Sustainable supply chain management

A review of literature and implications for future research

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Received 2 January 2018
Revised 11 February 2018
Accepted 3 March 2018

Abstract

Purpose – The business enterprises are increasingly focusing on buying and supplying of products and services in a manner to reduce the adverse impacts on the environment, society, and economy. In view of the above, the concept of sustainable supply chain management (SSCM) has received attention of the industry and academia due to its importance on environmental, social and corporate responsibility through economic performance. The paper aims to discuss these issues.

Design/methodology/approach – The structured literature review attempts to map the various theories in the SSCM literature from the perspectives of economic performance, environmental dimensions, and social values and ethics.

Findings – As supply management is vital for enhancing organizational competitiveness, the present work attempts to investigate the theoretical perspectives in SSCM to develop an understanding of the current research activities and future potentials.

Practical implications – This work aims to gain a number of valid insights for the practitioners and the researchers. It also focuses on the perspectives of governance mechanisms for successful implementation SSCM practices in the business enterprises.

Originality/value – As the theory building initiatives with implications on the conceptualization of SSCM is limited in literature, this work has also been able to identify the trends and relevant research gaps to define the potential areas for future research.

Keywords Social sustainability, Environmental sustainability, Sustainable supply chain management, Economic performance, Sustainability

Paper type Literature review

1. Introduction

Due to the present economic condition and globalization, the supply chains (SCs) are getting more and more complex (Varma *et al.*, 2006) and subsequently designing, organizing and interacting within the SC has become a challenging task (Gold *et al.*, 2010a, b). The need of a change in focus from firm level to SC level and also aligning the organizational goals with the sustainability goals is necessary owing to the rising environmental and social concerns (Gold *et al.*, 2010a, b). All the stakeholders in the SC must work together to achieve the sustainability goals. Organizations will remain reluctant to commit to sustainability standards, till the time specific laws have not been enforced. The measurement of the success of sustainable initiatives differs from organization to organization (Searcy *et al.*, 2009).

SC functions contribute significantly to the field of sustainability and when viewed from a life cycle perspective, the sustainable initiatives are not possible without involving the SC

The authors are greatly indebted to the panel of reviewers for their valuable comments and suggestions which has helped to modify the paper to the present form.

Management of Environmental Quality: An International Journal

1477-7835
DOI 10.1108/MEQ-01-2018-0003

management function (Preuss, 2005). The structural components in the supply chain management (SCM) literature are identifiable and affect behavior which involves the planning, monitoring, workflow design, organizational structure, knowledge management, and communication structure. However, the behavioral components are less recognizable and hence more challenging to synchronize across the SCs which are management techniques, leadership, risk management, rewards and recognition, culture and attitude, and trust and commitment (Winter and Knemeyer, 2013). In the recent literature available, the principles of sustainability have become one of the major trends in SCM. The present review of literature includes assessment of SCM policies with a triple bottom line orientation.

Sustainable supply chain management (SSCM) has been the topic of interest for a number of research papers both in qualitative and quantitative fields (Genovese *et al.*, 2017). So, it is quite necessary that sustainability concerns must be incorporated into the core functions of the SC namely purchasing, manufacturing, distributing, storing, warehousing, usage, recycling and disposal which have been depicted in Figure 1 (Linton *et al.*, 2007). Business firms are under tremendous pressure in order to able to sustain their existing SC due to recent trends of globalization, market changes, demand uncertainty, and economic challenges. Focusing only stressing on the internal efficiencies of SC will be insufficient to gain competitive advantage. If sustainability concepts are integrated into core functions of a business firm's SC, it achieves a good market position in the global context (Khodakarami *et al.*, 2015).

Transformation of the conventional SCM into SSCM generates tremendous pressure on firms to bring changes to their existing SC in order to meet the current sustainability needs (Busse *et al.*, 2017). SSCM is management process which integrates environmental considerations, social performance, and economic contribution. Varied customer demand and complex product components gave rise to a strong internal competition between businesses along with the global competition (Raut *et al.*, 2015). SSCM generates the right sets of abilities for the firms to be able to differentiate themselves from their contemporaries (Khodakarami *et al.*, 2015).

There are several instances of firms developing a commitment towards adopting sustainability practices in order to make their SCs sustainable (Govindan *et al.*, 2015). Eco-friendly products and pollution free production practices are being encouraged for sustainable development (Xie, 2016). The sustainability theory inspires firms to implement practices such as return of products to manufacturer at the end-of-life cycle, environment friendly management of returns (Zhu *et al.*, 2005), while incorporating green strategies at each level of SC, maintaining healthy working conditions, fair compensation practices, equal human rights and cultural diversity (Rajak and Vinodh, 2015).

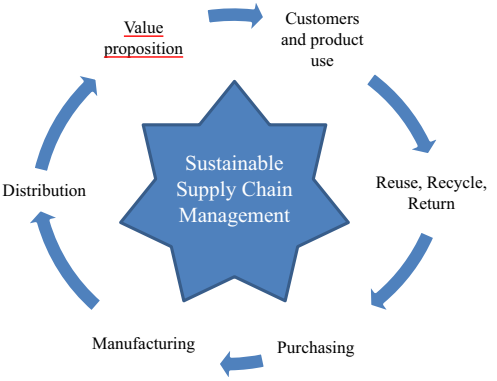

Figure 1.
SSCM core functions

In a challenging and competitive world like ours, SSCM is such a robust tool that could bring about revolution by enhancing corporate effectiveness in terms of social and environmental performance thereby achieving profitability (Seuring and Muller, 2008; Tseng *et al.*, 2015; Fahimnia *et al.*, 2017). The academic research related to SSCM has been given importance in recent times. But, there is a need for deep academic inquiry to help the SC managers in their decision-making process without compromising the importance of sustainability.

The remainder of the paper is organized as follows. A set of definitions for SSCM has been presented in Section 2. The methodology adopted to conduct this study has been presented in Section 3. A detailed review of literature including various aspects of SSCM is presented in Sections 4 and 5. Some managerial insights have been provided based on the study in Section 6. The potential gaps that have been identified from the literature and relevant research recommendations have been presented in Section 7. The paper ends with the concluding remarks in Section 7 followed by the references.

