM and the underlying operational elements are “transparency, resource-based optimization, automation, design for longevity, design for risk identification and minimization, full life cycle
product stewardship, and pre-disposition to agility and innovation” (Kumar et al., 2012, p. 1280). To achieve the most effective eco-design results, all supply chains partners from designers to suppliers, distributors, and customers must be integrated into the process, the features, and material sourcing activities.

When considering eco-design, the first thing that comes to mind is product design, but there is another often forgotten component of the supply chain, which is product packaging. Packaging plays an important role in transferring material from one location to another, but it is also an excellent marketing tool that sends a certain message to the buyer and helps entice them into purchasing the product. Packaging cannot be eliminated and minimizing packaging material, therefore reducing its protection, can have negative consequences such as product damage during transit and lowered quality levels upon arrival to the customer. Reducing packaging can also lead to increased costs for the organization due to repair and redistribution as well as poor perception about the product caused by frequent damages and quality issues. Given that packaging is required, but also waste that will end up in a landfill at some point, it is important to design product packaging that is the least impactful on the environment. This can be accomplished by integrating the use of recycled material in its production and biodegradable components after the product is used. Reusable packaging such as skids and containers are an excellent method for minimizing waste and closing the supply chain loop. To sustain a balance between package waste and product protection, Kumar et al. (2012) recommend quality metrics that measure the percentage of packaging that cannot be reused or recycled and the percentage of the product damaged while in transit.

Green purchasing and sourcing.
As described by Eltayeb and Zailani (2009), green purchasing is “an environmentally-conscious purchasing initiative that tries to ensure that the purchased products or materials meet environmental objectives set by the purchasing firm, such as reducing sources of waste, promoting recycling, reuse, resource reduction, and substation of materials” (p. 97). This element of the supply chain is critical to the success of GSCM implementation, because an organization can execute a green purchasing strategy that aligns with their objectives and gains competitive advantages in global markets (Hwang, Wen & Chen, 2010). This stage is also significant because each decision-making process at this level has a hidden cost that impacts the environment. Implementation of GSCM through green purchasing initiatives have a positive influence on both economic and operational performance. Green purchasing can be utilized as an organizational approach to foster production technology that minimally impacts the environment and reduce resource consumption. Furthermore, green purchasing signifies that supply chain managers must critically examine the issue of environmental sustainability in their sourcing efforts in parallel to consideration of cost, quality, and delivery (Eltayeb & Zailani, 2009). Other green purchasing practices in new technology such as solar panels and energy efficient heating and lighting can also boost environmental performance for an organization. Being innovative and harnessing the firm’s creative energy to meet sustainability goals is imperative to successful GSCM implementation.

Christensen, Park, Sun, Goralnick, and Lyengar (2008) state that understanding green sourcing is one of the best approaches to recognizing improvement opportunities that involve both internal and external stakeholder. The authors provide a Six-Step Green Sourcing Model for an environmentally sustainable purchasing approach:
1. Assessing opportunities - The organization must evaluate internal costs in areas of energy, disposal, packaging, alternate materials, and water. Once these costs are analyzed, a spend analysis must be conducted to determine opportunities that have a positive impact on the environment.

2. Evaluate internal supply chain - Identify the business requirements, product specifications, and internal stakeholders, then compare them to the latest industry offerings in environmental sustainability and efficiency with the goal of developing a total cost model that has a positive impact on environmental sustainability.

3. Assess the supplier base - Formalizing a supplier assessment process allows for the organization to build a robust and versatile supplier base that is environmentally conscious. Understanding different opportunities through discussion with the supplier base can increase performance metrics.

4. Establish a sourcing strategy - By evaluating the quantitative and qualitative criteria of the supplier base, it will lay the foundation for assessing the sourcing strategy and its processes. Internal stakeholders should give feedback on green opportunities, so all grounds are covered.

5. Implement sourcing strategy - At this stage, the organization requests quotes and begins negotiations with possible suppliers who is the most appropriate for meeting the firm’s green supply chain strategies and initiatives.

6. Measure specific metrics - Start to track supplier performance on delivery, compliance, and pricing by a defined set of metrics. The organization must ensure that these metrics incorporate the firm’s environmental impact goals and measures the results of the
sourcing strategy. Make adjustments and provide training to suppliers if they fail to meet goals.

**Reverse logistics.**

Reverse logistics is defined as “the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods, and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal” (Rogers & Tibben-Lembke, 1999). The primary function of reverse logistics, also known as product recovery, is all recovery efforts or return of products and material from the customer for the purpose of recycling, reuse, remanufacture, repair, refurbishing, and disposal of the product (Carter & Ellram, 1998; Ramirez & Morales, 2014). This process can produce positive benefits to the internal process within an organization by reducing excessive or unnecessary consumption or resources (Pacheco et al., 2018). Despite the fact that reverse logistics costs are typically high, a study conducted by high-technology businesses in Taiwan concluded that by means of reverse logistics activities, the total cost could be reduced from 31.2% from 49.1% (Ramirez & Morales, 2014).

