ABSTRACT

This is an exploratory research study that aims at serving as a primer on key concepts related to the development, status, practices, and other constructs of green supply chain management (GSCM). It involves adopting an environmentally-conscious mindset in conducting company-level, strategic, tactical, and operational processes and is closely related to the broader concept of sustainability. Since the field is still in its developing stage, an extensive literature review was done on the discipline and underlying topics that are nurturing this emerging academic and practice field. Supply chain management, sustainability, and environmental operational initiatives. Several concrete approaches used in investigation GSCM initiatives are introduce as well as the role of organizational factors in the adoption of environmental innovations, based on a survey. The study advanced the proposition that organizational capabilities matter significantly in the adoption of GSCM practices and reveals importance background information pertaining the new posture on the relationship among supply chain management, social responsibility, and environmental consciousness. A key implication is that companies have to embrace the importance of working collaboratively with their partners to improve the social responsibility performance of the supply chain, causing a "green multiplier effect" throughout the supply chain. The study also concludes that there is a clear research need to establish the potential link among GSCM initiatives, competitiveness, and economic performance, to provide a stimulus for companies to green their supply chains.

Keywords: Green Supply Chain Management, Environmental Operational Initiatives, Sustainability.
1. INTRODUCTION

One of the biggest challenges for companies in the 21st century is the growing need for integrating environmentally sound choices into supply chain and logistics practices. While the past three decades have seen businesses come under increasing scrutiny from stakeholders on numerous environmental issues, these factors are becoming secondary, as green supply chain management (GSCM) initiatives are being perceived as sound practices that can improve competitiveness, environmental performances and robust partner’s relations. [11] GSCM is closely related to the broader concept of sustainability and involves adopting an environmentally-conscious mindset in conducting numerous company level (strategic, tactical and operational) processes and the development of sound strategies around environmental impact issues. [17,50] Approaches like green purchasing and manufacturing, eco-labeling and reverse-logistics are only a small sample of terms frequently used by environmental conscious stakeholders. [54, 2, 48]

Environmental and economic advantages of the entire supply are hard to implement effectively without the serious commitment of key supply chain partners. The central assumption of most GSCM initiatives is that investments in greening can be resource saving, minimize waste, and improve productivity, promoting efficiency and synergy among company partners. Due to the on-going development of green technologies, regulations and climate stabilization agreements, sharing green experiences and current knowledge between manufacturing companies and their supply chain partners has become a necessity. [35, 1] This creates a special synergy and it is expected that will improve the corporate image, competitive advantage and marketing exposure. [10] Accordingly, green initiatives which involve key partners will not only have a positive impact on the environment and yield increased efficiencies, but certainly create enhance competitive advantages in environmental innovations and operations for all partners. [37, 33]

2. LITERATURE REVIEW

Until the early 1970s, most researchers coincide that SCM is both an emerging field of practice and an academic domain. [9] This rationale provided the foundation to improve upon the more limited conventional view that a supply chain is a linear aggregation of self-regulating and somehow interconnected processes, as showed in Figure 1. At the beginning of the 1980s, researchers and practitioners started to characterized different SCM processes as logistics, purchasing, customer relationship management, industrial relationship marketing, service management, etc., but still lacked a sound holistic theory of the field.

![Figure 1: Supply-Production-Distribution (Linear) System](image_url)
However, much of these researches focused on only one phase or functional area at a time, and the collective rarely were deemed as a system. Motivated by this attitude, GSCM was mathematical conceptualized as:

**Green Inbound Logistics/Material Management + Green Manufacturing/Operations + Green Outbound Logistics/Marketing + Reverse Logistics**

By the middle of the 1990s, the Supply Chain Council developed and maintained a process reference system that allows companies to assess measure and improve their supply chain processes. The name given to this reference system was Supply Chain Operations Reference Model or SCOR Model (Supply Chain Council). In principle, the model attempts to mend the linear limited conceptualization of SCM and other shortcomings. Consisting of three levels of process detail and five process elements (plan, source, make, deliver and return), SCOR allows companies to examine their supply chain processes and the relations among partners, suppliers and customers in an integrated and holistic way. [25.] The general SCOR Model is shown in Figure 2.