2. SSCM: definition and evolution of SSCM

The different definitions of SSCM in the literature prove that there exists a range of various constructs that have been adopted by researchers in this field. It is only practical to understand and accept multiple concepts in a relatively new field like SSCM (Touboulic and Walker, 2015). Some of the important and landmark definitions are presented in Table I.

3. Detailed review of literature: context setting

The practioner-led or cross-functional characteristics of SCM includes planning, purchasing, manufacturing, and distributing (Council, 2008) but does not solely focus on any one of these processes (Cooper *et al.*, 1997). When compared to conventional SCM that particularly stresses on the economic perspectives, SSCM is associated with the integration of the environmental and social objectives extending upto the economic dimension (Seuring and Muller, 2008). The demand of this area is increasing, be it academically, socially, or economically, which can be seen by the exponential growth of scientific publications in the recent times and mostly some of the recent ones (Min and Kim, 2012; Seuring and Muller, 2008). Furthermore, a wide range of empirical research which utilizes field survey, case study type research, and broad empirical studies, several other works use formal and mathematical models for practice and theory-based research (Brandenburg *et al.*, 2014).

Quantitative models are generally applicable for closed-loop SCM (Fleischmann *et al.*, 1997) whereas a majority of the models that are employed for SSCM are mostly conceptual. Only a few papers in the field of SSCM, use of formal modeling approach (Seuring and Muller, 2008). With the passage of time the formal modeling approaches have gained importance. An eclectic review of these models is lacking in the context of SSCM.

In order to explore the vast opportunities to enhance organizational sustainability, a deeper and more thorough understanding of the common and unique modeling features is required. The existing SSCM studies in literature are mostly descriptive. Authors have identified the areas which can integrate people and planet issues into the SC such as eco-friendly product and process development, eco-friendly operations management, remanufacturing, and closed-loop SCM. An overview on the applicability of operations research (OR) activities have been presented for the management of natural resources, such as water, solid wastes, and air pollution and rendered many formal models in the relevant areas (ReVelle and Eiselt, 2005). Some authors have worked on the combined optimization issues in the field of green logistics that includes reverse logistics, waste management, and transportation scheduling (Sbihi and Eglese, 2007). These were some of the early research done which made way for wide SSCM research.

Author	Definitions
Shrivastava (1995)	Reduction of risks occurring in long term that is associated with resource utilization, energy utilization and associated costs, product design, pollution, and management of waste in a supply chain
Beamon (1999)	An extended supply chain that aims at minimizing environmental impacts of a product throughout its entire life cycle, such as green design, resource saving, harmful material reduction, and product recycle
Jørgensen and Knudsen (2006)	The means by which companies manage their social responsibilities across dislocated production processes spanning organizational and geographical boundaries
Linton *et al.* (2007)	Integrate issues and flows that extend beyond the core of supply chain management, including product design, manufacturing by-products, by-products produced during product use, product life extension, product end-of-life, and recovery processes at end-of-life
Seuring (2008)	Integration of sustainable development and supply chain management (in which) by merging these two concepts, environmental and social aspects along the supply chain have to be taken into account, thereby avoiding related problems, but also looking at more sustainable products and processes
Font *et al.* (2008)	Adding sustainability to existing supply chain management processes, to consider environmental, social and economic impacts of business activities
Ciliberti *et al.* (2008)	The management of supply chains where all the three dimensions of sustainability, namely the economic, environmental, and social ones, are taken into account
Carter and Rogers (2008)	Integrating and attaining the organization's social, environmental, and economic goals in a systemic coordinated manner so that the inter-organizational business decisions lead to improvement of the long-term economic performance of the organizations and its supply chains
Seuring and Muller (2008)	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 sustainability, such as, the economic, environmental and social, into account which are derived from customer and stakeholder requirements
Pagell and Wu (2009)	The specific managerial actions that are taken to make the supply chain more sustainable with an end goal of creating a truly sustainable chain
Badurdeen *et al.* (2009)	Involvement of the planning and management of sourcing, procurement, conversion and logistics activities involved during pre-manufacturing, manufacturing, use and post-use stages in the life cycle in closed-loop through multiple life-cycles with seamless information sharing about all product life cycle stages between companies by explicitly considering the social and environmental implications to achieve a shared vision
Haake and Seuring (2009)	The set of supply chain management policies held, actions taken, and relationships formed in response to concerns related to the natural environment and social issues with regard to the design, acquisition, production, distribution, use, reuse, and disposal of the firm's goods and services
Wolf (2011)	The degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organization processes for sustainability
Closs *et al.* (2011)	Reflection of the firm's ability to plan for, mitigate, detect, respond to, and recover from potential global risks. Risks and supply chain considerations such as product development, channel selection, market decisions, sourcing, manufacturing complexity, transportation, government and industry regulation, resource availability, talent management, Alternative energy platforms and security
Wittstruck and Teuteberg (2012)	An extension to the traditional concept of supply chain management by adding environmental and social/ethical aspects
Hassini *et al.* (2012)	The management of supply chain operations, resources, information, and funds in order to maximize the supply chain profitability, while minimizing the environmental impacts and maximizing the social well-being

Table I.
SSCM definitions

(*continued*)

Author	Definitions
Ahi and Searcy (2013)	The creation of coordinated supply chains through the voluntary integration of economic, environmental, and social considerations with key inter-organizational business systems designed to efficiently and effectively manage the material, information, and capital flows associated with the procurement, production, and distribution of products or services in order to meet stakeholder requirements and improve the profitability, competitiveness, and resilience of the organization over the short- and long-term
Pagell and Shevchenko (2014)	Sustainable supply chain is the design, coordination, control and organization of a supply chain to make it truly sustainable with minimum expectation being to achieve economic viability, while ensuring no harm to environment and social systems over an extended period of time
Raut *et al.* (2015)	Sustainable supply chain management (SSCM) is management process which integrates environmental considerations, social performance, and economic contribution. Varied customer demand and complex product components gave rise to a strong internal competition between businesses along with the global competition

Table I.