Reverse logistics is a complex process that requires a strategic decision to establish certain combinations of product recovery functions that have an impact on optimizing resources and minimizing effects that are determinantal to the environment. Ramirez and Morales (2014) express the significance of realizing the costs of these activities and how it affects organizational performance. Collection of used products is an essential operation for a company, because this activity somewhat determines the price and quality of returned products that will soon be competing with new products on the shelf. Considering that it is impossible for companies to evaluate the quality of the product until it has been delivered to the point of inspection, there is
not a well-defined sequence of a process for the collection of items. Consequently, this increases
the uncertainty and costs of the value of returned products (Ramirez & Morales, 2014).
Furthermore, the wide range of returned products, the timing of its collection, and their location
have an impact on reverse logistics costs as well.

Organizations are focusing on improving the company’s reputation and its image by
creating competitive advantages by directing their supply chain efforts on economic and socio-
economic sustainability with reverse logistics functions (Pacheco et al., 2018). The three main
purposes of reverse logistics are (Eltayeb & Zailani, 2009):

1. *Reuse*, the process of collecting products and reselling them to customers as used
   products. There are no additional labor or material that is involved.

2. *Refurbishing*, the process of collecting products and reselling to customers, but unlike
   reused products, there is additional labor and material that is required to restore the
   product to its original condition.

3. *Recycling*, the process of collecting products that are at the end of the life cycle by
   disassembling and separating materials into different groups such as steel, aluminum,
   plastic, and glass. Then it is processed into recycled materials.

It is important to note that large and medium size companies are more likely to invest in
reverse logistics than small size companies. This may be due to smaller companies lacking
financial and labor resources to closing the supply chain loop. Additionally, reverse logistics
activities are less prevalent in developing countries in contrast to developed countries due to a
lack of recycling systems, waste management initiatives, and consumer interested in
environmental sustainability.
Green transportation.

Green transportation is the activity of loading products onto a vehicle and moving them from one location to another. When designing a green transportation system, factors to consider are vehicle routes, maintaining full containers, reducing deadhead miles, employing energy efficiency vehicles, maintenance and repair (Kumar et al., 2012; Saridogan, 2012). Through careful design of transportation networks, the organization can reduce energy consumption, therefore resulting in cost savings. An example of this would be a semi-truck that drives through mountainous terrain to get from point A to point B. This route will increase costs for the organization due to the additional gas and energy the truck will require to pull the load up the peaks. Instead, the truck can be rerouted to drive around the treacherous terrain to save on gas and energy costs.

Kumar et al. (2012) also state that the mode of transportation should be considered when designing a GSC network. Many organizations will choose to take advantage of inexpensive options such as rail or sea instead of planes or trucks, but this can mean extra inventory in the pipeline and potential for additional pollution resulting from longer lead times. Slower modes of transportation also prevent organizations from being flexible and responsive to changing customer demands. An inability to respond to potential sales can hurt the company reputation and will cause lost revenue and market share. It is critical that an organization measure transportation metrics in (Kumar et al., 2012):

1. Transportation distances
2. Average energy consumed per mile
3. Container fill rate
4. Inventory nodes
Organizational Performance

As the world and our society become increasingly environmentally conscious, organizations must adapt to these changes and manage their organizations so that they are sensitive and considerate to these environmental and social issues. For this reason, expanding interest in areas of GSCM practices in enhancing organizational operational performance has become many firms’ top priority (Yu et al., 2014). In this seminar paper, operational performance pertains to the strategic dimensions that a company wishes to compete in its industry. These four fundamental dimensions are flexibility, delivery, quality, and cost. GSCM practices are one of the many approaches to improving organizational performance. Measuring performance contributes to evaluating the success of organizational goals, if its meeting core objectives, and possible future directions that the firm must take to further their success. As explained by Al-Ma’aitah (2018), environmental performance is the main goal of GSCM implementation, and it helps achieve the balance between organizational performance, short-term and long-term financial performance to meet a variety of shareholder and customer expectations.

Applying organizational performance measurements that add value to the firm is quite a difficult task and there are multiple issues that emerge when applying performance measurement tools across the supply chain. One of the major issues with implementation is tracking and assessing its success. It is imperative to measure the impact of GSCM on operational performance, because this data is presented to top management in order to gain support and commitment for GSCM. By presenting evidence of competitive cost advantages and savings from GSC integration, management will be more likely to endorse GSCM initiative and incorporate it into the supply chain strategy (Hervani et al., 2005).
Other challenges when incorporating operational performance metrics into GSCM implementation include:

- poor understanding of measurements tools by management;
- controlling performance of external suppliers;
- poor goal alignment across the organization;
- subpar information systems for data gathering and analysis;
- failure to establish standardized performance measures;
- determining a correlation in improvement or decline in performance metrics to added value; and
- establishing limits on what will be measured.

These issues must be tackled with strong commitment from organizational leaders and collaboration with one another through communication and transparency among all of the supply chain partners (Hervani & Helms, 2005). By addressing the problems and fostering creative discussions to resolve the issues, the challenges of measurable and value-creating performance metrics will not seem so complex.

