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## **Industrial Application Review for Sustainable Supply Chain Management**

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### **Abstract:**

This article aims to serve several purposes. First of all, it provides an overview of the opportunities and challenges involved in the implementation of a sustainable supply chain, as well as the CLSC. Secondly, It includes an analysis of the cost saving, risk mitigation, the delivery of a superior service with the provision of returns and the opportunity of reducing the company's carbon footprint. The critical challenges of implementing a sustainable closed-loop supply chain include the potential cost of implementation, and ensure the collaboration and transparency throughout the chain. This article also provides a critical examination of selected opportunities and challenges deriving from the implementation of SSCM. The managerial implications are also discussed.

**Key Words:** Sustainable supply chain, Closed-loop supply chain, Green, Opportunity, Challenge

## 1. INTRODUCTION

Sustainable development can be defined in many ways. There is a quoted definition which comes from the 'Our Common Future' publication: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland, 1987:43). Sustainable supply chain management (SSCM) can be defined as "the strategic, transparent integration and achievement of an organisation's social, environmental, and economic goals in the systematic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chain" (Carter and Rogers, 2008:368). This definition can be linked to the concept of the triple bottom line or the tripartite model of sustainability. Figure one outlines what is involved in a SSC. Firms should avoid those activities that fall outside of the intersection of the centre area instead striving for an integration of all four elements in the centre of the Figure.

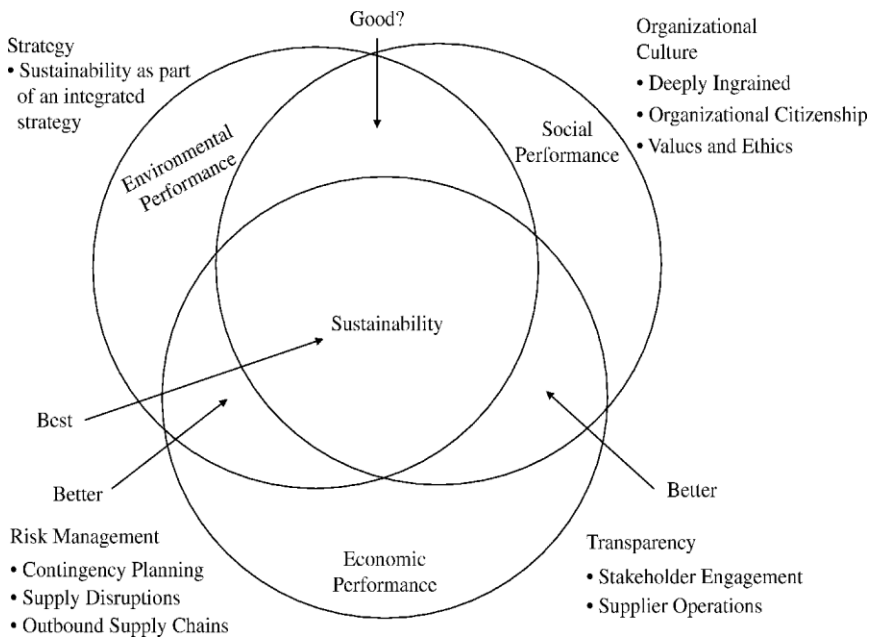


Fig. 1 Source: Carter and Easton (2011: 48)

In the current economic climate, a company's economic success is intertwined not only with its social and environmental actions but also with those of its suppliers (Accenture, 2008). Therefore, the sustainable supply chain management is very important. Preserving the environment can be seen as a burden for companies (Guide et al, 2003: 5). Although sometimes sustainable solutions seem not to be profitable, stakeholders are increasingly demanding that firms should manage their environmental and social issues (Carter and Easton, 2011),

particularly under the economic, regulatory and consumer pressures (Srivastava and Srivastava, 2006; Krikke et al, 2003; Zhu et al, 2005). Nowadays, Consumers demand more environmentally-friendly products and are increasingly recycling (Krikke et al 2003; Chan et al, 2010). Many US firms and EU firms have become interested in reverse supply chain for economic reasons or/and legislation reasons. For example, Germany enacted the German Packaging Order and the German Recycling and Waste Control Act in 1993, which places the responsibility of waste avoidance of the manufacturer. In addition, Germany also mandated that auto manufacturers should take full responsibility for the recycling of disposed cars (Lapide, 2008). It can be seen as early green initiatives. There are some US legislations using tax credits and the banned landfill of certain products to encourage reuse activities (Guide et al 2003 b). According to research, many developing countries firms especially in China are coming under pressure from developed countries firms of conforming with green and sustainable practices because they are suppliers of those developed countries firms. Developed countries firms will not purchase from the low cost producers unless they conform with the firms' sustainable standards (Zhu et al, 2005).

