Evolving consumer awareness has led to academic and corporate interest in establishing sustainable supply chain logistics. Yet, this area is still in its infancy with various potentials. This study aims to briefly review the literature of the sustainable supply chain logistics over the last decade based on the triple bottom line approach. A number of common challenges have been identified. Opportunities are also highlighted in disciplines such as logistics and occupational safety and health management. This study emphasizes the importance of sustainable supply chain logistics. It is hoped that this study able to provide platform for proposing future research opportunities.

**Keywords:** Economic, Environment, Occupational Safety and Health, Social, Supply Chain Logistics (SCL), Sustainability

1. Introduction

Globalization and competition have forced many companies to revisit their supply chain logistics strategies. The ideologies of logistics and supply chain have been influenced in the last few decades. Firms are increasingly replacing the traditional objectives of their supply chain which focused on reducing costs, time and quality to newer concepts which include responsiveness, agility and leaness (Norrman and Jansson, 2004). According to Williams, Esper and Ozment (2002), the importance of partnerships and strategic alliances have changed, as the industry migrates from the traditional supply chain management approach to the e-supply chain management (eSCM) perspective. Moreover, the focus on leadership style also provides potential of leadership changes to reap fully the benefits of operating in the eSCM environment. In recent years, there has been increasing awareness of the sustainability of supply chain logistics, in which enterprises compete based on multiple competitive performance objectives such as quality, price, responsiveness, flexibility, and dependability. Sustainability could be referred as ability of organizations to satisfy the needs and expectations of customers and other stakeholders including shareholders, employees, supply chain partners and society over the long term in a balanced way (ISO, 2009).

With various firms involved in supply chain and logistics processes, differing quality and standards may exists, leading to conflicts in maintaining sustainability. For instance, failure to maintain appropriate temperature and abusive storage conditions resulting from inconsiderate actions of supply chain partners may lead to
safety issue in the food industry (Soosay, 2008). Hence, providing suppliers with training on sustainability issues or partnering with them in developing sustainability management system such as health and safety conditions might be able to reduce the risks of poor quality or production disruptions (United Nations Global Impact, 2010). As the field of supply chain logistics has an inherent connection to sustainability, it is necessary for researchers to continue to enhance the extant body of knowledge to offer theoretical and pragmatic insights to facilitate supply chain managers to meet these challenges. As management principles and theories linked to sustainable supply chain logistics continue to develop, there is a need to evaluate our existing position and where we should be going as we move forward.

While various studies have been focusing on integrating the idea of sustainability and supply chain (Seuring & Muller, 2008; Srivasta, 2007; Mollenkopf, Stolze, Tate & Ueltzschy, 2010; Winter & Knemeyer, 2013), there is little work done to explore the role of logistics as a supply chain function towards sustainability. The annual logistics costs of the world’s gross domestic product was estimated at 12 per cent and this supply chain function was ranked as second to the costs of goods sold for most firms (Dey et al., 2011). Beyond the monetary costs, logistics process also appears to produce up to 75 per cent of a firm’s carbon footprint, implying a substantial impact on the environment (The Council of Supply Chain Management Professionals, 2008). More recent studies such as Kucukvar et al. (2016) showed that onsite and upstream supply chains found to have over 90% of total energy use and carbon footprint. In other words, as the findings of Silva, Fritz and Nunes (2015), the research on sustainability is focusing on the environmental dimension while the research on supply chain management is focusing on the economic dimension. The combination of economic and environmental costs contributed by logistics to supply chain management makes it a key area, creating a need to explore opportunities to boost the logistics performance.

There are many review studies reported in the past. Hervani, Helms and Sarkis (2005) provide an integrative framework for study, design and evaluation of green supply chain management performance tools. Vanany, Zailani and Pujawan (2009) suggest that supply chain risk management is a relatively “immature” issue with rapid growth of interest, therefore future research should explore collaborative risk management and strategies could for a resilient or robust supply chain. Some researchers focused on theory-building efforts. According to Tseng, Lim and Wong (2015), the top-ranking aspect to consider in sustainable supply chain management is the stakeholders. On the other hand, Seuring (2013) suggests the three dominant approaches on the modeling side as equilibrium models, multi criteria decision making and analytical hierarchy process. Touboulic and Walker (2015) observed that theory-building efforts in sustainable supply chain management remained scarce, where the predominance theories applied were macro theories, i.e. resource-based view, stakeholder theory and institutional theory. Some others emphasized practical relevancy. Jonsson and Holmström (2016) highlighted the four components of practically relevant supply chain planning (SCP) theory, i.e. context, intervention, mechanism, and outcome (CIMO). Their research concluded that past literatures have been identifying enablers and antecedents for outcomes without reference to implementable practices and practical contexts, which were considered insufficient for relevancy to practice. According to Witt struck and Teuteberg (2011), signaling, information provision and the adoption of standards are pre-conditions for strategy
commitment, mutual learning, the establishment of ecological cycles and the critical success factors of SSCM. Specifically, Giunipero, Hooker and Den slow (2012) indicated that top management initiatives and government regulations drive purchasing and supply management sustainability while investments in sustainability and economic uncertainty are a hindrance. Nevertheless, Silvestre (2016) describes four promising avenues for future sustainable supply chain management investigations, namely (i) Sustainable Supply Chain Drivers and Barriers, (ii) Sustainable Supply Chain Genesis, (iii) Sustainable Supply Chains and Innovation, and (iv) Supply Chain Sustainability Trajectories.

