Article

Green Supply Chain Management: A Potent Tool for Sustainable Green Marketing

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Abstract
The concept of ‘Greening’ is intrinsically linked to offsetting and abatement of greenhouse gas (GHG) emissions, resulting largely from fossil fuel–based and energy-intensive industrial operations and various anthropogenic actions. ‘Kyoto Protocol’ pioneered the concept of mandatory reduction and compliance of GHG reduction norms applicable for major polluting nations in the world by 2012 and beyond. This prompted the corporate world to go in for introduction and commercialisation of ‘clean’ and ‘green technologies’ to mass produce and market wide-ranging green products. This had in turn led to the concept of Green Marketing. The concept of Green Supply Chain Management (GSCM) has been a parallel development to push the green products in an ever-expanding market with huge future potential—given growing customer consciousness towards eco-friendly green products and changing lifestyles. The article reviews and analyses different dimensions and facets of GSCM, including the evolution of the concept, approaches of building the constructs of GSCM, implementation strategy, linkage with transport systems, ‘Lean’ concept in supply chain management (SCM), green innovations and sustainability issues of GSCM and Green Logistics strategies for evolving integrated GSCM system.

Keywords
Green supply chain management, green marketing, sustainable development

Green Supply Chain Management (GSCM): The Concept
The increasing pace of globalisation and industrialisation has revolutionised the way the corporate world is responding to the changed lifestyle with time. Some of the major casualties of the energy-intensive mode of industrialisation are enhanced rate of greenhouse (GHG) emissions, global warming and ecological degradation. As the public becomes more aware of environmental issues and global warming, consumers are asking more questions about the eco-friendliness of products they are purchasing. Companies are confronted with embarrassing questions like how green their manufacturing processes and supply chain are, the state of their carbon footprints and how they recycle and dispose wastes, etc. Consumers increasingly prefer to purchase products that are free of toxins, produced with minimum level of pollution-linked contaminants and with minimal environmental impact. Increasing evidences are accumulating that a gulf of difference exists between consumers’ green claims and the certified quality of green products. Companies that successfully adopt a green policy can generate profits, provide positive social impact and reduce environmental impact as there is an apparent link between improved environmental performance and financial gains. Realising this perspective, companies have looked into their supply chain and explored areas where they can expect more profits (Murray, n.d.). Prominent features of leading green supply chains include an emphasis on life cycle costing, asset efficiency and waste reduction and service innovation and recycling. Executed effectively, GSCM stimulates product and service innovation, improves asset utilisation and deepens customer relationships and service levels through a shared focus on reducing waste and cost (van den Broek, 2010).

Several companies have gone one step further by GSCM as a competitive advantage (Murphy, Poist & Braunschweig, 1995; Sarkis, 1998; Vachon & Klassen, 2008; Wu & Dunn, 1995; Yang & Sheu, 2007). The premise of GSCM is that sharing and integrating environmental ideas and concerns across organisational boundaries will greatly enhance green manufacturing. More manufacturing firms have recognised the importance of GSCM practices and have begun to foster long-term partnerships with their suppliers to increase environmental performance (Handfield & Bechtel, 2002; Johnson & Sohi, 2003; Rao & Holt, 2005).
GSCM improves Green Marketing operations by employing an environmental solution in the following ways:

- improves agility—GSCM helps to mitigate risk and speeds up innovations;
- increases adaptability—green supply chain analysis often leads to innovative processes and continuous improvements;
- promotes alignment—GSCM involves negotiating policies with suppliers and customers, which results in better alignment of business processes and principles.

Core focus of the lectureship will be on the necessity of green and on-green operations (network design and reverse logistics, transportation, green manufacturing and remanufacturing and waste management).

One of the biggest challenges for companies in the twenty-first 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 GSCM initiatives are being perceived as sound practices that can improve competitiveness, environmental performances and robust partners’ relations. 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. Approaches like green purchasing and manufacturing, eco-labelling and retro-logistics (or reverse-logistics) are only a small sample of terms frequently used by environmental conscious stakeholders (Walton, Handfield & Melnyk, 1998; Zhu & Sarkis, 2004).

Green supply chain is conceived by different research workers from four different perspectives, namely, (a) ‘Green supply chain refers to the way in which innovations in SCM and industrial purchasing may be considered in the context of the environment’ (Chen, Shih, Wu & Spyur, 2008); (b) Environmental SCM consists of the purchasing function’s involvement in activities which include reduction, recycling, reuse and the substitution of materials (Harris & Naim, 2006); (c) ‘The practice of monitoring and improving environmental performance in the supply chain...’ (Nones, Morques & Evgenio, 2004); (d) ‘Integrating environmental thinking into a SCM, including product design, material resourcing and selection, manufacturing processes, delivery of the final product to the consumer as well as end-of-life management of the product after its useful life’ (de Brito & Vander Laan, 2010). From these four definitions, we see that there is a range of author focus and purpose on green supply chains and their management, that is, purchasing, operations, marketing or logistics, etc., also influences the definition. Greening the industry is increasingly gaining importance in all sectors, especially in high-tech electronics, fast-moving consumer goods (FMCG), followed by automotive original equipment manufacturer (OEM), sustainable solutions, etc. (Rodrique, Slack & Comtois, 2001). According to Sarkis (2007), the supply chain system should include purchasing and inbound logistics, production, distribution and reverse logistics. He also shows how firms focus on total quality management (TQM), with its emphasis on improving product quality, zero defects, customer satisfaction, training and employee empowerment, etc., and integrate it with environmental management resulting in total quality environmental management (TQEM).