A profound and thorough literature survey helped in understanding that sustainability is affected mostly externally, i.e. government, customers, or stakeholders (Gold *et al.*, 2010a, b). The literature also suggests that a vertical collaboration and adoption of sustainable practices in the entire SC is the call of the day (Carter and Rogers, 2008). Empirical research on SSCM has mainly focused on single firms ignoring the inter-organizational factors (Carter and Easton, 2011). This contrast in findings urges to explore further into the literature to understand if intercompany perspectives and the influence of all the stakeholders are included in the quantitative models on SSCM.

The primary focus of the research being done in SSCM considers the environmental issues whereas the social aspects are ignored not only in empirical research (Gold *et al.*, 2010a, b) but also in the analytical modeling field as well (Tang and Zhou, 2012). There is a paucity of multi-criteria decision making (MCDM) methods for green logistics (Dekker *et al.*, 2012). Authors have found that for remanufacturing and product recovery, solution methods like discrete-event simulation, fuzzy logic, genetic algorithms, and mixed-integer linear programming are identified as desired modeling approaches (Ilgin and Gupta, 2010).

Traditionally, the economic aspect of sustainability was mainly focused by firms and businesses; however, lately the environmental and social aspects have gained impetus even though it is extremely difficult to be able to measure them. Most organizations are adapting to sustainable standards due to an increased stakeholder pressure, to focus on the environment and the society (Seuring and Muller, 2008). It does not imply that the economic aspect is to be completely neglected. It is clear that the companies who adopt sustainable activities by considering the environment and society, have long-term economic benefits and competitive advantage (Carter and Rogers, 2008; Markley and Davis, 2007).

The environmental aspect in the triple bottom line of sustainability involves the objectives, plans, tools and techniques to encourage greater environmental responsibility and promote eco-friendly and pollution free technologies (Klassen, 2001). The social aspects of sustainability are for SSCM as organizations involve multiple stakeholders with varying goals, objectives, and perspectives and managing this variation poses a challenge (Hall and Matos, 2010). Considering the triple bottom line in a single analytical framework and measuring them is a challenge (Winter and Knemeyer, 2013). Some authors attempted to identify the reasons of success of the sustainability initiatives (Pagell and Wu, 2009). They found that for a SC to be sustainable the best organizational practices of the traditional SC along with new sustainable practices must be considered simultaneously. In a system with a set of parameters, if one is altered then the other parameters are also affected. It is a

challenge to handle these uncertainties in the SC that typically occur at the interfaces between the triple bottom line (Winter and Knemeyer, 2013).

Researchers have suggested facilitators for SSCM such as: strategy in line with the firm's overall strategy towards sustainability; risk management by incorporating emergency plans for any kind of disruptions in the SC; a work culture to promote ownership and willingness to adopt high ethical standards while focusing on the society and the natural environment; and fair means of communication with stakeholders to monitor the various SC operations (Carter and Rogers, 2008). Carter and Rogers (2008) stated that adoption of environmental and social measures should be in line with economic goals of the organization. This alignment of the company's economic goals with sustainability standards encourages the adoption of SSCM practices. It may not be that the environmental performance has a positive impact on the organization's economic performance (Seuring and Muller, 2008) leading to competitive edge (Gold *et al.*, 2010a, b).

The literature states that maximum effect is seen in the supplier's concern for sustainability when companies establish collaborative relationships with their suppliers (Charter *et al.*, 2001). But, the present-day suppliers do not have adequate financial opportunities and information to enhance their firm's sustainability performance. South-East Asian firms have made product changes to be able to match the Western buyer's needs but have not really adopted the sustainable standards in their SC (Hamner, 2006). Hence, it is necessary that the green procurement strategies should be made robust enough to be able to identify the reality rather than just sticking to the terms and conditions over paper. Eco-labeling strategies have also come up to be able to track the extent of sustainable initiatives involved in the manufacturing of a product (Ball, 2002).

4. Perspectives of SSCM

SSCM has emerged from the identification of the strategic importance of purchasing and supply decisions to attain the organization's long-term performance, and address the sustainability issues. SSCM researchers need to understand the risk arising out of the lack of a conceptual foundation in SSCM which can otherwise become a legitimate management discipline (Carter, 2011). The descriptive nature of current SSCM research has been elaborated which is useful in gathering knowledge on facts, however, these are unable to significantly contribute to the SSCM theories and that is why this field was considered to be conceptually immature and underdeveloped having a lot of scope for further research (Hoejmose and Adrien-Kirby, 2012). There are broadly three different perspectives of SSCM that have been addressed by researchers over time, such as, environmental perspective, social perspective and economic perspective. We have attempted to classify the available literature by including two more perspective, i.e. the performance measurement perspective and governance perspective. The various perspectives of SSCM have been categorically represented in Figure 2.

4.1 Environmental perspectives of SSCM

The environmental perspective in SSCM is mostly about the conservation of the environment that the SC is working in. It is imperative to run the SC processes and functions in such a manner that the ecology remains undisturbed and unharmed. Industrialization is the one of the major sources of environmental damage. Organizations today consider the various environmental issues owing to the increased pressure from stakeholders about environmental challenges; however, there exist firms that can adopt sustainable practices due to the innate nature of processes involved. The firms should direct their suppliers to adopt and adapt sustainable measures some of which are judicious utilization of natural resources, ethical labor practices, lower greenhouse gas emissions, etc. The hazardous wastes and their emissions generated by various SC are the chief sources of environmental