Moreover, while various studies have been conducted in diverse areas of sustainability encompassing green purchasing, ethical sourcing, carbon footprint and reverse logistics, much of these researches focused solely on individual element, such as environmental. Hence, this study aims to provide a review on the development of research focusing on the integration of sustainability and the area of logistics in the supply chain in a broader picture, based on the triple bottom line approach. It is expected that this study able to provide platform for proposing future research opportunities.

2. Supply Chain Logistics Elements
Supply chain logistics (SCL) is better understood within the context of end-to-end supply chain (Metro Vancouver, 2009). It could be referred as a part of the chain that plans, implements and controls the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and consumption in order to meet the customers’ needs (Zakaria et al. 2010). These various activities imply that managing logistics processes in supply chains can be complex and difficult. Moreover, with intense globalization, firms are increasingly expanding global sourcing of materials, equipment and finished goods, leading to huge logistics and distribution challenges, which requires a greater degree of coordination ever before. A retailer purchasing goods from international markets for instance need reliable partners to ensure products are delivered in a timely manner. Continuous flow of supplied inputs is not only crucial at the final stage, yet it is also critical in the production stage, in which shortages of raw materials could lead to underutilization of capital intensive processing facilities and labor. Some of the common problems arising from inefficient logistics and distribution process include delayed product and service delivery, high product damage rate and supply disruptions.

Figure 1 - Supply Chain Logistics Functions within an End-to-End Supply Chain

![Figure 1 Supply Chain Logistics Functions within an End-to-End Supply Chain Source: Sustainable Supply Chain Logistics Guide (Metro Vancouver, 2009)](chart)
At the heart of these issues is the fact that businesses along the supply chain need to reconfigure their logistics operations to gain and sustain their competitive advantage. The logistics operation has been positioned as an area in which firms could gain strategic advantage over their competitors. The focus has been transformed from cost effective to enhanced quality and timely production and delivery, responsiveness, agility and leanness (Norrman and Jansson, 2004). A new and expanded role of logistics function will be required in the new extended manufacturing enterprises, as a firm’s success will increasingly depend on its ability to coordinate and integrate the production activities at geographically dispersed and distinct locations with its logistics operations, of which this new enterprise logistics will place a high priority on both inter-firm and intra-firm integration of logistics activities for sustainable commercial success. This is pertinent as the integration of sustainability concepts into logistics concerns not only diverse business activities and processes across functional silos within an individual business entity, yet also involve cooperation between parties across the network of relationship that form a supply chain. For instance, Hasan (2013) reported that companies which are working together in measuring supplier performance, developing alternative methods of supply and increasing the recyclable content of products able to increase logistics efficiency and serve customers better.

![Figure 2 Key Focus Areas within Logistics and SCM](source: Adapted from Kearney (1999) by Norrman and Jansson (2004))

### 3. Sustainable Elements

The term sustainability could be defined as using resources to meet the needs of the present without compromising the ability of future generations to meet their own needs (The World Commission on Environment and Development, 1987). This definition implies the necessity of firms to not only focus on meeting economic goals, but also concentrate on the sustainment of nature’s resources and the societies served (Elkington, 2004). Morana (2013) also introduces a framework for sustainable development of supply chain management (Figure 3) with details about every aspects using the balanced scorecard (BSC) as a strategy performance management tool.

The economic dimension is well understood, developed and widely used as a basis to measure organizations performance e.g. profitability (Guide Jr. & Van Wassenhove, 2009). It was found that the green supply chain management practices lead to better performance in economic, environmental, operational, and social
performance (Geng, Mansouri and Aktas, 2017). The environmental element includes a set of organizational goals that deals with aims to promote greater environmental responsibilities and encourage development of environmental friendly technologies and business processes (Klasses, 2001). The social dimension refers to organizations’ ethical responsibility that may encompass activities that are not necessarily codified into law, but nevertheless are expected of business by societal members.