Different researchers have defined GSCM from different perspectives, driving forces and purposes for which the concept is used. Sarkis (1999) refers to the supply chain as a system which includes purchasing, production, distribution and reverse logistics. Handfield, Walton, Sroufe and Melnyk (2002) defined that supply chain encompasses all activities associated with the flow and transformation of goods from raw materials (extraction) through the end-user, as well as associated information flows. In 1996, the Manufacture Research Consortium (MRC) in Michigan State University first put forward the definition of GSCM. The definition comprehensively considers the environmental influence to optimise resource utilisation in the supply chain in manufacture industry. This principle is similar to life cycle of a product. Product life cycle is an idea that products pass through a cycle of life—similar to humans—of birth, maturity and death. The product life cycle provides a degree of structure to the life of products, and thereby provides direction for the diverse functional efforts required to produce and deliver product/service offerings (Birow, Fawcett & Magnon, 1998). Many studies addressed product life cycle along with supply chain or GSCM. Since GSCM normally involved the inverse of the product flow, reverse logistics are automatically included in the GSCM conceptual framework. Sheu, Chou and Hu (2005) proposed a linear multi-objective programming model optimising the operations of both integrated logistics and used product reverse logistics in green supply chain. According to Gilbert (2000), greening the supply chain is the process of incarnating environment criteria or concerns into organisation purchasing decisions and long-term relationship with suppliers. GSCM is integrating environmental thinking into SCM. GSCM has emerged in the last few years and covers all phases of product life...
cycle, from the production of raw material through design, production, distribution phases to use of products by the customers and its disposal at the end of product’s life cycle. According to Nones et al. (2004), GSCM encompasses an integration of logistics with the business strategy with the business environment in a synergetic manner to maximise the operational effectiveness and the desired impact.

GSCM integrates traditional SCM practices and environmental criteria into organisational purchasing decision and long-term relationship with the supplier (Ho, Shalishali, Tseng & Ang, 2009; Nones et al., 2004). GSCM focuses on reduction of wastes of all industrial operations in order to conserve energy and prevent the dissipation of dangerous materials into the environment (Ho et al., 2009; Paksoy & Lam, 2009; Solvang, Deng & Solvang, 2007). GSCM is a kind of modern management model in the whole SCM, which considers the environmental influence and efficiency. It should keep in touch with suppliers, manufacturers, sellers and consumers. The detailed contents include Green Designing, Green Production, Green Package, Green Marketing and Green Recycling (Fengwen & Yuhua, 2003).

**Difference between Conventional SCM and Green SCM**

Conventional SCM is usually concentrated on economy and control of the final products, but seldom considers its ecological effects/impacts. In comparison, GSCM is green, integrated, ecologically optimised and takes into consideration the human and Phyto-toxicological effects as well. Companies put ecological congeniality requirements as one of the predominant criteria for products. At the same time, the company must assure its economic sustainability by staying competitive and profitable (Ho et al., 2009). Differences between conventional SCM and GSCM are summarised in Table 1.

**Table 1. Difference between Conventional SCM and Green SCM**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characteristics</th>
<th>Conventional SCM</th>
<th>Green SCM</th>
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<tbody>
<tr>
<td>1.</td>
<td>Objectives value</td>
<td>Economic</td>
<td>Ecological</td>
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<tr>
<td>2.</td>
<td>Ecological optimisation</td>
<td>Integrated approach</td>
<td>High ecological impacts</td>
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<td>3.</td>
<td>Supplier selection criteria</td>
<td>Price switching supplier short-term relations</td>
<td>Ecological aspects long-term relations</td>
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<td>4.</td>
<td>Cost prices</td>
<td>Low</td>
<td>High</td>
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<tr>
<td>5.</td>
<td>Speed and flexibility</td>
<td>High</td>
<td>Low</td>
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**Sources:** Ho et al. (2009); Sarkis (2003).

**Interfacing GSCM with Environment**

The idea of GSCM is based on two related fields, namely, environment management and SCM. Hervani, Helms and Sarkis (2005) characterised GSCM as a composite whole of green purchasing, green manufacturing/green materials management, green distribution/marketing and reverse logistics in an integrated and systemic gestalt. Accordingly, a comprehensive definition of GSCM would be ‘a management approach to link environmental concerns with all stages of the supply chain comprising purchasing material, managing material, product and process design, inbound logistics, production, outbound logistics and reverse logistics’ (Aragon-Correa, 1998). Controversial issues linked to this concept include the question as to whether value can be created through a green supply chain and whether in that case GSCM can demonstrate a better economic return. All the same, it still remains an open-ended question about the most suitable performance criteria to measure an excellent environment-friendly supply chain. Another relevant question is: To what degree companies should take a proactive approach towards a green strategy in order to gain a competitive advantage (ibid.)?

**Approaches of Building the Constructs of GSCM**

GSCM construct should essentially encompass the following key elements for effective operationalisation and system integration with Green Marketing channels:

1. Product Life Cycle Analysis (PLCA)
2. Waste Management
3. Vendor Assessment

**Product Life Cycle Analysis (PLCA)**

Life cycle assessment (LCA) is a technique for assessing the environment aspects and potential impacts associated with a product, process or service over its life cycle. The Society of Environmental Toxicology and Chemistry defines the LCA as follows:

The life cycle assessment is an objective process to evaluate the environment burdens associated with product, process, or activity by identifying energy usage and environment releases, to assess the impact of those energy and material and material uses and releases on the environment, and to evaluate and implement opportunity to effect environment improvements. The assessment includes the entire life cycle of the product, process or activity, encompassing extracting and process of raw materials; manufacturing; transportation and distribution; use/reuse/maintenance; recycling and final disposal. (Chu & Wei, 2010)
Waste Management

Wastes can be defined as anything that add adverse effects to the environment without adding value. Waste management is an effect-directed approach that is reactive in nature and tries to reduce landfill. The reactive pressures are usually attributed to the government as well as regulators for preservation of a status quo among the corporate competitors. Europe leads the path by making the manufacturers responsible for the waste generated throughout and at the end of the product life cycle. On the other hand, waste prevention or reduction is a ‘catch it at the source’ approach that is proactive in nature and helps to build among the customers and communities at large a harmonious linkage for gaining competitive advantage in the market (Ho et al., 2009).

Vendor Assessment

Vendor assessment is the rating of vendors according to environment auditing of vendors. A rating is given to all the vendors according to how much they affect the environment in terms of the following:

- Vendor management is done following vendor environmental questionnaire
- Asking for product test reports
- Demanding bill of material (BOM)
- Environmental auditing of vendors

Implementation of a Green Supply Chain

There are four basic steps to implement a green supply chain. The four steps are as follows: (a) identify costs, (b) determine opportunities, (c) calculate benefits and (d) decide, implement and monitor (Ho et al., 2009; Nones et al., 2004; Sarkis, 2003). Ideally, companies engaged in promotion of Green Marketing should customise this approach to best suit their own organisational needs and culture (Nones et al., 2004). The following model is a decision-making framework suggested by EPA (2000), and it is based upon the best practices of several companies that have successfully initiated and implemented environmental accounting to best suit their own organisational needs and culture (Nones et al., 2004).