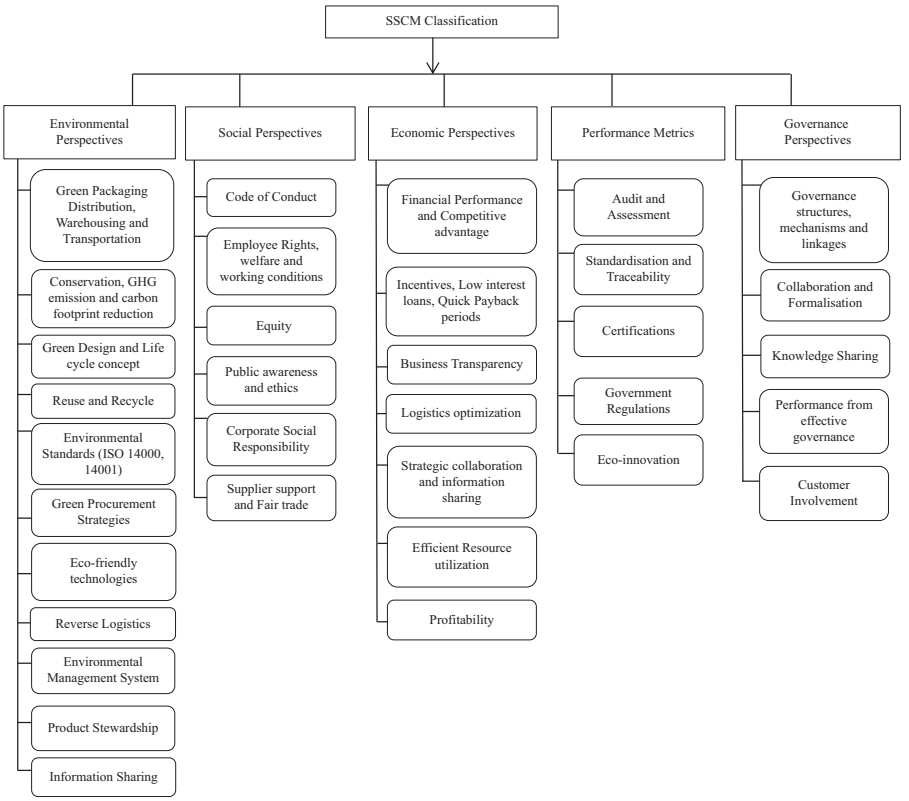

Figure 2.
Classification of SSCM literature

pollution and damage thereby an increased focus on various waste control measures are a necessity. The environmental aspect of sustainability constitutes a critical research area in SSCM.

The environmental focus generated more quantifiable benefits than the social focus (Banerjee, 2003). Authors have conducted an analysis in SC to study the impact on environment and found that the techniques for optimal use of energy in manufacturing results in a substantial decrease of carbon emission by minimizing energy consumption to a minimum (Bevilacqua *et al.*, 2014). Researchers have included concepts of sustainability into the field of logistics and SCM and suggested the use of high productivity freight vehicle for transportation as it would minimize the cost of transportation by 33.5 percent and also its impact on the environment (Lee and Wu, 2014).

It has been suggested that a few SSCM activities can be included in the business plans for a sustainable future such as minimizing the cost of packaging by effective product design, reuse and recycling, reduced turnover and recruitment costs by efficient storage, warehousing and transportation facilities, proper working conditions (Carter and Rogers, 2008). This would lead to low labor cost because of high motivation, enhanced product quality, and adoption of the ISO 14000 standards.

The environmental aspect in the triple bottom line of sustainability involves the objectives, plans, tools and techniques to encourage greater environmental responsibility and promote eco-friendly and pollution free technologies (Klassen, 2001). One of the major aspects of a sustainable SC is the adoption of green procurement strategies (Varnäs *et al.*, 2009).

The reverse logistics aspect is one of the most important processes in the green SCM framework, which is connected to recycling. In the case of reverse logistics, a manufacturer is ready to accept the products that had been shipped earlier for recycling, refurbishing or disposal (Varma *et al.*, 2006) which supports process from "cradle to cradle." This also supports the concept of SSCM which leads to the conclusion that sustainable initiatives need to be incorporated at all SC stages. Effective use of scarce resources is possible through recycling, reuse and waste reduction which is the entire motive of reverse logistics resulting in improved competitiveness (Rao and Holt, 2005). Authors conclude that the product life cycle assessment leads to environmental stability (Varma *et al.*, 2006; Hagelaar and van der Vorst, 2002).

The enterprises need to work closely with their suppliers in order to improve the environmental performance of their products and production processes. If an environmental management system is incorporated in an organization, then it can portray itself as environmentally proactive by providing a means to monitor the environmental performance. The stakeholders can hence verify if the environmental improvements are a reality or a marketing strategy (Darnall *et al.*, 2008).

The life cycle analysis (LCA) has huge environmental benefits. In order to truly benefit from LCA, intense SC partnerships are required (Hagelaar and van der Vorst, 2002), however; regardless of several attempts of highlighting the importance of SC relationships, the focus is mainly on greening the SC processes.

Design for the environment represents the design and development of new products and processes that address issues of the natural environment. These products are not only recoverable but also durable, repeatedly usable and eco-friendly. The aim of product stewardship is to support the ecological perspective in the entire value chain including all the stakeholders including R&D members, designers and suppliers (Rusinko, 2007). This strategy establishes a reputation in the market as an environmentally responsible organization. It may be noted that if a product is recalled from the market as it has not met the environmental concerns, the economy of the organization is hampered.

Structural changes in the logistics system can foster environmental sustainability. Customers prefer green packaged products in the recent times owing to the rising environmental concerns. Authors have revealed that there is a need to implement energy-efficient logistics systems and minimize the global carbon footprint (Halldórsson and Kovács, 2010). The importance of role of retailers in minimizing carbon footprint in a SC has been felt by several researchers (Wiese *et al.*, 2012). Some of the measures for minimizing the carbon footprint are economy in energy usage, use of cross-docking and third party logistics service providers, green packaging, and accuracy in demand forecasting (Ji *et al.*, 2014).

SC managers take decisions pertaining to environment without adequate information which gives rise to adoption of common assumptions and readily available rules for decision making (Wu and Pagell, 2011). SSCM has been classified into 3R's (reuse, recycle, and remanufacture) for process improvement, and (reduce, recover, and redesign) for product design (Kuik *et al.*, 2011). However, the major challenges for environmental sustainability lie in the uncertainties, complexities, organizational culture, cost and operationalization of the sustainable initiatives. The details of the review papers on SSCM from environmental perspective are presented in the Table II.