Researchers also scrutinise into the practical outcomes of these three dimensions. Dalé, Roldan and Hansen (2011) concluded that the economic pillar is the most important one, while the environmental pillar is becoming more relevant, and the social one is still incipient. Ashby, Leat and Hudson-Smith (2012) suggest that the environmental dimension and social dimension are treated separately in the literature with limited integration, and the sustainability research provides limited practical outputs. Varsei (2016) found that the literature has predominantly dealt with one or two dimensions, while sustainability has been misinterpreted as green or environmental practices with the general oversight of the social dimension. Nevertheless, Adetunji, Price and Fleming (2008) suggest that the SSCM is considered from the perspective of green procurement/purchasing in the construction sector, and they observed a high culture of health and safety and environmental consciousness due to the sector’s high exposure to environmental, health and safety issues. Furthermore, the results from Pereseina et al. (2014) show that intensified international collaboration on environment and traffic safety can help sustainable supply chain management, and the results from Chacón Vargas and Carlos Eduardo (2016) suggest that environmental and social responsibilities are increasingly important issues for the stakeholders of focal companies in emergent economies. Despite the less prevalent of social and environmental elements in business practice, these dimensions are characterized as essential business operations that could provide economic benefits. For instance, re-organization of production process for improved environmental performance may create opportunities for firms to innovate, with less energy used and lower waste handling costs may be reaped (Mohezar and Zailani, 2014).
Within the context of supply chain logistics, the increased outsourcing of activities across globe and growing concerns on societal and environmental impact of production and consumption led to renewed interest in sustainability. The business processes which cut across different functions within a firm and across other firms within the supply chain provide direction as to future research opportunities focused on the integration of sustainability and supply chain logistics. For instance, the procurement trend of U.S. apparel industry which manufactures most of their products in developing countries presents a number of pertinent social issues including the provision of clean and safe working conditions within suppliers’ factories and maintenance of fair rates of pay for workers and contractors employed by suppliers (Dargusch and Ward 2010) which have raised the importance of sustainability concept. This concept has been put forward by NGOs, government and multilateral institutions as a step in limiting the negative impact of firms’ production on society and environment. Organizational practices that lead to more sustainable supply chains are found to be a mixture of best practices in traditional supply chain management and also new proactive behaviours towards sustainable practices, with the three elements aligned adequately (Pagell and Wu, 2009). Concurrently, logistics performance of a firm depends greatly on the company’s supply chain management strategy and sustainability approaches such as waste elimination, supply chain risks management and cleaner production (Govindan et al. 2014; Green, Whitten and Inman 2008). In summary, the field of sustainable supply chains has evolved from a perspective and investigation of standalone research in social and environmental areas; through a corporate social responsibility perspective; to the beginnings of the convergence of perspectives of sustainability as the triple bottom line (Carter and Easton, 2011).

4. Research Methodology

In order to establish the current state and identify opportunities for future research on sustainable supply chain logistics, an extensive literature review was conducted. The assessment period for the study is between the years of 1995 and 2016, representing a 22-year time horizon for the analysis. The year of 1995 was used as a starting point as at this time the intersection between sustainability and SCM began to appear in literature (Seuring, 2004). Various databases including EBSCO, Emerald, Taylor and Francis, Science Direct and Wiley Inter-Science were utilised to identify relevant articles. Among the journals selected are

- Applied Energy
- California Management Review
- Corporate Social Responsibility and Environmental Management
- European Journal of Operational Research
- IIMB Management Review
- International Journal of Physical Distribution and Logistics Management
- International Journal of Production Economics
- Journal of Cleaner Production
- Omega
- Resources, Conservation, and Recycling
- Supply Chain Management: An International Journal
- Transportation Research Part E: Logistics and Transportation Review
In selecting the articles, a decision was made to focus on three different disciplines. They were logistics/SM, operations/production management and social/environmental management. Over one hundred articles were reviewed and they were classified based on the triple bottom line approach. Under the economic sustainability, all literature dealing with economic applications such as financial performance, cost reduction, competitive advantage and economic benefits were placed. All literature that concern with carbon footprint, green logistics, recycling and emission reduction were grouped as under the environmental classification. Social approach consists of literature that highlights issues such as fair trade, human rights, social responsibility and labor practices.

5. Findings and Discussions

Our findings indicate that the number of publications in the domain of sustainable logistics supply chains is growing with years, implying that more researchers are undertaking research in this area. Nevertheless, most of the articles that were examined were published in the single domain with more focus were given on environment and economic dimensions, rather than sustainability as a holistic integrated concept. This is expected with the heightened consumers concern on environmental issues relating to product-and-process derived pollution. For instance, a regulation was implemented globally over relatively short timeframe to phase out chemicals with Ozone Depleting Potential during 1990s (Linton, 2007). A steady increase on public recognition of global warming as environmental issue could also represent the on-going development in this area of sustainability. Yet, an increasing number of recent publications were found to posit sustainability issue on holistic perspective, suggesting the arising of subtle movement towards a broader examination of sustainability in the literature.