Green Purchasing and Inbound Logistics

Greening the supply chain has numerous benefits to an organisation, ranging from cost reduction, to integrating suppliers in a participative decision-making process that promotes environmental innovation (Rao, 2002). Green purchasing strategies are adopted by organisations in response to the increasing global concerns of environmental sustainability. Green purchasing emphasises on reduction of waste produced, material substitution through environmental sourcing of raw materials, waste minimisation of hazardous materials, and so on. The involvement and support of suppliers is crucial to achieving such goals. Therefore, companies are increasingly managing their suppliers’ environmental performance to ensure that the materials and equipments supplied by them are environmentally friendly in nature and are produced using environmentally friendly processes. Min and Galle (1997) studied ‘green purchasing’ to determine the key factors affecting an enterprise’s choice of suppliers, the key barriers and the obstacles to green purchasing initiatives. They also investigated the influence of green purchasing on a corporation’s environmental goals. Sroufe (2003) presents a framework involving performance indicators and supplier assessment metrics. It is found that environmental initiatives such as strategic environmental sourcing and eco-friendly green project development initiatives improve an organisation’s competitive position and reduce market risks.

The green purchasing function involves the acquisition of materials from suppliers to meet the needs of producing the organisational product or service. Purchasing includes duties such as vendor selection, material selection, outsourcing, negotiation, buying, delivery scheduling, inventory and materials management, and to some extent, involvement in design. Green purchasing has a number of environmentally based initiatives that may be incorporated into the purchasing function as follows (Lamming & Hampson, 1996; Lloyd, 1994): Supplier Environmental Questionnaires; Supplier Environmental Audits and Assessments; Environmental Criteria on Approved Supplier List; Require Suppliers to undertake independent Environmental Certification; Jointly Develop Cleaner Technology/Processes with Supplier(s); Engage Suppliers in Design for Environment product/process innovation; Reduce packaging waste at the customer/supplier interface; Reuse/Recycling of materials requiring cooperation with supplier; Reuse initiatives (including buy-backs and leasing); Conduct LCA with cooperation from suppliers; Seek to influence legislation in cooperation with suppliers; Create supply ‘club’ to collaborate on environmental issues; Coordinate minimisation of environmental impact over full supply chain; Build environmental criteria into supplier contract conditions; Audit Supplier Environmental Performance.

Green Distribution and Outbound Logistics

Whereas purchasing and inbound logistics focus on managing the vendor-organisation relationships of the supply chain, the distribution and outbound logistics
function is meant to address the organisation–customer relationship issues. Customer relationships are greatly influenced by Green Marketing policies. Some studies have found that ultimate individual consumer interest in the environment and environmentally sound products is quite substantial, even though there has been a slight decline. This interest along with government regulations, are two external pressures that flow throughout the supply chain. Studies have shown that many companies are putting pressure on their suppliers and suppliers are listening to corporate customers, as well as the end-user (Lamming & Hampson, 1996). One of the controversies in Green Marketing and customer relationships is whether customers continue to show interest in environmentally sound products which translates into actual purchase. Various studies have shown that the interest is usually higher than actual purchase. This argument can be made for either individual consumers or corporate and industrial buyers. Even though this issue has been shown to be an individual consumer phenomena (Mandese, 1991; Schlossberg, 1990), the extension to corporate buyers needs a more complete evaluation using product life cycle approach.

One of the reviews of the literature found a number of areas within standard practice of outbound logistics that have implications for greening the logistics function (Wu & Dunn, 1995). The design of a logistics network and its planning are two of the more strategic issues facing logistics managers in this function. Many trade-off decisions need to be made with regard to the firm’s market, customer, product and logistical resources. Some of the design and management criteria that support environmental planning in this area include fewer shipments, less handling, shorter movements, more direct routes, and better space utilisation. But each of these issues includes trade-offs among delivery time, responsiveness, quality and cost, as well as environmental performance. Warehouse and delivery packaging design are two important issues in outbound (and inbound) logistics and distribution. Wu and Dunn (1995) argued that warehousing, other than land use requirements, also generates much of the packaging waste in the supply chain. Freight consolidation functions and ‘break-bulk’ operations carried out in warehouses also have the potential of utilising transport capacity more efficiently, thus minimising the environmental impact of the outbound transport system.

Reverse Logistics

Reverse logistics incorporates the return of materials, components and products back into the ‘forward logistics’ chain. Carter and Ellram (1998) have defined reverse logistics as an environmentally conscious approach by incorporating reverse distribution and resource reduction. Their complete definition for reverse logistics is the return, upstream movement or goods or materials resulting from reuse, recycling, or disposal with the minimisation of waste which results in more efficient forward and reverse distribution processes. Reverse logistics operations generally include the following major steps: collection, separation, densification or disassembly, transitional processing, delivery and integration. The operational emphasis is dependent on the type of material or component that flows in the reverse logistics channel. Practical examples of issues that have been addressed in the reverse logistics function are as follows:

Siemens Nixdorf Information system AG has a recovery plant located in Paderborn, Germany. The recovery plant reconditions and recycles used computers. The customer bears the burden of some of the disposal costs. It charges customers on a sliding scale based on the product type and disassembly and recycling costs (Ayers, Ferrer & Van Lyensee, 1997). Rank Xerox, with a history of leasing copier equipment, has implemented programmes to increase the leasing option to help in recovery of parts and equipment. These programmes have increased the rate of return for purposes of asset recovery and in turn decreased the costs of fully warranted equipment at reduced prices. Marketing programmes have been developed strictly for promoting these green products (ibid.). As a new pattern of enterprise strategy management, GSCM pursues coordinate optimisation of economic efficiency and social efficiency; reverse logistics is not only the foundation of circulation economy but also has synergism with the construction of green supply chain.

Green Suppliers and Importance of Green Purchasing

Suppliers play an important role in the supply chain and have a direct impact on production quality, cost and reputation. Sarkar and Mohapatra (2006) observed that providers will affect the supply chain performance of the major factors, and poor suppliers will affect the overall supply chain performance. Today, many companies are giving their suppliers pressure, asking them to follow the suppliers’ Executive Environmental Management System, as well as go through the ISO 14001 certification (Zutshi & Sohal, 2004). The level of suppliers’ market-orientation will affect manufacturers’ trust level (Zhao & Cavusgil, 2006). Providers in a number of qualities for manufacturers of products have significant influence (Forza & Filippini, 1998). Cannon and Homburg (2001) opined that suppliers and manufacturers in the relationship between manufacturers developing sustainable competitive advantage are very important. Winn and
Roome (1993), through environmental principles into supplier management mechanism, administrate the greening movement. Zhu and Sarkis (2004) observed in the manufacturing industry in China in their study, discussed in the GSCM, that the external GSCM primarily concerned with suppliers’ and customers’ interaction.