4.2 Social perspectives of SSCM

Sustainability has become a mandate for human survival and progress (Sharma and Ruud, 2003) and should be attained in "an inclusive, connected, equitable, prudent and secure manner" (Gladwin *et al.*, 1995). The social perspective of SSCM is inclusive of the individuals as well as the organization as a whole. Top professionals and SC managers across the globe must understand that their decisions should not violate the fundamental humanitarian values and ethics. They are responsible to maintain a healthy society in which their

Serial No.	Factors	Description	References
1.	Green packaging distribution, warehousing and transportation	Green or eco-friendly packaging involves the usage of those raw materials and manufacturing methods that have minimum or no adverse impact on the environment and also require low energy consumption. Green packaging reduces the required storage space in the warehouse and also during transportation	Wu and Pagell (2011), Wiese *et al.* (2012), Chaabane *et al.* (2012), Zailani *et al.* (2012), Amemba *et al.* (2013), Dubey *et al.* (2013), Zhu *et al.* (2013), Ji *et al.* (2014)
2.	Conservation, GHG emission and carbon footprint reduction	Conservation of natural resources like water, mineral reserves etc. plays a vital role in creating a sustainable SC. The carbon and GHG emissions that occur during the production stages i.e. manufacturing, commissioning, maintenance, and decommissioning add up to pollution level and must be kept under a check	Halldórsson and Kovács (2010), Despeisse *et al.* (2012), Wiese *et al.* (2012), Zhu *et al.* (2013)
3.	Green design and life cycle concept	Green design focuses on reduction of product's operating costs while enhancing the financial performance of the firms. The life cycle assessment involves the analysis of the product during creation, extraction, processing, transportation, use and disposal. Green design addresses the issues such as environmental risk management, product safety, occupational health and safety, pollution prevention, resource conservation and waste management	Hagelaar and van der Vorst (2002), Varma *et al.* (2006), Kuik *et al.* (2011), Amemba *et al.*(2013)
4.	Reuse and recycle	It is an essential component of green operations. The process of remanufacture, reuse and recycle or in other words repairing, refurbishing, remanufacturing, cannibalizing and recycling of products by the manufacturers are crucial for product recovery which in turn creates good will amongst the customers	Carter and Rogers (2008), Amemba *et al.* (2013)
5.	Environmental Standards (ISO 14000, 14001)	Firms should implement the green standards into all the core SC operations for instance, while purchasing it should be ensured that deals are struck with environmentally certified suppliers through ISO 14000 and 14004. Timely environmental audits need to be conducted for supplier's internal management, and to ensure suppliers' ISO 14001 certification	Carter and Rogers (2008), Amemba *et al.* (2013)
6.	Green procurement strategies	Green procuring consists of activities that include the reduction, reuse and recycling of materials during the procurement of raw materials. In addition to this it is also a solution for ecologically and financially concerned enterprises. It also talks about identifying and dealing with only the green suppliers	Varnäs *et al.* (2009), Amemba *et al.* (2013)
7.	Eco-friendly technologies	Research on eco-friendly technologies is plenty. And the focus is more on the eco-friendly technologies that are also economically viable. The enterprises must develop their SC strategies that involve environmental friendly technology, equipment and other facilities to achieve a pollution free production process. The government must also encourage the innovation of eco-friendly technologies	Klassen (2001), Amemba *et al.* (2013)
8.	Reverse logistics	Reverse logistics concepts are aligned to coordination of two markets, the uncertain supply, decisions related to returns disposition, and postponement. It includes servicing,	Rao and Holt (2005), Varma *et al.* (2006)

(*continued*)

Table II.
Environmental perspectives

Serial No.	Factors	Description	References
		refurbishment remanufacturing and recycling, with the intention for proper disposal by the manufacturer	
9.	Environmental management system (EMS)	EMS facilitates the implementation of SSCM. The enterprises that have adopted EMS have a competitive advantage over others. It is basically a system or a database that integrates processes and tools for the purpose of training personnel to gather environment related information which shall be useful in monitoring the SC in future	Sroufe (2003), Darnall *et al.* (2008)
10.	Product stewardship	Product stewardship is representative of the cradle to grave (or cradle) responsibility for the lifecycle of a product. It is a strategy that states that the concerned manufacturer will take the full responsibility of the product including product end-of-life	Rusinko (2007), Ashby *et al.* (2012)
11.	Information sharing	The implementation of green initiatives requires coordination of personnel that includes information sharing, which helps in the wise decision making in various SC issues	Wu and Pagell (2011), Reefke *et al.* (2014)

Table II.

organization is functional. Authors have highlighted that the social aspect of sustainability is one of the most important aspects in SSCM as organizations involve multiple stakeholders with varying goals, objectives, and perspectives and managing this variation poses a challenge (Hall and Matos, 2010).

Social responsibility concepts have used Carroll's (1979, 1991) work of the hierarchy of economic, legal, ethical, and other responsibilities to identify the SCM activities which can cater to social responsibility. Social sustainability is related to poverty alleviation, ensuring justice and human rights, and all round welfare of the employees (Krause *et al.*, 2009). The interrelation and prioritization of ecological, human, and economic aspects is difficult to comprehend. Employment of socially sustainable practices into business enterprises is a challenging task (van der Heijden *et al.*, 2012).

A socially responsible enterprise must extend its values and standards to their suppliers (Tate *et al.*, 2010) and focus on maintaining long-term partnerships, proper communication and supplier development (Leire and Mont, 2010). Fair trade is a social practice that aims at attaining fairer partnerships with suppliers and it provides another alternative model for international trade that involves better trade practices, fair pricing, and informing the consumers about the adverse effects of traditional trade practices. The supplier management strategies should focus on developing the suppliers and guiding them to implement the sustainable supply chain (SSC) practices to attain competitive advantage (Harms *et al.*, 2013). Authors have stated that adding the stakeholder concerns into the decision-making process would pave way for identification of necessary steps that are a pre-requisite for designing, planning and operating a socially responsible SSC (Simões *et al.*, 2014).