There are also barriers of implementing a SSCM strategy such as gaining compliance to standards and regulations throughout the supply chain, and engaging suppliers beyond tier-1. Furthermore, measurement tools and management systems, which are currently in their formative phases, may be required. This is the only area of implementation that will require additional costs. These issues will be discussed further in the following literature review, which will serve as a foundation of the proceeding critical discussion of the challenges and opportunities relating to the implementation of SSCM.

The following literature review will include an overview of green supply chain and the closed-loop supply chain (CLSC), and a consistent examination of the opportunities and challenges to the implementation of each.

## 2. LITERATURE REVIEW

### 2.1 Green supply chain

The green supply chain can be defined as 'the process of using environmentally friendly inputs and transforming these inputs through change agents whose by products can improve or be recycled within the existing environment develop(ing) outputs that can be reclaimed and reused at the end of their life cycle' (Penfield, in Stokes et al, 2009). Nowadays, many customers want to be associated with 'green' companies and they always want to buy green products.

#### 2.1.1 Implementing green and sustainable supply chain

Rao and Holt (2005) identified how it is perceived that implementing a green and sustainable SC promotes efficiency and synergy which help environmental performance, minimises waste and achieves cost savings. It is also perceived that this will enhance the corporate image, competitive advantage and marketing exposure. The results of the authors' research conclude

that where there is 'greening' of the inbound, production and outbound, there is a lead to significant values for competitiveness and economic performance. However the way to green the inbound requires the firm to integrate the suppliers into its green supply chain, which is a very difficult task as identified by Herman Miller Inc., W. Drew Schramm, Senior Vice President of global supply and logistics. Yet when collaboration is achieved with suppliers it results in considerable opportunities for firms, decreasing time and money in procurement of sustainable materials. Mr. Schramm identified the firms having the best sustainability achievement from a SC point of view as having the ability to work with suppliers in developing sustainable products. The firm works closely with suppliers, providing them with a clear understanding of what the firm's strategy is and hence what type of components they require. This enables the firm to introduce green products to the market more quickly than other firms as suppliers give them what they want, when they want it (Quinn, 2008).

There is an example that furnishing firm called Herman Miller Inc have integrated sustainability into their strategy which originated from their founders. The firm is deeply involved with sustainability and work closely with designers and suppliers. Suppliers know that the firm wants to purchase the most environmentally-friendly materials and are willing to meet their needs. The firm also implements a DfE Design for the Environment strategy of each product by using the most environmentally-friendly materials and considers post consumption and recycling in the design (Quinn, 2008).

In 1996 the firm also became the first furniture firm to partner with Toyota to implement kan ban thereby decreasing inventory and space and increasing quality and safety. Their philosophy is 'for a better world around you' (Herman Miller Inc. 2011). This firm in accordance with figure one has integrated sustainability into their strategy, sustainability is deeply embedded in the organisational culture and finally the firm is highly transparent and works closely with their suppliers and designers.

Lapide (2008) identifies the risk of firms if not controlling their SC and ensuring that it is sustainable. It would result in the crash of the firm's reputation t but their contracted supplier, if the supplier or suppliers-supplier found to be in breach of sustainable and green regulation. It is hence up to the firm to ensure that these suppliers comply with local and government regulations. HP takes these steps and requires all direct suppliers to adhere to its code of conduct (Sept, 2008). Despite this admiral step, this does not ensure that the suppliers supplier are acting in a sustainable manner.

### **2.1.2 Challenges**

The tripartite challenge of sustainability is only beginning to emerge, and good practises within the supply chain are not yet clearly defined (Turner and Houston, 2009:16) Therefore the organizational requirements of supporting triple bottom line outcomes is an area of exploration and learning (Worley et al, 2010: 325) and the responses of multinational enterprises (MNEs) have been widespread. For example, Wal-Mart has reconfigured the organization-wide

processes across the supply chain and engaged its internal and external networks to increase their environmental performance. Further after the Gap Inc. were charged with condoning sweatshop conditions, child labour, and forced labour in their highly fragmented supply chain, they took action by creating a multi-stakeholder collaboration capability. The dimensions of the capability were built over time, initially the organization developed an apparel factory monitoring and compliance capability; thereafter, in response to limitations in the compliance approach they launched a second set of activities that involved extending the multi-stakeholder approach beyond the factories to the apparel industry's supply chain (Worley, 2010:328).