Environmentally Preferable Purchasing (EPP), often referred to as green purchasing, is the affirmative selection and acquisition of products and services that most effectively minimise negative environmental impacts over their life cycle of manufacturing, transportation, use and recycling or disposal. Examples of environmentally preferable characteristics include products and services that conserve energy and water, minimise generation of waste and releases of pollutants; products made from recycled materials that can be reused or recycled; energy from renewable resources such as bio-based fuels, solar and wind power; alternate fuel vehicles; and products using alternatives to hazardous or toxic chemicals, radioactive materials and bio hazardous agents. In simple words, green purchasing is adding environmental aspects to price and performance criteria when making purchasing decisions. Ultimate goal is to reduce environmental impacts of sourcing and to increase resource efficiency. Green purchasing is the practice of applying environmental criteria to the selection of products or services. Green purchasing is now relatively common among larger companies and appears to be increasingly used as a corporate practice. For example, a 1995 survey of 1,000 buyers of office equipment and supplies showed that 80 per cent of respondents were taking part in environmental initiatives within their organisations. In 1993, just 40 per cent of respondents responded this way. Internationally, Germany undertook structured green public procurement activity in the 1980s followed by other European countries like Denmark (1994), France (1995), UK, Austria (1997) and Sweden (1998). The US EPA developed Guidance for Environmentally Preferable Purchasing, while Japan enacted the Green Purchasing Law in May 2000 to promote green purchasing as national policy. The law requires all governmental bodies including local governments to practice green purchasing and report the summarised purchasing records to the public.

**Interfacing with Green Marketing**

Green Marketing includes environment-friendly packaging, environment-friendly distribution, and so on. They are all initiatives that might improve the environmental performance of an organisation and its supply chain (Rao, 2002). Management of wastes in Green Marketing such as reverse logistics and waste exchange can lead to cost savings and enhanced competitiveness (Rao, 2002). Many of these initiatives involve compromises between various logistics functions and environmental consideration in order to improve the environmental performance of an organisation (Wu & Dunn, 1995). Currently, it is quite common to use packaging that prevents the product from damage and makes it easy to handle. The use of packaging—whether it is made of glass, metal, paper or plastic—mainly leads to the solid waste stream. In order to emphasise these environmental impacts of packaging, many nations now develop programmes and laws that aim to minimise the amount of packaging that enters the waste stream, such as the Packaging Directive in the EU. In China, many Small and Medium Enterprises (SMEs) are facing the problem of how to dispose of the waste from their production process. Lack of strict waste management law may lead to unregulated and indiscriminate disposal of wastes, causing environmental pollution. However, more environmentally engaged SMEs are adopting on-site waste management treatment facilities and waste exchange networks.

To address the problem of industrial waste management in China, many government agencies are trying to promote the concept of industrial ecology for corporations, especially for SMEs where a ‘closed loop’ approach (Frios, 1999) utilises all waste through the recycling and reuse of energy and materials.

The impact of Green Marketing on customer relationships, and the impact of corporate customers on suppliers, had also been widely investigated (Kärnä & Heiskanen, 1998). Encouraging suppliers to take back packaging is a form of reverse logistics that can be an important consideration in Green Marketing, with a study by Dorn (1996) identifying an increase in market share amongst companies that implemented an environment-friendly packaging scheme. Wu and Dunn (1995) identify warehousing and packaging design as the two most important issues in outbound logistics and distribution. They argue that standardised reusable containers, good warehousing layouts and easy information access reduce storage and retrieval delays, which leads to savings in operating costs. In an environment-friendly transportation system, essential elements of a transportation system such as type of transport, fuel sources, infrastructure, operational practices and organisation can be considered. These elements and the dynamics that connect them determine the environmental impact generated in the transportation logistics phase of the supply chain (Kam, Smyrnios & Walker, 2003).

**Strategies of Green Supply Chain**

The simplest strategy of GSCM with regard to inter-organisational investment resource development is one...
of risk minimisation. Firms adopting this strategy are proposed to do so in response ostensibly to stakeholder requirements. Such a strategy is ideal for the organisation that retains minimal internal environmental management resources or has only recently begun to consider the introduction of a supply chain greening programme. It is based on minimal inter-organisational engagement. Such efforts might involve the inclusion of basic clauses in purchasing contracts for suppliers to meet all relevant regulatory requirements. Most frequently used with this approach is the cascading of an established international standard such as ISO 14001 (King, Lenox & Terlaak, 2005). The use of an existing performance standard, an approach used initially by the Ford Motor Company with its suppliers and now more frequently by other organisations for their supply chains, offers: (a) established environmental performance benefits, (b) third party or arms-length management of performance and a system recognised globally by other organisations. This third aspect improves the efficacy of uptake by suppliers because the system is recognised by the market and other industry members, reducing the ambiguity of desired performance levels and minimising the need for customer involvement.

A more complex and developing strategy in recent years has been the ‘eco-efficiency’ or ‘lean-and-green’ approach to GSCM. This type of strategy derives environmental performance benefits for the supply chain beyond mere regulatory compliance through the requirement for suppliers to meet operations-based efficiency targets. Much of the environmental performance benefit arises from specific manufacturing practices that have been found to provide secondary environmental performance benefits. The efficiency-based strategy ties environmental performance to operational processes in the supply chain, and this strategy allows the extension of performance requirements into the supply chain that maximises economic performance and provides secondary environmental performance benefits through waste and resource use reductions. It requires more comprehensive and supply chain-specific performance specifications than the simpler risk-based strategy. It also requires a higher level of involvement between supply chain partners arising from the use of more complex interfirm performance requirements. Using this strategy to facilitate greater efficiency in the supply chain does not require the development of co-specialised resources specific to environmental performance. The necessity for collaboration on efficiency, however, provides a facilitating role for context-specific, complex problems such as waste reduction and recycling (Geffen & Rothenberg, 2000). The strategy can provide a cost-reduction advantage to the supply chain and readily fits with pre-existing organisational goals of optimisation.