Table 1 Classification of Sustainable SCL Research

<table>
<thead>
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<th>Category</th>
<th>Author</th>
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<tbody>
<tr>
<td>Factors</td>
<td></td>
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<tr>
<td>External: Social Factors</td>
<td>Cantor (2008), Hutchins &amp; Sutherland (2008), Halldorsson et al. (2009)</td>
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5.1 SCL Sustainable Economically

Literatures on SCL sustainable economically are mainly focus on supply chain risks. Since supply chains involve hundred if not thousands of companies over several tiers, there are significant risks inherited owing to the failure of environmental or social performance and disruptions of operational processes. In line with this, several studies in this dimension had attempted to categorise the supply chain risks. For
instance, Johnson (2001) divided supply chains risks between supply risks (e.g. capacity limitations, currency fluctuations and supply disruptions) and demand risks (e.g. seasonal imbalances, volatility of fads, new products). From the other point of view, Zsidisin et al. (2000) focused on supply risks related to design, quality, cost, availability, manufacturability, supplier, legal, and environmental, health and safety. According to Chopra and Meindl (2007), all supply chains were subject to some amount of risk, including supply disruptions and delays, demand fluctuations, and price fluctuations; while Narasimhan and Talluri (2009) characterised supply chain risk as a disruption or negative outcome triggered by unpredictable and/or uncertain events. A more recent study conducted by Vilko and Hallikas (2012) analyzed the risk impacts in terms of delays in the supply chain.

Within the supply chain context, a second category of literature focus on discussing ways to mitigate the risks associated with sustainable SCL practice. Braithwaite and Hall (1999) emphasized that the relationship between corporate strategy, risk and the implications for supply chain management are poorly understood and in need of further exploration. Building on this perspective, Souter (2000) and Christopher et al. (2002) further stressed that companies should not only focus on their own risks: they must be able to identify and assess the potential causes or sources of those risks at every significant link along the network. Conventional strategic management, which focuses on individual firm as the competitive unit in the industry, is no longer a key to a sustainable competitive advantage. Achieving competitiveness and excellent firm performance requires a supply chain which is able to respond quickly to any fluctuations in customer demands and uncertainty occurring along the network. Therefore, successful supply chain logistics management requires a transformation; from managing individual functions to coordinating and integrating key business processes with chain members.

Christopher and Peck (2004) argued that as supply chains become more complex as a result of global sourcing, supply chain risk increases. Hence, the challenge to business was to mitigate that risk through creating more resilient supply chains. In this perspective, resilience implied flexibility and agility, and its implications on supply chain extend beyond process redesign to fundamental decisions on sourcing and the establishment of more collaborative supply chain relationships based on far greater transparency of information. A number of focal firms for instance have introduced supplier evaluation schemes, in which suppliers are assessed on how they deal with environmental and social issues. This approach serves as a guarantee that the supplier will act according to the standard, thus help avoiding related sustainable risks. This was highlighted in 37 papers, in which environmental and social performance were seen as the prerequisites for suppliers to be included as part of the supply network. Several authors have reported that in the textile industry, producers offering organic cotton products had to ensure that they had such supplier before entering the business. This prompted producers to allocate considerable investments at partner locations as a means to develop supply structure and help improve production facilities and processes, leading to reduced supply risks. Notwithstanding this, there seems to be a need for deeper information flow along the supply chain, in which suppliers have to obtained detailed insights into subsequent stages of lifecycle.

Bhamra, Dani and Burnard (2011) identified areas for advancing resilience research, in particular: the relationship between human and organizational resilience;
understanding interfaces between organizational and infrastructural resilience. With regard to supplier management, the result from Harms, Hansen and Schaltegger (2013) reveals that Germany companies mainly implement risk-oriented sustainable supply chain management (SSCM) strategies. Furthermore, Mensah, Merkuryev, Longo (2015) developed a supply chain resilient strategy with appropriate strategies and tools namely, six sigma practices, lean production, flexibility and a strong corporate culture, while Hohentstein, et al. (2015), and Ansari and Kant (2017) argued that most research has been qualitative. Authors such as Brandenburg et al. (2014) evaluated developments and directions of sustainable supply chain management, and has provided a content analysis on quantitative, formal models that address this research area.

On the other hand, Kleindorfer and Saad (2005) used operations principles, such as supply chain optimization, supply chain agility, contingency planning, collaborative sharing of information in the supply chain, flexibility and modularity, and total quality management (TQM) as the building blocks to effectively manage disruptive risk in a supply chain. Christopher and Lee (2004) suggest that the element to mitigate supply chain risk is improved ‘end-to-end’ visibility. Ghadge, Dani and Kalawsky (2012) identified future research agenda in supply chain risk management include behavioural perceptions, sustainability factors, risk mitigation through collaboration contracts, visibility and Traceability, risk propagation and recovery planning, industry impact and holistic approach.