Social sustainability is closely related to corporate social responsibility (CSR) that includes activities for social good, beyond the obvious, economic interests of an organization (Sarkis *et al.*, 2010). Some authors have assessed the relationship between corporate social decisions and social indicators of sustainability by incorporating life cycle assessment model (Hutchins and Sutherland, 2008). They argue that every single corporate decision affects national level measures of social sustainability of SSCM. The idea of CSR is that the firms should meet the economic, legal, ethical, and other expectations of stakeholders and also satisfy their economic needs keeping in mind the societal and the environmental needs (Defee *et al.*, 2009). Some researchers have indicated the social implications of SSCM as a

part of the CSR initiatives (Keating *et al.*, 2008; Tencati *et al.*, 2010). In order to facilitate proper coordination between various activities such as procuring, manufacturing, distributing, and marketing, the promotion of CSR activities cannot be ignored (Keating *et al.*, 2008) SC managers who take decisions regarding the operational, strategic, and design aspects can play a major role in kick starting the adoption of sustainability practices. These steps have a direct influence on the quality of living, safety, health concerns, and public welfare (Sarkis *et al.*, 2010). Hence, there is a requirement of systematic supportive management structures and monetary investments into the SSCM field.

Few researchers have concluded that most organizations are adapting to sustainable standards due to an increased stakeholder pressure to safeguard the environment and the society (Seuring and Muller, 2008). It does not imply that the economic aspect is to be completely neglected. There are instances of companies that have adopted sustainable activities taking into account the environment and society have had long-term economic benefits and a leading edge among the contemporaries (Carter and Rogers, 2008; Markley and Davis, 2007).

While environmental sustainability is focused on conservation of natural resources, social sustainability is about the management of social resources, involving people's skills and abilities, organizations, partnerships, and social values (Sarkis *et al.*, 2010). The concept of social equity explains that all the members of the society have an equal right on the resources and opportunities, which also includes fair treatment to employees (Krause *et al.*, 2009).

The International Labour Organisation has issued a set of principles that protects the labor's rights, wages, and job security and also alleviates child and unethical labor practices (Leire and Mont, 2010). The role of external legislation in protecting the workers' job security has been highlighted in the literature. So, there is a need to improve the social and economic status of the weaker sections of the society by designing opportunities within SSCM (Hall and Matos, 2010). The violations of human rights should become an integral issue in social sustainability.

In order to achieve social sustainability, authors have proposed a six-level scanning framework wherein the six levels are people level, functional level, firm level, chain level, network level, and societal level (Fabbe-Costes *et al.*, 2014). Some authors also reported from an ethnographic study about the increase in demand for sustainable fashion, clothing and tourism which are the result of knowledge diffusion and public awareness (Cervellon and Wernerfelt, 2012). Some of the social initiatives for SSCM are ethical and value-based collaboration among the SC actors and ethical purchasing (Roberts, 2003). Authors have reported that the social perspective in TBL has been over shadowed by the environmental and economic perspectives (Dubey *et al.*, 2016). The details of the review papers on SSCM from social perspective are presented in the Table III.

4.3 Economic perspectives of SSCM

The primary objective of every business, firm or organization is profit making. Hence, the sustainability criteria should be incorporated in such a manner that profitability is ensured with effective conservation of environment and society. In order to ensure improvement for a longer term and maintain firm's economic stability the SC managers must think about adoption of SSCM activities which are profitable for a sustained period (Carter and Easton, 2011). It is seen that firms who readily want to adopt sustainable practices into their SC, must be able to find a tradeoff between the contradictory objectives such as generation of profits and simultaneously reducing the adverse environmental impacts while upholding the various social responsibilities. Several authors have identified the importance of social and environmental sustainability initiatives in SCs to achieve strategic economic benefits (Zailani *et al.*, 2012; Ortas *et al.*, 2014). Along with environmental and social dimensions of

Serial No.	Factors	Description	References
1.	Code of conduct	Code of conduct is a set of rules that needs to be adopted by all enterprises. It includes social responsibilities, religious norms, moral values which is essential to build a good reputation of the organization. Employees stay motivated when their organization abides by an ethical code of conduct	Roberts (2003), Matos and Hall (2007), Keating *et al.* (2008)
2.	Employee rights, welfare and working conditions	The employees in an organization have some fundamental rights such as, right to privacy, fair compensation and transparency, zero discrimination. Legislations that protect the employees rights exist, however, implementing these in real terms is still a challenge. The working condition is also a major factor to keep the employees motivated. It is the enterprise's responsibility to take care of the employee welfare at all times	Carter and Rogers (2008), Leire and Mont (2010), Simões *et al.* (2014)
3.	Equity	The concept of equity balances the input and the output of an enterprise while ensuring fairness and justice. Any discrepancy in this fairness affect the decision making of employees. Homogeneity, equitable income, access to goods and services and fair employment are elements of equity	Keating *et al.* (2008), Krause *et al.* (2009), Tencati *et al.* (2010), Mani *et al.* (2015)
4.	Public awareness and ethics	The firms that leverage "ethics" and form a social committee which addresses the issues pertaining to employee equity, sustainability and anti-corruption are the ones that attain true sustainability. Awareness creation is the best form of communication to educate the public to contribute towards sustainable development	Roberts (2003), Matos and Hall (2007), Gold *et al.* (2010a, b), Fabbe-Costes *et al.* (2014), Cervellon and Wernerfelt (2012), Mani *et al.* (2015)
5.	Corporate social responsibility (CSR)	CSR constitutes a set of policies, strategies, actions and initiatives to attain social sustainability. It is a mandate for firms is most countries which urges the firm to address the requirements and needs beyond its stakeholders. It urges the firms to work in a more ethical, fair, law-abiding and responsible manner towards the stakeholders. It addresses on various areas such as, human rights, employee rights, environmental protection, community involvement, supplier relations, ethics, legal issues, economic responsibilities, social responsibility and corporate governance	Defee *et al.* (2009), Angus-Leppan *et al.* (2010)
6.	Supplier support and fairtrade	With the demand of an sustainable SC there has been a remarkable philosophical shift concern the firm's suppliers. Firms have realized that suppliers require adequate time and support to understand the benefits of SSCM. It is about time that we identify the ways of how best to audit the performance of key suppliers against their own written policies and management systems. Social sustainability can be attained by selecting socially responsible suppliers. Fair trade practices in the SC can lead to social sustainability	Tate *et al.* (2010), Leire and Mont (2010), Harms *et al.* (2013), Simões *et al.* (2014)