![Supply Chain Operations Reference (SCOR) Model Management Processes](image)

Figure 2: Supply Chain Operations Reference (SCOR) Model Management Processes

Afterward, the underpinning paradigm was to regard the SCM as a holistic, systemic and synergetic field, and fundamental difference among distribution, logistics and SCM were established, as shown in Figure 3.[12]
During the first part of the 1990s, a fresh posture regarding the relationship among SCM, social responsibility and environmental consciousness began to “catch-on”. Companies embraced the importance of working collaboratively with their supply chain partners to improve their social responsibility performance. [22] As companies became more social responsible (induced or voluntarily) there was a tendency to adopt a more proactive environmental sustainability mind-set in their supply chain initiatives. [16] At the end of the 1990’s, innovative conceptual models and implementation methods flourished under the expression “supply chain environmental management models.”

Conversely, and counter intuitively, considerable research began to surface supporting the proposition that building on the company and partners’ social responsibility dispositions can increase performance indicators such as profitability and effectiveness, on the supply side, and customer satisfaction, on the demand side. [36, 45]

They suggested (see Figure 5) that transactional oriented companies tend to operate as independent silos, decreasing the possibility of accomplishing environmental supply chain initiatives. These companies spend much of their supply chain management efforts and resources in limited managerial control processes. Companies with a network orientation are more concern with the effectiveness of the entire flow that delivers their products to the end customer. They make great efforts to develop sustainable supply chains and are proactive in many environmental friendly initiatives.
3. RESEARCH OBJECTIVES

The main objective of this study was to conduct an investigative research on the status and direction of key issues of GSCM. Specific research objectives were:

- Based on a survey-based approach, provide a preliminary account of the degree that companies’ capabilities matter in the adoption of GSCM practices.
- Concisely explain key concepts and strategies in the domain of GSCM. In particular, barriers in the implementation of GSCM practices, approaches for implementing Reverse Logistics Process, role of mentoring within GSCM, improvement methods used in the purchasing and transportation systems, the impact of SCM Risk Management on GSCM, and the adoption of voluntary Environmental International Standards affects GSCM practices.

4. METHODOLOGY

Prior studies using contingency and force field theories make it clear that research on GSCM as an articulate body of knowledge still in an embryonic stage. [20] For this reason, it was conducted an exploratory research framework based on:

1. A survey-based approach
2. An extensive field and field-related literature review.

The empirical, survey-based research approach used a questionnaire submitted to a limited, but representative number of companies (thirty nine) on factors associated with the adoption of GSCM practices. The questionnaires were distributed to the responsible persons for GSCM initiatives in each company and used a five-point Likert scale. [15]

For the field-related literature review, the focus was on articles published on the underlying topics that are nurturing this emerging field. The literature review was classified into three categories of research interest: environmental conditions identification, decision process development, and supply chain integration. The first research category entails identifying conditions that prompted the adoption of environmental initiatives and fostered the issue of sustainability as a strategic issue. Most of articles in this category were based on surveys and interviews. The second category studied the decision choices to implement GSCM specific initiatives. The third category pertains to SCM, where companies collaborate to integrate various key processes and the implementation activities carried out.
5. RESULTS & ANALYSIS

5.1. Organizational Factors Associated with the Adoption of GSCM Practices: Survey-based Research Approach

The findings of the survey support the hypothesis that organizational capabilities matter significantly in the adoption of GSCM practices (see Table 1.) Based on the questionnaires, companies were classified as High-Adopters or Low-Adopters. The findings are robust, with companies in the High-Adopter sample scoring considerably higher in terms of several organizational factors important to the implementation of GSCM practices, than companies in the non-adopter sample.

<table>
<thead>
<tr>
<th>Organizational Resources</th>
<th>Average Factor Score</th>
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<tbody>
<tr>
<td></td>
<td>High-Adopters</td>
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<tr>
<td>Environmental Resources</td>
<td>4.01</td>
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<tr>
<td>Business Practices</td>
<td>4.51</td>
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<tr>
<td>Performance Monitoring</td>
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<tr>
<td>Overall Score</td>
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From Figure 5, the Critical Ratios suggest that greening the different phases of the supply chain does lead to an integrated green supply chain where the green inbound function of the supply chain, as well as a green production stage leads to a green outbound phase. Even as it might be expected that the greening of the inbound function leads to green production, the critical ratio for this link is lower than the required; therefore, it is acknowledge that there is still not enough evidence to establish the significance of this link. However, the green supply chain comprising all three phases clearly leads to significant values for competitiveness and economic performance. This establishes the linkage between the green supply chain and competitiveness for which many anecdotal examples exist, but empirically tested evidence is lacking.