Another stream of research in economic dimension focusing on the discussion of supply chain logistics performance. According to Spekman, Kamauff Jr and Myhr (1998), firms must select both partners and supply chain strategies carefully. This is due to coordination and collaboration are different which require different levels of trust and commitment, hence different outcomes, while information technology is key to the development of an integrated supply chain. Findings from Skjoett-Larsen (2000) concluded that third party logistics (3PL) were not merely a means to cost efficiency, but also as a strategic tool for creating competitive advantage. The result of Pradabwong et al. (2017) highlights the role of intra- and inter-organizational practices, and clearly demonstrates the joint role and impact of business process management (BPM) and supply chain collaboration (SCC) respectively.

Three aspects relating to risks were commonly mentioned in the literature as barriers for implementing sustainable supply chain logistics - higher costs, coordination efforts and complexity, and missing communication along the network (Seuring and Miller, 2008). Number of studies has demonstrated a link between sustainability in SCL with lower costs (e.g. Roa and Holt 2005). Yet, extending the supply chain to include issues such as recycling and refurbishing adds new level of complexities which in turn could increase costs at least in the short term. Issues such as the uncertainty associated with the recovery process with regards to quality, quantity and timing of returned products as well as the collection and transportation of these products, containers, pallets and packaging reflect increase costs from society to supply chain partners. Despite that the relationship between economic performance and environmental are observed, long-term studies are not yet existed to provide a comprehensive insights. Performance of the logistics function has often been mentioned in the context of common indicators such as quality, speed, dependability, flexibility and cost. The impact of social dimension on economic performance is further rarely addressed in the literature.
Table 2 Economics Initiatives Based on Sustainable SCL Research

<table>
<thead>
<tr>
<th>Category</th>
<th>Author</th>
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<tbody>
<tr>
<td>Total Quality Management (TQM)</td>
<td>Kleindorfer and Saad (2005)</td>
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<tr>
<td>Supply disruptions and delays</td>
<td>Chopra and Meindl (2007)</td>
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<tr>
<td>Demand Fluctuations</td>
<td>Chopra and Meindl (2007)</td>
</tr>
<tr>
<td>Price Fluctuations</td>
<td>Chopra and Meindl (2007)</td>
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5.2 SCL Sustainable Environmentally

During the last two decades, purchasing and supply chain managers have seen the integration of environmental issues embedded in related standards into their daily tasks (Aronsson and Brodin, 2006). Such triggers have increased interests in green supply chain management (GSCM) literature. Srivastara (2007) defined green supply chain management (GSCM) as integrating environment thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life. As for the key driver that promote green supply chain, manufacturers in UK perceive the greatest pressure to improve environmental performance is through legislation (Holt & Ghobadian, 2009).

Within this area of research, several key themes have emerged including the concepts of green design, green operations, reverse logistics, waste management and green manufacturing (Guide, and Srivastava, 1998; Srivastava, 2007). Several authors have discussed techniques such as life cycle assessment in assisting firms to design products that are able to minimize environmental impact over its useable life and afterwards (Arena et al. 2003; Beamon 2008; De Carvalho, 2012; Khiewnavawongsa and Schmidt, 2008). This field of research however, are found to be interfacing with the engineering and reverse logistics while considering resource depletion as environmental impacts. The management of sustainability through eco-design has avoided depletion of resources and increased the value created by individual products. For instance, Lee and Lam (2012) suggest that the use of information system and technology for reverse logistics enhances the customer’s business process and provides value-added process for customer retention. Yet, the challenge for the producer of the product is to develop offerings that enable them to capture more of the product value. The degree to which a product can be reused, remanufactured, recycled, incinerated or dispose of depends greatly on the product design. For instance, high lead content in cathode ray tube and electronic products results in difficulties for disposal process owing to the toxicity of lead (Linton et al. 2007). Such issue has been discussed by several authors (e.g. Gold et al. 2010; Ryan, 2010; Vachon, 2003; Sarkis et al. 2010; Rahman and Subramaniam, 2011).
Ruamsook and Thom chick (2012) suggest that the most visible and environmentally damaging element of supply chains and logistics activities is freight transportation, and the two issues pertinent are greenhouse gas emissions and their dependence on finite petroleum resources. In line with these research, substantial number of papers have also focused on the carbon footprint issue as an ecological impact (Ngo and Mohanta, 2010; Srivastava, 2008; McKinnon, 2010; Hsu, et al. 2013, Hogget 2014). A carbon footprint could be defined as the total set of greenhouse gas emission in the form of CO2 that are produced directly or indirectly by an individual, event, organization or product (Carbon Trust, 2007). Wu, Dunn and Forman (2012) suggest that energy efficiency, fuel efficient, and fuel saving are among the most mentioned in green supply chain. Rossi et al. (2013) put three bodies of knowledge, i.e. logistics service providers, eco-efficiency and logistics innovation into a single framework of eco-efficiency innovation. Furthermore, study from Byrne, Ryan and Heavy (2013) shows though many organizations are willing to implement sustainable logistics practices to address the environmental impact, there are concerns of hidden costs and risks associated with the implementation.