Table III.
Social perspectives

sustainability, authors have also included the economic dimensions such as financial performance, cost minimization, competitive advantage and profits (Winter and Knemeyer, 2013). In order to attain economic sustainability, some critical factors such as collaborative relationships through information sharing, optimized logistics support and profitability need to be addressed (Dubey *et al.*, 2016). Many authors have also suggested that SC

partnerships and environment related programs have a positive effect on the perspectives of SSCM (Vachon and Klassen, 2008; Blome *et al.*, 2014). The implementation of SSCM energy-efficient practices are feasible through financial incentives, loans and low pay back periods (Dam and Petkova, 2014; Glover *et al.*, 2014). A firm's long run success and its competitive advantage are the economic considerations. When compared to the social and environmental aspects, the economic aspect is about the judicious utilization of the natural resources and attaining a high return on investment (Rumelt, 1974). Traditionally, the economic aspect of sustainability was mainly focused upon by firms and businesses; however, lately the environmental and social aspects have gained impetus even though it is challenge to be able to measure them.

It has been suggested in the literature that a collaborative planning, forecasting and replenishment system to promote partnerships in the SCs, and ways to achieve collaboration for sustainable competitive advantage in the SC (Attaran and Attaran, 2007). The benefits of inter-organizational SC collaboration to support enterprises for initiatives to reduce recycling and disposal costs through the creation of a common platform have been reported time and again (Lee and Lee, 2010). Supplier selection is integral for SC collaboration, profitability, and technology integration for which various multi-criteria decision-making tools are used (Dubey *et al.*, 2016). Researchers have revealed that future SCs need to develop collaborative relationships with cost reduction measures by acquiring the technical, communication, and financial skills (Giunipero *et al.*, 2006).

The implementation of SSCM strategies through coordination of the organization's economic, environmental and social goals results in maintaining transparency of all their business processes (Pagell and Wu, 2009). When cost was measured over the whole product life cycle, sustainable strategies are cost effective for both in short term and long term, it led to competitive advantage by identifying, drafting, and communicating the firm's SC strategies and goals in collaboration with their suppliers (Krause *et al.*, 2009). Authors have stated that the governments must promote procuring from small and local suppliers through partnerships to enhance the local economic and social aspects of sustainability (Walker and Preuss, 2008).

It is necessary to align marketing strategies with SSCM strategies to create a lean and resource efficient SC (Brindley and Oxborrow, 2014). When compared to the social and environmental aspects, the economic aspect is about the judicious utilization of the natural resources and attaining a high return on investment (Rumelt, 1974). The details of the review papers on SSCM from economic perspective are presented in the Table IV.

4.4 Governance perspectives of SSCM

It has been identified that "governance" as a structure which makes sure that the decisions taken should define long-term and sustained value of an organization. The governance aspect has been of great interest for scholars and practitioners across nations. The linkage between corporate sustainability and governance mechanisms at the SC level is still unclear (Formentini and Taticchi, 2016). Companies need to develop customized governance mechanisms for improving their sustainability performance, maintaining the relationships with the stakeholders and implementing sustainable strategies (Gimenez and Tachizawa, 2012). Inter-firm collaboration is considered as one of the three core governance structures that define relationships between organizations (Williamson, 1996), the other two being markets and hierarchies (Coase, 1937; Williamson, 1998).

Authors have defined sustainable supply chain governance (SSCG) as a set of various practices, initiatives and activities implemented to strengthen relationships with the inter-organizational functions and departments and their SC actors and stakeholders with due consideration to their sustainability goals (Formentini and Taticchi, 2016). The field of SSCG is relatively new and aims to examine the role of governance structures and mechanisms in

Serial No.	Factors	Description	References
1.	Financial performance and competitive advantage	Firm's financial health over a specific time period is the financial performance of the firm. It is measured in monetary terms by analyzing the firm's policies and operations. Assets recovery, cost minimization, enhanced profitability, effective inventory management, adequate environment regulations are the of the key performance measures of SSCM that lead to competitive advantage	Krause *et al.* (2009), Winter and Knemeyer (2013)
2.	Incentives, low interest loans, quick payback periods	The planning and price incentive decisions include low interest loans with quick payback period to stakeholders. The eco-friendly technologies have long and uncertain payback periods whereas the cheaper technologies have faster pay back periods or low interest rate loans. This issue requires attention	Dam and Petkova (2014), Glover *et al.* (2014)
3.	Business transparency	Business transparency of product conformity is essential to create a transition towards a more sustainable supply. Transparency upstream is also crucial to attain sustainability by promoting green products and processes and endorsing the green way of manufacturing	Pagell and Wu (2009), Brindley and Oxborrow (2014)
4.	Logistics optimization	Stock forecasting, continuous supply, quality management, returns management, and waste management are some of the other problems faced by retailers globally. The requirement of optimized means of transportation of products along the SC is crucial. Logistics optimization through concepts like reverse logistics which not only concentrates on waste management but also on significant cost reduction is the answer to this problem	García-Arca *et al.* (2014)
5.	Strategic collaboration and information sharing	Sustainable practices require strategic collaboration in order to serve the market in a better way. High level of collaboration amongst all the stakeholders will reduce costs which requires incentives and clear communication. Adoption of environment management systems that enables effective information sharing	Attaran and Attaran (2007), Vachon and Klassen (2006), Ashby *et al.* (2012), Gimenez and Tachizawa (2012), Liu *et al.* (2012), Bai and Sarkis (2014), Blome *et al.* (2014), Brindley and Oxborrow (2014), Azadi *et al.* (2015)
6.	Efficient resource utilization	A firm must be able to make the best possible use of the available resources. Since, the availability of natural resources limited, optimized use of resources will create a sustained supply of the same	Rumelt (1974), Brindley and Oxborrow (2014)
7.	Profitability	The implementation of sustainable practices improves the firm's performance and boosts the brand image leading to profitability. Sustainable practices are profitable because they reduce waste minimize overhead cost and warehousing costs, contribute to energy reduction and defect minimization that directly impacts profitability	Krause *et al.* (2009), Wu and Pagell (2011), Zailani *et al.* (2012), Glover *et al.* (2014), Dam and Petkova (2014), Ali *et al.*