There are some challenges which emanate from the previous cases and empirical literature. These are addressed within four themes: the successful sustainability performance indicators, transparency, risk management and sustainability as a novel concept. The emergent nature of the concept of sustainability and the inherent lack of proven and defined programs for global implementation is a consistent issue, leading to differentiated responses and trial and error programs which we can see within the Gap Inc. case through the evolution of their sustainability program. Furthermore, the development of metrics and performance indicators are crucial elements of the process, which is currently lacking (Velva, 2009:19). Sophisticated audit processes have been developed in Wal-Mart and Hewlett Packard Company (Turner, 2009: 21), however difficulties in this area have led to the failure of many green initiatives due to the wide range of parameters within metrics.

### **2.1.3 Risk management**

Scott Charon, the program manager of Herman Miller's design for the environment team states that "When we're Greening our supply chain we feel that we're eliminating our risk" (Varmazis, 2008:1). SSCM provides an opportunity to mitigate risks in the form of disruptions to supply, scarcity of resources, fluctuations in energy costs, poor supplier quality or reputational and even associated legal actions due to poor environmental and societal performance. Actions taken by Esquel (clothing manufacturer) and structural changes through the implementation of SSCM, have led them to create partnerships with their suppliers of cotton (farmers) in China. Esquel introduced their suppliers to sustainable farming techniques, such as drip irrigation to decrease their water use and natural disease control programs to lessen their reliance on pesticides. This has resulted in a higher quality of cotton, and a doubling of their yields, the farmers' income when the demand for organic cotton around the world is soaring, Esquel has secured a dependable, major supply (Lee, 2010:65).

### **2.1.4 Transparency**

Zuckerman (2010:32) stated that between "40% and 60% of a company's carbon footprint resides upstream in its supply chain – from raw materials, transport, and packaging to the energy consumed in manufacturing processes. For retailers, the figure can be 80%". The fragmentation of the supply chain has obviously provided serious challenges of implementing SSCM and complicates the necessary end-to-end compliance when the adjacent suppliers extend beyond tier-1. This has been addressed by Wal-Mart by the elimination of

intermediaries and the consolidation of the supply base (Plambeck, 2007:22-23); however these options may not be available or perhaps only operational to an extent. In this case of collaboration, the remaining options could be extremely challenging, when cultural and geographic distance and tiers separate actors. This requires, first education of the need for transparency, and then creating alignment through incentives such as direct aid, training or subsidies (Lee, 2010) to persuade all partners that they will benefit from the collaboration. For example, Starbucks had to direct interactions with farmers in their supply chain they decided to employ the CAFE program and pay premiums to top scoring suppliers on this sustainability scheme (Lee, 2010).

## **2.2 Closed-loop SC and reverse logistics**

A closed-loop supply chain is a recoverable product environment which involves strategies in order to increase the product life via repairing, remanufacturing and recovering materials from the recycling of products (Jayaraman et al 1999), it incorporates the traditional forward supply chain as well as the reverse supply chain/reverse logistics. The traditional supply chain places the customer at the end of the process whereas a closed-loop supply chain includes the return process and the manufacturer has the aim of deriving additional value from returned products (Guide et al, 2003), and meeting the demands from various sources in relation to their social responsibility (Coronado Mondragon and Lalwani, 2011).

The European Working Group on Reverse Logistics defines the reverse logistics as ‘the process of planning implementing and controlling backward flows of raw materials, in process inventory, packaging and finished goods. From the points of view of manufacturing, distribution, usage, recovery or proper disposal’ (Rubio et al 2008:1100), for the purpose of recovering value (Srivastava and Srivastava, 2006). Environmentally friendly logistics arrangements including reverse logistics and closed loop SC are an essential part of a SSC (Preuss, 2009).