**Internal GSCM and organizational performance.**

Internal GSCM is an important aspect that an organization must endorse in order to improve performance outcomes. When environmental management practices are incorporated into supply chain operation, it drives performance benefits in areas of cost savings, efficiency, and product quality (Yu et al., 2014). Furthermore, studies have shown that there is a positive correlation between internal GSCM, quality management, flexibility, and cost savings (Lee, Rha, Choi, & Noh, 2013). The main internal drivers for GSCM implementation can be attributed to upper management’s desire to increase opportunities and efficiencies that result in decreased
environmental impact and reduced disposal costs and energy use (Kumar et al., 2012). In order to successfully implement GSCM initiatives, there must be an internal commitment and effort from senior managers to design and integrate GSC into their strategic business operations. Cooperation between departments is also imperative to GSCM success, because this is the key driver behind external GSC practices. Individuals responsible for designing, sourcing, purchasing, and manufacturing must all work collaboratively to meet the organizational objective of becoming a ‘green’ firm. Moreover, environmental sustainability initiatives that are based on internal efforts make the supply chain highly flexible in responding to changing customer demands and increase output performance (Lee et al., 2013).

**External GSCM and organizational performance.**

External GSCM is considered as overseeing the activities of the suppliers (upstream and downstream) and the customers. On the side of the supplier, these activities include evaluating supplier sourcing practices, environmental compliance, supplier’s environmental certification, their commitment to environmental sustainability initiatives, and experiences with implementing green sourcing activities. For customers, the activities are related to designing customer requirements related to green initiatives into the product, being cognizance of customer attitudes on environmental sustainability, and implementing plans to further satisfy customer demands in areas of environmental impact and sustainability. Stakeholders and other competition are the main external drivers for GSCM. This is caused by severe environmental regulations and penalties, consumers’ attitudes towards sustainability, and the necessity for manufacturers to streamline environmentally-friendly processes into their supply chain (Kumar et al., 2012).

**Suppliers.**
When there is a collaborative effort with suppliers to reduce environmental impact through sourcing, packing, and inbound and outbound logistics, there can be an enormous improvement in quality and cost (Yu et al., 2014). Improving a supplier’s environmental performance can be differentiated between two approaches: supplier monitoring and collaboration with suppliers (Tachizawa et al., 2015). Supplier monitoring refers to a supervisory approach to controlling outputs, evaluating a supplier’s environmental track record, and supplier audits that are conducted by the purchasing agent or by an independent third party. Monitoring is utilized as a tool for supplier risk management to minimize information discrepancies. On the other hand, collaboration refers to a teamwork effort with the supplier through training and education to design and implement environmentally-friendly material and processes that are beneficial for both sides of the party. The main distinction between the two approaches is that monitoring is a risk management tool, while collaboration is an environmental performance improvement initiative.

Organizations that lack the financial and labor resources to successfully implement GSCM initiatives must depend on building strong business relationships with suppliers to gain a competitive advantage within their respective industry. By forming these long-term partnerships, organizations are able to provide invaluable information to their suppliers on business goals, establish a two-way communication system where innovative ideas can be shared and discussed, receive a commitment to environmental sustainability from suppliers, and gain a mutual understanding of the focal organization’s value to GSCM. As argued by Pfeffer and Salancik (2009), even semiformal partnerships are also essential to the successful implementation of GSCM initiatives because fostering a trust-based business relationship leads to a social connection between interdependent suppliers. Through collaboration and full commitment from
suppliers, the organization can acquire the competitive advantages and enhance organizational performance that otherwise could not be achieved on their own.

**Customers.**

Organizations that are under customer pressure to embrace environmental sustainability are more likely to implement GSCM initiatives (Florida & Davidson, 2001; Darnall, Henrique, & Sadorsky, 2010). Customer-centric GSCM involves a firm and its customers to collaboratively plan and execute environmental management practices (Chavez et al., 2016). Being fully aware of customer requirements is the fundamental aspect of GSCM. Designing and integrating green practices into the supply chain has become an integral component of the ability to close the supply chain loop. It has also been proposed that an organization’s success and ability to continue business is highly dependent on its ability to satisfy the requirements of its stakeholders (Chavez et al., 2016). By establishing a customer-centric GSCM that understands their needs, organizational metrics that measure customer satisfaction can be developed, proved, and even improved to generate additional benefits for the company.

**Conclusion**

There is a substantial advantage for any organization that adopts GSCM initiatives including cost savings, improved quality, better brand reputation, and increased efficiency. When an organization is aware of consumer behavior and their perception of environmental impacts, it is possible to engineer new supply chain processes and techniques that alleviate its influence on the environment. In order to design and integrate GSC that deliver positive effects on operational performance, each organization must conduct a critical assessment of their supply chain from design, sourcing, purchasing, manufacturing, and distribution and develop performance metrics that add value to the organization and the customer. Although there are many challenges that an
organization will face before, during, and after the GSC implementation phase, the firm will be able to recognize the operational benefits once the processes are in place. Environmental sustainability is everyone’s responsibility. We must continue to preserve our precious ecosystem through innovation without compromising our way of life.
References