![Figure 6: Critical Ratios of the Studied Phases of the Supply Chain](image_url)
Based on the survey, most sample companies use performance measures for their supply chains based on ISO 14000 or a total quality management approach. In the past, most difficulties in their supply chains performance measures arise from non-standardized data, inadequate technological integration, discrepancy in organizational policies and lack of agreed upon metrics. The implementation of GSCM initiatives forces them to reevaluate and initiate corrective actions on several metrics.

5.2. Results from the Literature Review

   The literature review revealed that the barriers to establish GSCM practices have internal and external sources. The main external sources are regulations, government compliances, customer requirements, competitors’ dynamics, poor supplier commitment, and industry specific barriers. The main internal barriers include cost, unawareness of their supply chains, poor expertise in GSCM approaches and lack of commitment or legitimacy. The following paragraphs, briefly discuss several approaches used by companies in their GSCM efforts.

   Most companies begin implementing GSCM initiatives voluntarily, putting into operation retro-logistics programs. These include used-product acquisition, inspection and disposition (determining whether to repair, remanufacture, use of spare parts, or recycle), remanufacturing, and remarketing. The most used approaches in this category are Value Capturing Approach (VCA) for returned products, Business Practices for Green Corporate Image and returned product based on the Products Life Cycle. [41]

   Hines and Johns study the mentoring role within GSCM as an emerging concept that promotes a more valuable affiliation among suppliers. [27] This mentoring culture goes beyond monitoring and evaluation, towards guiding and supporting suppliers and requires a substantial adjustment in the attitude of the key companies in a supply chain. Specific operational initiatives of this category include holding environmental awareness seminars for suppliers and vendors, undertaking educational program to explain the benefits and relevance of GSCM initiatives, setting up environmental teams to guide suppliers in their development of environmental programs, visiting supplier premises to provide on-site recommendations and assisting in the set up of their environmental programs. Supplier mentoring is proactive, non-threatening, shares potential benefits, and builds teamwork.

   In an environmentally-friendly transportation system, essential elements of a transportation system such as type of transport, fuel sources, infrastructure, operational practices and organization, are considered. Underlying constructs for specific strategies includes:

   • Environment-friendly waste management
   • Environmental improvement of packaging
   • Eco-labeling
   • Recovery of company's end-of-life products
   • Providing consumers with information on environmental friendly products and production methods
   • Use of environmentally-friendly transportation

   Supply chain risks can arise from many sources and sometimes without warning. By identifying and quantifying risks, companies can make business decisions based on hard information rather than on instinct or intuition. An organization that embraces risk-adjusted supply chain management enjoys important additional information upon which to base their GSCM decisions. While maintaining efficient supply chain operations is profitable, it is also
a very challenging continuous improvement process due to the high risk that is involved in potential failures.

The use of international standards environmental management systems may improve companies’ environmental performance. For example, an increasing number of companies are certifying their environmental management systems by ISO 14000 series standards. Supporters of ISO 1400 claim substantial operational, managerial, and competitive benefits for companies that adopt the international guidelines. Following a growing interest in corporate social responsibility, the International Organization for Standardization (ISO) announced plans for development of the ISO 26000 guidance standard for social responsibility. Despite initial signals that ISO 26000 will be built on the intellectual and practical infrastructure of ISO 9000 and ISO 14000, the Advisory Group on Social Responsibility set a different direction: a guidance standard and not a specification standard against which conformity can be assessed.

6. CONCLUSIONS

This study serves as a primer on the development of GSCM as a field. Also, has shown several concrete approaches used in implementing GSCM initiatives and examined the role of organizational factors in the adoption of environmental innovations, based on a sample. The study advanced the proposition that organizational capabilities matter significantly in the adoption of GSCM practices. The supply chain concept grew out of the recognition that the process of transforming raw materials into final products and delivering those products to customers is becoming increasingly complex: Not simply a compilation of linear processes. Changes in the environment and the understanding that there are operational and economic advantages in “greening” the business proposition, have forwarded a fundamental shift in business practices. The aforementioned results demonstrate that greening the supply chain, significantly lead to better competitiveness and economic performance of the company, gains in terms of less or minimal environmentally waste, reduced costs, compliance with regulation, reduced pollution, improved resource utilization and enhancement in economic performance.

However, if GSCM practices are to be widely adopted, is necessary to demonstrate an explicit and stronger link among their efforts of implementation, economic performance and competitiveness. Thus, there is a clear research need to establish the potential link between GSCM initiatives, competitiveness and economic performance, to provide a stimulus for companies to green their supply chains.

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