**Innovation-based Greening Strategies**

The innovation-based GSCM strategy is distinct from the efficiency-based approach because of its use of a supply chain environmental performance strategy that is more environment-specific. Organisations are increasingly aware of the potential for narrow purchasing policies to in-source components or services from suppliers that may be legally non-compliant with environmental regulations or who themselves procure goods in an environmentally irresponsible way (Bowen et al., 2001). Some organisations have begun to guarantee more comprehensive product life cycle considerations for consumers of their products. Once a supply chain begins to consider specialised processes, technologies or complex performance standards for suppliers such as chemical avoidance, the level of knowledge exchange and relational investment begins to change. Moving from an efficiency-based GSCM strategy to a greater level of innovation or integration of environmental performance in supply chain and product design requires specialised environmental resources (Lenox & King, 2004). Keeping up-to-date with environmental legislation changes and training suppliers in environmentally relevant process changes requires more dedicated environmental resources, specialised personnel and design. The development of such resources provides the conditions for an organisation to shift from an efficiency-based to an innovation-based GSCM strategy. For products, the resources developed could be used to incorporate innovative environmental planning into specific product designs, characteristics, functionality or life cycle-related activities (for example, service, repair and recycling). At the process level, they could be deployed to develop environmentally robust methods and systems for the production, distribution and use of products.

**Closed-loop Strategies**

Closed-loop strategies are a more recent type of GSCM strategy and represent the most complex and collaborative form of this type of activity. Often referred to in its simplest form as ‘reverse logistics’, closing the loop involves the capture and recovery of materials for either remanufacture (high value) or recycling (low value) (Kocabasoglu, Prahinski & Klassen, 2007). These materials can arise during production, as returned goods, post use and at the end of life. The closed-loop strategy ties or integrates environmental performance to the whole supply chain. Very few examples of coordinated recycling or closed-loop activity in the supply chain currently exist however. Prominent examples include Kodak’s return and remanufacture of its disposable cameras, Hewlett-Packard’s retrieval of used printer cartridges and BMW’s end-of-life vehicle requirements for suppliers.
(Guide, Kraus & Srivastava, 1997). The motivation for a closed-loop strategy remains low for basic reasons of poor and distributed control over the reverse supply chain, lack of available infrastructure and the inability of supply chains to believe that such activity is economically viable. Designing and successfully using a closed-loop strategy present one of the most complex endeavours for a single organisation to undertake within its supply chain (Richey et al., 2005). In its simplest form, ‘closing the loop’ may involve product take-back and reverse logistics implemented only in the retail portion of the supply chain. In more complex ‘closed-loop’ systems, used or obsolete products and waste are taken back by the producer and remanufactured or recycled rather than being disposed of to landfill. The closed-loop strategy represents an approach that seamlessly integrates issues of economic, operational and environmental performance. Organisations considering implementation of a closed-loop supply chain require high levels of control over the capture and return of used materials.

**Supply Chain Key Performance Indicators (KPIs)**

It is essential to assess the supply chain in a numerical manner, since the individual companies involved and the supply chain as a whole can benchmark themselves against their competitors, so that they can continuously improve, and dynamically adjust their KPIs. According to Inger et al. (1995), the most strategic supply chain KPIs are delivery performance, schedule adherence, lead time and product logistics costs. Meanwhile, Moore (1998) used the concept of ‘SCOR model KPIs’ to assess the performance of a significant number of organisations. They categorised three external and one internal attributes and they selected specific KPIs to measure the performance of the organisation. These attributes were supply chain delivery reliability, supply chain responsiveness, supply chain flexibility and supply chain asset management efficiency. The KPIs that they used to measure organisations were delivery performance to commit date, fill rate, perfect order fulfilment, order fulfilment lead time, supply chain response time, production flexibility, cash-to-cash cycle time, inventory days of supply, net asset turns. However, it is important to align these KPIs to Green Logistics; it is vital to determine whether or not these KPIs can be aligned to sustainable distribution, and if not, it will be necessary to develop a new set of KPIs to assess the performance of transport from a holistic green supply chain perspective.

**Supply Chain Management Practices**

Organisation’s implementation of GSCM practices and the organisation’s environmental performance and economic performance have positive relations (Zhu & Sarkis, 2004). SCM practices of organisations can conduct sales performance; financial performance and competitive edge have a positive impact (Li et al., 2006). GSCM practices are rather of wide range, from internal and external. GSCM practices include internal environmental management, external GSCM, investment and restore the ecological design or environment practical design (Zhu & Sarkis, 2004). Several authors have researched about SCM practices, but most recently, Li et al. (2006) developed a list of sub-constructs for SCM practices to link them to performance. These constructs are Strategic Supplier Partnership, Customer Relationship, Information Sharing, Information Quality, Internal Lean Practices and Postponement.

Towill (1999) developed other frameworks to guide supply chains to reach an effective operation. He stated a number of pre-conditions that companies need to apply in order to simplify material flow. These rules are ‘unbiased and noise-free information flows; time compression of all work processes; achievement of consistent lead times; choice of smallest possible planning period; adherence to the schedule i.e. elimination of pockets of “Just-in-Case” materials, selection by simulation of the “best” supply chain controls; and finally, matching the simulation model to the real work process via process flow and information analyses’. However, there has been little research on the impact of supply chain practices on Green Logistics performance; this gap in the Green Logistics literature needs to be filled.

Some examples to show the impact on supply chains (van den Broek, 2010) are as follows:

- Wal-Mart, which in 2005 launched a sweeping business sustainability strategy, recently set the goal of a 5 per cent reduction in packaging by 2013. The retail giant expects the cut in packaging will save 667,000 metric tonnes of carbon dioxide from entering the atmosphere. Moreover, the company anticipates $3.4 billion in direct savings and roughly $11 billion in savings across the supply chain;
- Nestlé employs an ongoing, company-wide sustainability programme that has generated significant environmental and financial benefits. The company has applied the strategy to its use of product packaging by initiating an integrated approach that favours source reduction, re-use, recycling and energy recovery. In particular, the company’s packaging material savings between 1991 and 2006 led to $510 million in savings, worldwide, according to Nestlé’s corporate website;
- Heineken committed to reduce fuel and electricity use through its ‘Aware of Energy’ programme. The company said in its 2006 sustainability report...
that it aimed to reduce fuel and electricity costs by 15 per cent between 2002 and 2010. At the time of the Diamond report, Heineken had achieved savings of 6 per cent—even after the acquisition of new breweries.