Another stream of literature focused on green purchasing. In particular, Malian et al. (2012) found that environmental purchasing and sustainable packaging has a positive effect on economic, social and operational performance. In this respect, the integration of sustainability concepts into supply chain logistics has also been discussed in the literature from regulatory and monitoring aspects (Hadfield et al. 2002; Zhu, Saris & Gang, 2005; Tunic, 2006; Cabana, Ramudhin & Paquet, 2012) discussed environmental regulations. Changes in policy might force manufacturers to explore new opportunities and change existing practices as a means to improve the sustainability of supply chain logistics function. Often, multinational corporations (MNCs), large retailers and brand name firms play a significant part in controlling and taking the responsibility of their partners' environmental practice, enabling them to monitor the supply chain logistics function over long distances without owning the firm. Management systems play a pertinent role in this regard and could serve as the minimum performance required. They mainly center on environmental management systems namely ISO 14001. Mamic (2005) for instance had gained insights on how such standards are implemented in the multinational corporations and their suppliers firms in the retail industry. Building on this idea, comprehensive supplier audits are thus required in green purchasing, which might again trigger further partnering as an effort to joint process improvement. In a more recent study, Pimenta and Ball (2015) found that the diffusion of environmental sustainability practices across manufacturing supply chain is sharply related to the purchasing, performance assessment and collaboration. The upstream supply chain logistics management activities are better designed with careful considerations of environmental aspects in regards to the products and processes. Glover et al. (2014) suggest that cost reduction is the dominant logic to pursue a sustainable agenda. Particularly, the results from Liu and Chang (2017) show that both closed-loop orientation (CLO) and green supply chain management (GSCM) have positive effects on the environmental performance and economic performance and that CLO positively impacts the level of implementation of GSCM.

Nevertheless, Amol and Ashish (2016) suggest that to achieve environmental sustainability, behavioural issues need to be addressed, while, practices of reverse logistics, closed-loop supply chain management and waste management need special
focus. Others studies focused on environmental risk management. For example, Manuj and Mentzer (2008) looked into the applicability of six risk management strategies with respect to environmental conditions in a global manufacturing supply chain context, namely postponement, speculation, hedging, control/share/transfer, security, and avoidance. Specifically, Wong, Wong, and Boon-itt (2015) identified four green supply chain integration (GSCI) practices in internal, supplier, customer, and stakeholder.

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<th>Table 3 Environmental Initiatives Based on Sustainable SCL Research</th>
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<tr>
<td><strong>Category</strong></td>
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<tr>
<td>Green / Eco-Design</td>
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<tr>
<td>Life-cycle analysis</td>
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<tr>
<td>Green Marketing</td>
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<tr>
<td>Environmental risk management</td>
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<td>Key drivers</td>
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5.3 SCL Sustainable Socially
Being a socially responsible organization requires a firm not to only concern on improving profits, yet to also maximize societal welfare, by participating in activities that are not necessarily codified into law, but nevertheless are expected by community. Example of such activities includes educational support, economic development, job training, employees volunteering, healthcare and housing. For instance, in the transportation sector, Deakin (2001) has introduced sustainable transportation concept, which focusing on meeting the mobility needs while preserving and enhancing human and ecosystem health, economic progress and social justice of existing as well as future. Carter and Jennings (2002) has further explored the notion of sustainable warehousing, which include activities such as proper storing and disposing of hazardous materials, donation of excess inventory to local people and safety training of forklift operations. Specifically, Hutchins and Sutherland (2008) further proposed four social performances that businesses should establish. Firstly, labor equity expresses the distribution of worker compensation within a company. Secondly, health care was needed to characterize a corporation’s role in providing or helping the health care of companies’ staff as well as their families. Safety refers to the safety of the workplace within a company. Lastly,
philanthropy described financial support that companies offer to community and to greater community.