The closed loop supply chain consists of some additional activities. Firstly, it includes the product acquisition/collection, which serves to obtain products from the customers at multiple sources. Secondly, it includes the reverse logistics, which means the channel of products from end user to disposition site. Thirdly, it includes testing, inspection, sorting, pre-processing and disposition, in order to determine the quality of the return and the optimal reuse option. In the fourth place, it includes reprocessing, refurbishing, reuse, repair, remanufacture, recycle or disposal. The other activity is, remarketing, redistribution, to create and exploit markets for refurbished goods and distribute them. (Guide et al, 2003; Krikke et al, 2003; Srivastava and Srivastava, 2006; Fleischmann et al, 2003)

Reverse logistics ‘happens in different ways that include variations in terms of the reasons for product return, the method of collection, the infrastructure used, the point to which product is returned, and the destination of the product’ (Coronado et al, 2011).

### **2.2.1 Opportunities & challenges**

A company that has embraced the CLSC is Estee Lauder (Cosmetics). The company used to dispose more than \$60 million of its products in landfills each year, which was one third of its retailer returns. However, after the company launched an investment of \$1.3 million in a reverse logistics infrastructure that included a system of scanners and business intelligence tools linked to an Oracle database, the company was able to increase productivity by 24% and reduced the destroyed products from 37% to 27% in the first year of operation. This saved Estee Lauder approx. \$0.5 million in labour costs, and has now manifested in a \$250 million product line of returned goods (Vaidyanathan and Luo, 2007:57-58). From this case one can glean several opportunities bestowed by implementation of a CLSC, including savings on procurement and disposal costs (Krikke, 2003), and the increased return on investment (Jayaraman and Luo, 2007:65), further the process generated valuable feedback regarding product and service performance. (Jayaraman and Luo, 2007:65). In line with the firm's resource based view (Barney, 1991) a high quality reverse logistics process can also be seen as a strategic resource or a differentiator for the firm (Worley, 2010). It also allows Estee Lauder to reduce their environmental footprint which may also be a differentiator of the firm in terms of advertising through 'green branding'.

Moving beyond this case there are several additional opportunities within the CLSC including the following areas. Firstly, the disassembly of products for spare parts (Fleishmann, 2003:4) and therefore procurement cost savings. Second, in rise of the service dominant logic (SD-L) of marketing and the growing perception of physical products as part of a service package (Hillegersberg, 2001: 76), after-life (or after-use) collection completes the service package and may act as a key differentiator. Third, in the relevant context the reverse logistics process allows the creation of long term relationships with customers or partners assuming the reverse logistics process is of a high quality (Jayaraman and Luo, 2007: 61). Secondly, it may reduce the cost of environmental compliance in the face of evolving and increasing regulation. As aforementioned the implementation of the CLSC presents a number of challenges, from the Estee Lauder case we can see that a significant investment was required in the form of information systems and we can assume that some re-structuring of the logistics process was also necessary. Furthermore it is usual for implementation of a CLSC to include some additional physical infrastructure (Kumar, 2008: 305).

Beyond the case, CLSC involves other significant challenges, e.g. there are additional complexities, such as the placement of inventory buffers, parts flow, and the uncertainty regarding the variable quality of returns and the inability to forecast their quantity, within the implantation of CLSC in an electronics supply chain in which products are remanufactured or disassembled for parts there are (Fleishmann, 2003; Jayaraman and Luo, 2007). Wassenhove (2003:1) states that according to whether the product is returned during or at the end of the product life cycle, will add further complexity to the CLSC as each returns type will require a reverse supply chain that considers the characteristics of the returned products to optimize the

value-recovery process. Further within an industry such as electronics when the products tend to have a short lifecycle the speed with which a product is reconciled to market is crucial, it must be treated akin to a perishable item to ensure maximum value is captured.

One of the most critical challenges of implementing CLSC is the necessary collaboration amongst supply chain partners, due to the uncertainties introduced by return flows (Hillegersberg, 2001). The challenges of advanced collaborations may be compounded by fact that these are new relationships established for the RLs process (Hillegersberg, 2001), which will inherently be characterised by lesser degrees of trust, and cohesiveness through unfamiliarity. Further, the relationship may be characterised by conflict of interest between actors, such as disagreements over condition of the return, item value and the timeliness of response (Jayaraman and Luo, 2007:59).