Supply Chain Management and Transport

SCM is a field that is usually been studied more from a market and product perspective rather than from a transport point of view. However, some authors have recently worked in the development of the supply chain and transport relationship. Firstly, Stank and Goldsby (2000) developed a decision-making framework that positions transport in an integrated supply chain. Regarding transport decision-making, decisions are made from strategic to operational level and from macro to micro level; they categorised these decisions as total network and lane decisions, lane decisions, mode/carrier assignment decisions, service negotiation and dock level decisions. However, they do not determine the impact of each of these decisions on Green Logistics performance, and most importantly, the decisions made at macro and strategic levels possibly have a more significant impact on Green Logistics performance, so it is vital to fill this gap in the literature.

Meanwhile, Potter, Lalwani, Disney and Velho (2003), stated that there has been little degree of change of transport management techniques, although there is evidence of demand variability, and subsequently, demand amplification on transport operations. In terms of demand amplification and transport, there has qualitatively been suggested a negative relationship between these two variables. However, according to Potter and Lalwani (2005), negative relationship has not been proven. In addition, they developed a framework that integrate five main strategic themes, namely coordinated distribution network management, transport cost visibility, exploitation of ICT, collaborative relationships and information feedback. However, these authors left an unfilled gap in the body of knowledge of supply chain and transport, since there has not been determined the impact of transport demand amplification on Green Logistics performance, and also the impact of their five main strategic themes on Green Logistics performance. SCM and transport are areas that should be discussed more in-depth; in order to do so it is necessary to develop a framework that allows a holistic analysis from a system perspective. Therefore, before discussing about supply chain strategies and practices, it is important to discuss more deeply about sources of uncertainty between supply chain companies and third logistics providers.

Supply chain uncertainty is a concept that is making inroads into GSCM operations. According to van der Vorst and Beulens (2002), ‘SC uncertainty’ refers to decision making situations in the SC in which the decision maker does not know definitely what to decide as he is indistinct about the objectives; lacks information about his environment or the supply chain; lacks information processing capacity; is unable to accurately predict the impact of possible control actions on SC behaviour; or, lacks effective control actions.

Therefore, uncertainty is produced mainly because of insufficient information within the supply chain and lack of effective control decision tools. On the other hand, at a strategic level, uncertainty can be divided into two main categories, external vulnerability and supply chain agility (Prater et al., 2001). External Vulnerability is related to demand and forecasting uncertainty, and complexity. Supply chain agility is related to sourcing flexibility and speed, manufacturing flexibility and speed, and delivery flexibility and speed. Therefore, it is important to determine the impact of external vulnerability and supply chain agility on Green Logistics performance.

Lean Supply Chain Management

The theory of Lean Thinking has evolved with time. The term ‘lean production’ was first used to describe the process of minimisation of waste in the automotive industry (Womack et al., 1990). According to Jones, Hines and Rich (1997), Lean Thinking has a natural starting point with value for the customer looking at the whole rather than the individual processes. However, ‘leaness’ means developing a value stream to eliminate all waste, including time, and to ensure a level schedule (Naylor et al., 1999). More recently, Hines, Holweg and Rich (2004) stated that Lean Thinking exists at two levels: strategic and operational. The customer value-creation strategic thinking applies everywhere, the shop-floor techniques do not, but value creation is only equal to quality, cost and delivery. However, Lean Thinking is not a supply chain strategy that can be adapted to all sorts of products. Developing a supply chain strategy consists of matching market characteristics (products, attributes and demand variability) with supply, and there are two sorts of products, fashionable and commodities (Fisher, 1997). Therefore, the commodities can be adapted to the ‘lean’ environment since there is high predictability of demand, and in consequence, the process can be controlled by the Lean Thinking level schedule requirements (Suzaki, 1987). However, all this discussion leaves questions unanswered about the characteristics and attributes of this supply chain strategy and it is also necessary to deduce the potential implication of Lean Thinking for Green Logistics performance.

From the Toyota’s tool box, Jones et al. (1997) stated the characteristics of truly Lean Thinking strategy, value
creation, value stream, level schedule (level demand and supply), organisation of work (preventive maintenance), pull system through Kanban inventory control system (minimisation of safety stock), standardisation of work (TQM), visual control devices and production errors detection. From these characteristics, it can be noticed that waste minimisation and level schedule play a strategic role in any Lean Thinking programme. However, it is important to think about the feasibility of this strategy—how this strategy can be adapted to a volatile market. Also, it is necessary to determine the impact of a typical Lean Thinking supply chain, where minimisation of inventory is achieved through level schedule and pull systems, on Green Logistics and transport performance. Elimination of waste and pull system is also a vital component of ‘lean’ SCM, as Naylor et al. (1999) stated, ‘in a “pure” lean supply chain there would be no slack and zero inventory’. Several authors include elimination of waste and pull system as a strategic Lean Thinking characteristic (Ohno, 1988; Jones et al., 1997; Abernathy, 2000; Mason-Jones, Naylor & Towil, 2000). This represents a similar issue as time compression presents, since there can be multi-goal problems between inventory reduction and transport optimisation. Therefore, it is important to establish how an inventory reduction strategy under a pull system can achieve its main goal, and at the same time, mitigate its negative effect on Green Logistics and transport performance.

**Potential of Lean Supply Chain to Green Logistics Performance**

It can be argued that ‘lean’ manufacturing has a positive impact on the environment, since its primary focus is on waste minimisation. However, there are certain constraints that need to be taken into account to determine whether or not Lean Thinking has a positive impact on the overall green supply chain performance. ‘Design, modelling, and analysis of the traditional supply chain has primarily focused on optimising the procurement of raw materials from suppliers to the distribution of products to customers’ (Beamon, 1999). This has included production/distribution scheduling, inventory control and locations, number of echelons, distribution centres (DCs), plant–product assignment, buyer-supplier relationships—determining and developing critical aspects of the buyer–supplier relationship and product differentiation step specification. However, this does not consider the total product life cycle, including reverse supply chain processes.