Within this area of research, few studies have been conducted to explore antecedents of socially sustainable supply chain logistics. The starting points are external force and incentives established by different groups, with stakeholders form the widest category. Motivation to satisfy the stakeholder demands emerge from the fact that addressing stakeholder needs can be correlated with a firm’s survival, economic well-being and competitive (Mitchell et al. 1997). León and Juan (2014) argue that the increasing sustainability awareness within society is pressuring Logistics and Transportation (L&t) companies to integrate CSR principles into their strategies and policies. For instance, De Brito, Carbone and Blanquart (2008) pointed stakeholders’ concern for consumers' health as prerequisite for sustainable logistics solutions. They advocated that certified retailers selling organic cotton products need to explicitly advertise traceability function along the chain to assure customers that their products do not contain genetically modified cotton, which is associated with health hazards. In an earlier study, McIntyre (2003) suggested that those firms that could respond to sustainability issues would generally be more proactive and are able to meet changing customer requirements and market forces, hence capable of creating an innovative and distinctive value chain. Notwithstanding these, all modes of government control in a form of legislation or economic incentive are of great relevance. Castka and Balzarova (2008) argued that organizations would adopt the social responsibility agenda for strategic, altruistic or coercive reasons, as this will facilitates firms in avoiding fines, penalties and public protest campaigns, leading to higher likelihood of long-term survival. Community has been highlighted as one of the main social issues in sustainable supply chain (e.g. Maloni and Brown, 2006; Borrella et al., 2012). Specifically, Marshall et al. (2015) identify different types of social and environmental supply chain practices, and uncover measures that bringing in new stakeholders into the decision-making process.

Since a failure of social responsibility aspect will not only affect individual firm, focal companies often passes the pressure on to suppliers. Some key actors, commonly consisting of multinational corporations (MNCs), large retailers and brand-name firms take control and responsibility of environmental and social practices of their suppliers and third party logistics providers in determining what should be produced, how and by whom (Anderson and Skjoett-Larsen, 2009). In return, Soosay (2015) suggests that it is the downstream players that reap most of these benefits and enhanced reputation. In a similar vein, Cantor (2008) urged the importance of firms across all echelons of the supply chain to improve their safety practices. This is reflected by study conducted by Kiathulthorn and Sathapornwanit (2012), which demonstrated that all Third Party Logistics (TPL) providers are subjected to comply with the buying company’s code of CSR conduct laid down. Andersen and Skjoett-Larsen (2009) suggest that practising CSR in supply chains requires that it is embedded within the entire organization. Specifically, Carter and Jennings (2002) argued that the third party logistics providers should take their drivers’ quality of life into account, such as operating schedules that permit drivers’ adequate time at home, and paying adequate salary; where safety issue is also concerned such as adequately maintained vehicles as well as properly cleaned trailers and tankers. Furthering these thoughts, Andersen and Skjoett-Larsen (2009) argued that embedment of CSR within the focal firm and its suppliers required employee
training and sharing of experience, training of key personnel at the supplier level, positive incentives for suppliers in the form of long-term contracts and enlarged purchasing orders, and regular auditing of suppliers’ performance. Particularly, the importance of supply chain talent management issues have been emphasized by Stank, Dittmann and Autry (2001), and Hohenstein, Feisel and Hartmann (2014).

**Table 4 Social Initiatives Based on Sustainable SCL Research**

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<th>Category</th>
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<tbody>
<tr>
<td>Health Care</td>
<td>Hutchins and Sutherland (2008)</td>
</tr>
<tr>
<td>Philanthropy</td>
<td>Hutchins and Sutherland (2008)</td>
</tr>
<tr>
<td>Community</td>
<td>Maloni and Brown (2006)</td>
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5.4 Discussion

The examination and classification of the extant literature illustrate that there is sufficient activity and on-going development in the domain of sustainable logistics supply chain. As such it is imperative and valuable for researchers to periodically evaluate the progress and identify any additional opportunities. As firms are faced with pressures to proactively tackle the sustainability issues in their logistics activities, it is pertinent for researchers to continue seeking ways to support this managerial effort.

Despite the rigorous development of sustainability issues in logistics operations, the discussion is still in its early stage. One may argue that it is premature. While there have been many examples of environmental and public health concerns, consumers remain sceptic around the sustainability issue with the suspicion that so-called “green washing” is commonplace. Although consumers declare that sustainability in products is important to them, there is little evidence that associate this element with buying habits (Harrington, 2011), offering a major avenue for future research. One implication of sustainability for researchers therefore is to assist firms in developing new estimation tools that could be adapted to existing techniques as an effort to address the new questions of sustainability in supply chain logistics. Total costs for instance, must include the effects of resource depletion and the generation of by-products that are neither captured nor used. While it is apparent that integrating sustainability into supply chain logistics would provide a broad range of strategic benefits and may not necessarily reflect in financial gains, only few studies examine firm performance from this perspective. For instance, companies that reduce the packaging not only achieve savings in cost but also embrace sustainability into branding. And the fact that sustainability advances quickly become commoditized is a positive driver for innovation (Harrington, 2011). Establishing the missing link to the economic dimension therefore would seem to be imperative in assuring a long-term view towards the integration of sustainability in logistics operations. Similarly, there is also value for increasing understanding as to how the three dimensions - social, economic and environment interact and support each other.
in the pursuit of economically viable and sustainable supply chain logistics, highlighting opportunities for taking a more holistic approach.