### 3. DISCUSSION AND MANAGERIAL IMPLICATIONS

#### 3.1 The costs of implementing SSCM

We have referred to Estee Lauder's initiative of implementing the CLSC which yielded an economic value of savings \$0.5 million in labour costs, and \$250 million product line of returned goods (Vaidyanathan and Luo, 2007:57-58), as well as increasing the companies ROI. In reference to the implementation of sustainable practices 3M's "Pollution Prevention Pays" program through employee-generated projects have reduced 3M's emissions by over 1 billion pounds since 1975 while saving the company approximately \$500 million. In various other cases the reduction of procurement costs through remanufacture, recycling and refurbishment are also heralded as key opportunities of the MNE. Also the implementation of SSCM is described as a win-win scenario. Michael Porter has stated that, in this new world, both business and the environment can win. Being green is no longer a cost of doing business; it is a catalyst for constant innovation, new market opportunity, and wealth creation (Porter and van der Linde, 1995). Subsequently, activists and society have jumped on the bandwagon, agreeing that businesses should be doing more and expecting them to do so. Walley and Whitehead (1994: 46) state that "unfortunately, this popular idea is ... unrealistic. Responding to environmental challenges has always been a costly and complicated proposition for managers. In fact, environmental costs of most companies are skyrocketing, with little economic payback in sight. The vision of these companies is based on free trade, market prices that reflects the comprehensive societal impact of products and processes, more flexible regulations, and investors who pay greater heed to environmental considerations."

The implementation of programs such as "Pollution Prevention Pay" has obviously improved firm performance and the triple bottom line, but as companies expand beyond efficiency based programs such the use of energy saving light bulbs, and strive toward eco-effectiveness throughout the supply chain it seems that "...costs will skyrocket". Therefore, Frances Cairncross (1991:1) suggested that "In a world where you cannot do everything, only a



value-based approach allow informed tradeoffs between costs and benefits”, which is the crucial last step of the implementation.”

**Table 1 The Implementation of a SSCM: Essential Elements**

The case for action
The company's sustainable supply chain strategy
Results of the self-assessment tool(such as a checklist)
Proposed new policy, standards, operations and activities tied to specific timelines and milestones
Immediate and medium-term resources required
Changes to current procedures and likely implications of those changes
Key performance and success indicators
Reward and incentive program requirements
A proposed process for monitoring and assessing success
Training and education needs and budget
Expected total costs and benefits assessment

Adapted from ‘Supply Chain Management Viewpoint: Sustainable supply chain management’, Accenture (2008).

### **3.2 The paradox of end-to-end compliance**

One of the key challenges of implementing SSCM is end-to-end compliance, which is of critical importance as between “40% and 60% of a company’s carbon footprint resides upstream (Zuckerman, 2010:32). Therefore, the sustainable performance of a supply chain will only ever be as strong as its weakest performer in this respect. As aforementioned the Gap Inc., attempted to gain compliance in emerging economies through the development of a monitoring and compliance capability (Worley, 2010). The concept of corporate responsibility has also been introduced through a number of codes of conduct and international standards such as the SA8000, ISO 9001, and ISO 14001 (Tencati, 2008: 518). CSR has thus become mandatory in international supply chain relationships and managers in emerging economies have had to learn more socially responsible practices. However, in emerging economies, the positive correlation between profit and CSR is still not pervasive, and the debate still continues. (Margolis and Walsh, 2003; Orlitzky et al., 2003; Rubbens and Wessels, 2004). Whilst Tencati et al (2008) have observed marked improvements in terms of reduced accidents, decreased staff turnover and greater productivity, they have also found that the monetary and non-monetary costs of complying with international standards may prove to be unsustainable, inhibiting integration to the international supply chain, as they have been left behind to bear the costs of Compliance.

### **3.3 CLSC - sustainable?**

Can the CLSC be described as sustainable if the opportunity drivers are merely economic? On reflection of the opportunities that may lie in the realm of the CLSC, the core benefits derived from the CLSC surround the realisation of economic value either in cost savings or increased profits from re-selling refurbished equipment, spare parts or raw materials, or anticipated future shortages, which will drive prices upwards according to the laws of supply and demand. These direct benefits are all economic drivers. After an analysis of 10 years of research in reverse logistics, products recovery and CLSC, Rubio et al (2008) concluded that almost all CLSC models are cost-driven. Therefore environmental performance will often be an indirect benefit, and assumingly not maximized. Neto and Bloemhof (2010:4463) stated that sustainability "... can only be obtained by changing the objectives from economy driven towards economy, environment and society driven. This draws us back to the model of sustainability, which is the tripartite achievement of social, environmental and economic goals for competitive performance. Therefore multiple objectives are necessary in the practice of sustainability and in this vein it seems that presuming along with other academics that the CLSC is sustainable by definition may be adding two and two and getting five. Neto and Bloemhof (2010:4478) therefore suggested the extension of the model and consider key issues that merit cogitation for the CLSC to evolve to SSCM. For example in the establishment of the recovery network the firm must consider whether facility location decisions are based on reasons which are purely economic (cost-saving) or environmental concerns have also received due attention. Additionally, the supply chain manager must consider what to remanufacture, in order to ensure that the decision is again based on economic and environmental concerns. These extensions to the implementation of the CLSC model, and their acceptance in the MNE may constitute challenges in themselves, but without them these cost-saving practices will by definition not create a sustainable supply chain and the opportunities associated with reduction of the carbon footprint will only ever be an indirect benefit and never properly maximised.