No longer is it acceptable or cost-effective to consider only the local and immediate effects of products and processes; it is now imperative to analyze the entire life cycle effects of all products and processes. Therefore, the traditional structure of the supply chain must be extended to include mechanisms for product recovery. (Beamon, 1999)

Hence, in order to mitigate the negative impact of transport on the environment, the integration of forward and reverse flows in the ‘lean’ supply chain should be considered, so it should be determined how supply chain companies and transport providers can integrate those flows to holistically optimise transport movements. Lean supply chains based their strategy on pull systems that aim to minimise the inventory within the chain. In order to achieve waste minimisation, these sorts of systems require Just-in-time (JIT) delivery. McKinnon (1996) has suggested that ‘JIT delivery cannot be considered a green solution; despite that it has not greatly increased road volume’. ‘The more JIT strategies are applied, the further the negative environmental consequences of the traffic it creates’ (Rodrigue, Slack & Comtois, 2001).

JIT is one of the main strategic features of Lean Thinking and is by far the one that represents the greatest challenge for Green Logistics. Therefore, in order to achieve a high level of Green Logistics performance, under JIT system, supply chain companies and their third logistics providers need to look for alternative means of achieving both at the same time. According to Minanham (1997), ‘Toyota is under a continuous improvement process of its JIT system, “location of the suppliers’ base helps to achieve a close-loop distribution network”, known as “milkrun” that can deliver parts from its suppliers to assembly base in a JIT principles’. Therefore, from a transport and supply chain perspective, sourcing and location of suppliers are critical factors to achieve an effective JIT system, since optimisation of transport flow can be achieved in conjunction with minimisation of inventory. In Japan, ‘Nissan with its factories more dispersed than Toyota, soon found the addition of buffer stock, well above that of those levels maintained by Toyota, to be a useful tool to offset traffic congestions in urban areas’ (Polito & Watson, 2006). Therefore, from a transport and supply chain perspective, it is important to determine the main strategic factors that allow high level of Green Logistics performance under a JIT system.

**Green Innovations and Sustainability Issues of GSCM**

Hurley and Hult (1998) noted that on the question of market dynamics, one is almost unable to find industries which do not engage in innovative activities. Porter and van der Linde (1995) also view that in a dynamic and competitive business environment, we must constantly innovate to be able to effectively respond to competitors,
legislators and other areas of businesses that are critical for survival. Schumpeter (1934) pointed out that invention and innovation is a different concept; innovation has become the industry and academia to the subject. Rogers (1962) pointed out that many scholars research subject of innovation from many views, but innovation can be regarded as a separate, integrated concept. However, researchers with the interest and views of different organisations of the innovation will define the difference; basically the definition of innovation can be divided into four perspectives: product perspective (Burgess, 1989), the process perspective (Johannessen & David, 1994; Kimberly, 1986; Scott & Bruce, 1994), product and process perspective (Dougherty & Bowman, 1995; Lumpkin & Dess, 1996; Tushman & Nadler, 1986) and multiple perspective (Robbins, 1996; Russell, 1995). The most recent study is about multiperspective. Multiple perspectives of scholars believe that regardless of the product or process perspective, the industry should focus more on ‘technological innovation’ level, while not ignoring the ‘management of innovation’ level. Thus, it will be ‘technological innovation’ (including products, processes and equipment, etc.) and ‘innovation management’ (including systems, policies, programmers and services, etc.) at the same time added into the definition of innovation.

In the 1990s, Green Century Council session, restarting the business community, compared to the traditional treatment at the end-of-pipe, through process and product innovation, production of environment-friendly products in an attempt to produce a green image (Ramus & Steger, 2001; Porter & van der Linde, 1995; Peattie, 1992). More and more enterprises are from the obedience of laws and regulations to transfer a positive strategy for innovation strategy (Aragon-Correa, 1998; Berry & Rondinelli, 1998). It continued to improve performance, in order to improve corporate body and enhance competitiveness (Nehrt, 1998). Porter (1991) suggested that enterprises through environmental regulations to the business environment innovative technologies, in addition to regulatory compliance requirements, can further reduce production costs and increase economic efficiency. Chen et al. (2008) pointed out that green innovation has a related impact on the enterprise’s competitive edge.

The most well-known definition of sustainability is that of the Brundtland Commission. It defines sustainable development as ‘a development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED, 1987). Elkington (1997) suggests the integration of the economic, ecological and social aspect of sustainability in a ‘triple bottom line’ concept, emphasising their intense interrelatedness. Dyllick and Hockerts (2002) conceive corporate sustainability as the business case (economic), the natural case (environmental) and the societal case (social). Thus, the following six criteria for achieving corporate sustainability are derived: eco-efficiency, socio-efficiency, eco-effectiveness, socio-effectiveness, sufficiency and ecological equity. Combining definitions of SCM and sustainability, Seuring and Müller (2007, 2008) define SSCM as ‘the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements’ (ibid.). As such, members in a sustainable supply chain have to fulfil environmental and social criteria, but equally have to remain competitive by meeting customer demands and related economic criteria.

Sustainability has become an increasingly important issue in today’s business world. All firms operating in domestic and global business must be cognizant of all the myriad aspects of sustainability. All areas of marketing, including SCM, have to operate in this new environment. Philip Kotler and Gary Armstrong (2010) look at sustainability as a marketing management practice that looks at the present needs of consumers and businesses and then developing practices that satisfy these current needs while making sure that the needs of future generations will be satisfied. Chad Holliday, a DuPont CEO, opines that no executive can afford to ignore this wave (Esty & Winston, 2006). Smart companies use environmental strategy to innovate, create value and build competitive advantage. A critical part of this environmental strategy involves the creative, effective use of Integrated Marketing Communications, as well as all other aspects of those critical four Ps of marketing strategy—Product, Promotion, Price and Place (Perreault & McCarthy, 1979).