The literature review highlights that there is growing recognitions of the role played by external pressures and incentives established by different groups as influencing factors that trigger firms to embrace sustainable SCL. Changes in policy and legislation introduced by many countries and jurisdiction that address sustainability issues have become influential proponent for manufacturers and researchers to explore the sustainability across logistics operations. Yet, the transformation could also flow in the opposite direction. Research and practice in this area could also impact policy development by presenting alternative scenarios for the expansion of sustainable SCL. For instance, the high lead content in cathode ray tube and electronic products which has resulted in complicated disposal decisions, have led to special regulations being introduced (Linton et al. 2007). Policies have been developed to divert these products from being disposed at municipal landfills to the reused and remanufactured process with the intent of integrating led used into new products. Having illustrated the effects of integrating sustainability in SCL on policy, desired outcomes are not only affected by policy, but also requires changes in the policy, creating a need for researcher to consider looking into this issue.

Based on the analysis on the classification matrix, much of the academic discussion in the research area point towards the need for cooperation among supply chain partners in addressing sustainable supply chain logistics issues. The focus on optimising operations through the development of sustainability has moved from a particular firm to the entire supply chain. Specifically, there appears to be an opportunity for researchers to examine this issue beyond focal firms’ perspectives to include external parties. For instance, apparel manufacturers such as Nike and Adidas have been blamed for inhumane working conditions and contaminations of the local environment, problem occurring during the production of their clothing at suppliers’ plants. Behavioural issues such as trust for instance, is crucial across all members in the network and must be guaranteed from the input suppliers until the end customers in pursuit if sustainable development.

<table>
<thead>
<tr>
<th>Issues</th>
<th>Opportunities / Constraints</th>
</tr>
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<tbody>
<tr>
<td>Need Managerial Measurement and Control</td>
<td>Opportunities to Develop new Estimation Tools</td>
</tr>
<tr>
<td>Growing Influence of Legislation</td>
<td>Opportunities to offer New Products or Services</td>
</tr>
<tr>
<td>Need Cooperation among Supply Chain Partners</td>
<td>Constraints of Talent Management of behavioural issues to be addressed</td>
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</tbody>
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6. Conclusions

Increasing consumers’ interests in environment-friendly product lifecycle and societal concerns has led to the integration of sustainability in managing business operations. Nevertheless, research that attempts to discuss sustainable SCL is rather limited. Within the existing literature, researchers have studied different angles to sustainable SCL. The industry has developed beyond internal aspects of risk controls
that ensure economical interest, to intense attention on environmental sustainability, and currently focuses on social aspects such as occupational safety, labor equity, freedom of association, anti-corruption or CSR. These approaches are expected to be further analyzed. Specifically, it is imperative to understand the types of sustainable SCL, and the appropriate initiatives. As the sustainable SCL research is growing rapidly, we see continual progress in building knowledge and insight. Despite the abundant theories, concepts and practices of sustainable SCL available in the literature, this issue still remains inconclusive, due to the theoretical and methodological aspects identified in the literature. This paper highlights several general as well as more specific opportunities for future research-based on a literature-based classification matrix built on the three sustainable dimensions. In the areas of sustainable supply chain logistics, there is growing role played by external parties, on top of inclination towards cooperation among supply chain partners.

Nevertheless, Logistics Bureau (2017) gives alerts of the 6 supply chain trends cannot be ignored, namely (i) Warehouse Robotics in the Supply Chain, (ii) Autonomous Road Transportation, (iii) The Blurred Line Between Logistics and Technology Services, (iv) The Appeal of Supply Chain Social Responsibility, (v) The Race for the Last Mile, and (vi) The Rise of the Virtual Logistics Team. Specifically, based on Accenture’s Strategy Supply Chain Workforce Research 2016, supply chain executives believe digital advances will augment the supply chain workforce, most significantly in the following areas: 65%: More forward looking, strategic decisions to support business goals, 51%: More data-driven decision making requiring more analytical skills, and 46%: More automation of transactional activities and exception handling (Kreutzer, Meyer and Puertas, 2017). Hence, the influence of disruptive technology to sustainable supply chain management is crucial in the coming decade, not only in terms of efficiency but survival of the fittest. Social responsibilities to the community are increasingly important issues in these days of technology that is changing the global workplace rapidly, and as artificial intelligence (AI) causes job losses and threatening the workforce, very likely the government will have to provide a guaranteed basic income to the affected people. It is hoped that through the understanding of existing literature and suggested research opportunities presented, researchers are better equipped to proactively conduct future sustainable SCL research, which would greatly facilitate firms and society in addressing such issue.

7. References


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