### **3.4 Managerial implications**

MNE supply chains tend to be global and fragmented in many functions being outsourced such as marketing, sales, design and R&D. Thus implementing an integrated SSC across a fragmented supply chain is very difficult. This challenge was identified as a major issue by industry experts, who suggested that cooperation and communication between supply chain members is essential in SSCM and implementation (Seuring and Müller 2008). For example for MNEs who outsource the design function, clear communication and specifications must be given in order to aid disassembly and remanufacturing. MNEs would therefore benefit from delegating sustainability responsibility to their procurement department who have to source from companies who design and produce using design-for-remanufacturing processes, as opposed to just quality and price considerations (Thierry et al 1995). MNE managers can create incentives for supply partners such as increased orders and preferential contract terms for complying and integrating sustainable practices (Business for Social Responsibility 2007). An MNE that has been successful at aligning SSC practices among its supply chain partners is Ford.

Ford uses 'The Aligned Business Framework (ABF)', which is a framework that is used to spell out business agreements and practices including sustainable ones between them and suppliers. As part of the agreement, Ford increases the volume of business with selected suppliers who comply with this framework. The ABF agreement seeks to enable Ford's supplier partners to take greater responsibility in ensuring sustainable environmental management systems throughout their value chain.

The bulk of research on SSCM focuses on technical and operational issues (Guide and Van Wassenhove 2009). However the author supports that there should be extended research attention outside of the traditional comfort zone of SSCM, by integrating the impact of marketing, accounting, managerial rewards, supply chain partner incentives and innovative technology, on increasing the value and performance of SSCs. Such research will make the field of SSCM more structured by identifying key drivers of profitability (Guide and Van Wassenhove 2009). More research on strategic factors seems necessary in order to develop a theoretical framework for strengthening and driving well designed SSC practices (Rubio et al 2008) because "poorly designed reverse supply chains with no link to the forward business may rapidly destroy value" (Guide & Van Wassenhove 2009). By strengthening SSCM concepts and theories, there will be more incentives for MNEs to implement SSCM for economic reasons alone besides meeting the consumer pressures and regulatory norms (Srivastava & Srivastava 2006; Carter and Rogers 2008).

However, most research on SSCM uses mathematical modeling, which may be difficult for MNE managers to understand and apply. Academic researchers may seek to use more practitioner friendly methodologies that are easier to understand in-order to motivate managers to apply SSC practices.

#### 4. CONCLUSION

This critical examination has served several purposes. The first two sections provide an overview of sustainable supply, the closed-loop supply chain and the opportunities and challenges involved in the implementation of a sustainable supply chain, as well as CLSC. These include cost savings, the mitigation of risk, the delivery of a superior service with the provision of returns and also the opportunity to reduce the company's carbon footprint. However, there are also critical challenges in the implementation of a closed-loop and sustainable supply chain; a crucial challenge is also the potential cost of implementation. Furthermore, there are serious challenges throughout the supply chain when implementing SSCM regarding collaboration throughout the chain and ensuring transparency. The CLSC provides additional technical issues such as forecasting accuracy and relevant returns channels for different products.

The third section provides a critical examination of selected opportunities and challenges deriving from the implementation of SSCM; firstly, the nature of the costs of implementation is

examined as this aspect may be viewed as both an opportunity and challenge according to the nature of the sustainable practices employed, and will often require trade-offs.

Secondly, an end-to-end compliance through collaboration is addressed as a challenge that if enforced incorrectly may actually create unsustainability within the supply chain, by forcing suppliers in developing economies to bear the costs of compliance and restrict their entry to the international supply chain. Lastly, we investigate the opportunities provided by the CLSC and consider that it may require extensions to allow it to be truly sustainable.

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