Sustainability, as defined by Kleindorfer et al. (2005), includes the topics of environmental management, closed-loop supply chains and a broad perspective on triple bottom line thinking, integrating profit, people and the planet into the culture, strategy and operations of companies. In other words, sustainability is a comprehensive approach to make a company more green, in a way that aligns an organisation’s profit and environmental goals. Kleindorfer et al. (2005) divided the primary drivers of sustainability in the supply chain into two groups: regulations and public expectations. The regulatory drivers of sustainability are corporate image, regulatory compliance, liability and community relations. The public expectations that drive sustainability are employee health and safety, customer relations, cost reduction and quality improvement (ibid.). According to Starik and Rands (1995), new patterns of sustainable production and consumption are only achievable
through a high degree of innovation of products and processes. Innovation refers to innovative technologies, products and services, innovative processes, innovative organisational models and innovative business ideas. Eco-innovation can be defined as actions to create or apply new goods, processes, systems, services and procedures designed to provide customer and business value and help to decrease negative environmental impacts (James, 1997; Rennings, 1998). There is a growing interest among top managers, stakeholders and academics regarding Green Marketing strategies and the potential impact on the triple bottom line. Firms are increasingly adhering to a triple bottom line performance evaluation, a concept coined to reflect the growing tendency of stakeholders to evaluate organisational performance on the basis of economic prosperity, environmental quality and social justice (Elkington, 1997).

Carter and Rogers (2008) identified four facets supporting the performance on the triple bottom line (Elkington, 1997) by means of a review of sustainability literature: risk management, transparency, strategy and organisational culture (Figure 1). On this basis, the authors define SSCM ‘as the strategic, transparent integration and achievement of an organization’s social, environmental, and economic goals in the systemic coordination of key interorganizational business processes for improving the long-term economic performance of the individual company and its supply chains’ (Carter & Rogers, 2008).

Figure 1. Sustainable Supply Chain Management

Green Logistics Strategies for Evolving Integrated GSCM System

Area of Green Logistics encompasses many segments that can be used to manage environmental impact. According to the fact that pollution is partly the consequence of economic activities, cooperation with the economy is necessary because of the need to assess levels of environmental impacts by each and every business related to transport logistics and try to minimise these. Minimisation of these impacts can be provided by using the knowledge and understanding the necessity of every company for individual organisation of Green Logistics programmes. The whole concept of Green Logistics includes strategies and activities of logistics operations that are designed in such way as to have less negative impact on the environment. The benefits of applying this concept to individual companies can be numerous: energy savings, lower operating costs and the possibility of positioning in the markets where the business is in compliance with environmental standards as an element of competitiveness (Bajor, Božić & Rožić, 2010).

Green Logistics is a relatively young research area. As original focus of logistics has developed from the original movement of finished products to transport, handling systems, storage and SCM, same happened in the Green Logistics, which now encompasses greening of the production, warehouses, transport, manipulation, packaging, marketing and in the end, the customer. Results of the research
have shown that ‘going green’ can bring profit by as much as 10 per cent when compared to a traditional supply chain in logistics industries. Designing a Green Logistics cannot be specified on one of the points in supply chains; it is a collection of organised set of activities, resulting in sustainable and upgradable green network that consists of planning the Green Production, Green Transport, waste reduction, energy savings, space savings, resource savings, planning a GSCM and having a green consumer.

Although in the past, the environment was not a major preoccupation or priority in the industry itself, the last two decades have shown a remarkable change as Green Logistics became increasingly a part of the SCM discourse and practices. The standard themes of materials management and physical distribution can be expanded with an additional focus on strategies able to mitigate the paradoxical nature of Green Logistics. Applying Green Logistics to supply chains must also consider the network and spatial footprint of freight distribution. Airports, seaports and rail terminals are among the largest consumers of land in urban areas. For many airports and seaports, the costs of development are so large that they require subsidies from local, regional and national governments (Rodrigue, Slack & Comtois, 2001).

There is growing evidence that green logistics results in increased supply chain performance, particularly since greenness per se favours an integrated perspective about supply chains. The actors involved in logistical operations have a strong bias to perceive Green Logistics as a means to internalise cost savings, while avoiding the issue of external costs. The top environmental priority is commonly reducing packaging and waste. The rise in energy prices is conferring additional incentives for supply chain managers to improve upon logistics and will correspondingly push energy and emissions at the forefront. These observations support the paradoxical relationship between logistics and the environment that reducing costs does not necessarily reduce environmental impacts. Overlooking significant environmental issues, such as pollution, congestion and resource depletion means that the logistics industry is still not very green. Green Logistics remains an indirect outcome of policies and strategies aimed at improving the cost, efficiency and reliability of supply chains.

Green Integrated Supply Chain Management (GISCM) brings together various stakeholders in the supply chain from within and outside the organisation to help the organisation improve its environmental credentials. To benefit both the business and the environmental bottom line, the SCM of an organisation needs to be analysed, planned and optimised for sourcing and deliveries, and in an environment-conscious manner. Such analysis includes suppliers, customers, regulatory authorities and employees at all levels of an organisation. Undoubtedly, electronic (Internet-based) systems deliver enterprises with a competitive advantage by opening up opportunities to streamline processes, reduce costs, increase customer patronage and enable straight thorough processing capabilities. These same characteristics of good SCM can be converted to handle environmental issues related to supply chain operation and processing.

GISCM involves the linking of suppliers and customers with the internal supply processes of an organisation from an environmental perspective. Internal processes include both vertically integrated functional areas such as materials, sales and marketing, manufacturing, inventory and warehousing, distribution and perhaps, other independent companies, which are involved in the supply chain (that is, channel integration). Customers at one end of the process can potentially be a supplier downstream in the next process, ultimately supplying to the end-user. Whilst large-scale GISCM systems are yet to happen in some organisations, the concept of establishing information flows between points in the supply chain has been around since the 1980s. Through Electronic Data Interchange (EDI), customers and suppliers have communicated supply data through direct dial-up interfaces and other mediums. However, the ability for the Internet to create a common communication infrastructure has made integration much more cost-effective. In sum, GISCM has a future promise to deliver the right product to the right place at the right time and at the right price.

Conclusions

Most companies currently engaged in energy-intensive operations such as manufacturing, infrastructure, mass rapid transport, etc., are confronted with embarrassing questions like how green their manufacturing processes and supply chains are, the state of their carbon footprints and how they recycle and dispose wastes. With growing consciousness towards ‘going green’, consumers increasingly prefer to purchase green products that are free of toxins, produced with minimum level of pollution-linked contaminants and minimal environmental or ecological hazards. The article has discussed at some length about different emerging concepts and operational strategies for successful implementation of green supply chain that could be successfully employed as a potent management tool, aiming at both corporate and product branding of green products. Linkage with transport systems, ‘lean’ concept in SCM, green innovations and sustainability issues of GSCM and Green Logistics strategies for evolving integrated GSCM system have also been discussed with suitable corporate examples to bring in greater clarity on the evolving concept.
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