Table IV.
Economic perspectives

SSCM (Vermeulen and Seuring, 2009). The role of collaborative approaches has been highlighted in the field of SSCG (Vurro *et al.*, 2009). Some authors have also revealed the importance of formalization of governance mechanisms. It is suggested that the investigation of environmental and social responsibilities beyond the organizational boundaries is vital to derive suitable implications for upstream and downstream functions of a SC (Bassen and Kovacs, 2008).

There is a need to study how the SC governance mechanisms respond to sustainable strategies, stressing on contracting issues (Carter and Easton, 2011). There are several papers that suggest frameworks to understand the linkage between the various governance mechanisms (Vurro *et al.*, 2009); however, empirical validation of how the sustainable business models come to practice and align with the governance structures is still missing (Formentini and Taticchi, 2016). It is essential to study the governance of inter-firm relationships and their influence from effective governance and the resulting firm performance. Some researchers have also argued that formal and relational mechanisms could be used to manage resources within partnerships, and these formal mechanisms are more suitable for property-based assets than relational governance which is best suited for knowledge-based assets (Hoetker and Mellewigt, 2009). They also stated that the companies that chose an effective governance mechanism would induce a positive impact in achieving some alliance goals, namely financial access, new markets opportunities, cost reductions, and risk minimization.

A set of new governance structures for SCs have been proposed which includes the involvement of consumers was found to be instrumental (Aschemann-Witzel *et al.*, 2017). Authors presented the crucial role of consumers in green procuring and green innovation by analyzing the various practices GSCM (Zhu *et al.*, 2017). They argued that greening of SCs remains unaffected by informal or casual consumer involvement rather require active and more formal consumer contracts. They also stated that it is instrumental to consider the types of governance structures that effectively manage relationships with the consumers, for instance, the contract vs relational governance, as they affect environmental performance.

It has been noted that very few papers have discussed the commitment level within the SC stakeholders and the types of governance mechanisms that needs to be embraced by the organization and the SC as a whole (Fawcett *et al.*, 2006). There is a clear opportunity for researchers to conduct empirical works to simplify the relationships between supply networks and governance techniques (Pilbeam *et al.*, 2012). A thorough understanding of the governance mechanisms from a SC viewpoint is imperative reckoning the sustainability aspect. Some authors have argued that there is vast scope for emergence of knowledge in the field of SSCM and SSCG with respect to firms like for instance, communication of the ecological and social impacts to all the SC actors and development of appropriate strategies to enhance them (Vermeulen and Seuring, 2009). Authors have studied the impact of environmental policy on decision making related to organizations' governance (Antonietti *et al.*, 2017). This work reported that stricter environmental regulations increase the probability of production being outsourced to international suppliers. They advocate the fact that the firms engaging in environmental innovation adopt governance decisions more readily that enable a stricter control over the SC.

The SSCM literature categorizes two distinct factors in the governance mechanisms: collaboration and formalization. In relation with the collaboration aspect, it is seen that organizations can achieve their sustainability goals by utilizing their market power without collaboration, or in contrast through shared or collaborative governance structure (Brockhaus *et al.*, 2013). In a non-collaborative situation, the organization imposes its decisions and sets the governance to the SC counterparts owing to its contractual power (Formentini and Taticchi, 2016). However, authors have also revealed that collaborative and shared governance techniques present a robust tool for the promotion of sustainable approaches (Vurro *et al.*, 2009; Gimenez and Sierra, 2013). Several authors define formalization as the amount to which taking decisions is controlled by a set of well-defined rules and regulations (Alvarez *et al.*, 2010; Pilbeam *et al.*, 2012). The formal routines or mechanisms are responsible for regulating and reporting the systems through which companies orient their dealings explicitly. The details of the review papers on SSCM from governance perspective are presented in the Table V.

Serial No.	Factors	Description	References
1.	Governance structures, mechanisms and linkages	In order to implement and control sustainability strategies and initiatives, with the ultimate goal of improving sustainability performance, companies need to establish governance mechanisms and structures to manage relationships with their SC actors	Gimenez and Tachizawa (2012), Fawcett *et al.* (2006), Pilbeam *et al.* (2012), Vermeulen and Seuring (2009), Vurro *et al.* (2009), Antonietti *et al.* (2017)
2.	Collaboration and formalisation	The literature highlights two relevant factors that characterise governance mechanisms, namely collaboration and formalisation. Firms can implement their sustainability strategies by utilizing their market power in a non-collaborative way, or by adopting a shared/collaborative governance style. However, in a non- collaborative setting, the firm depends on its contractual power to determine governance parameters and impose their decisions on its SC counterparts	Brockhaus *et al.* (2013), Formentini and Taticchi (2016), Vurro *et al.* (2009)
3.	Knowledge sharing	Informal mechanisms like knowledge sharing moderate the stakeholders' relationships and also affects the outcomes. When knowledge sharing is incorporated in the suppliers' development schemes, it results building up an effective collaboration	Vermeulen and Seuring (2009)
4.	Performance from effective governance	SSCM includes strategies like "supplier management for risk and performance." It has been observed that effective governance styles have a direct impact on the environmental and socio-ethical performance of the SCs	Hoetker and Mellewigt (2009)
5.	Customer involvement	It is imperative to manage the firm's interactions with their customers. Thus, involving of customers into the governance structure is essential. One of the driving forces and the key performance indicators of SSCM includes customer focus	Aschemann-Witzel *et al.* (2017), Zhu *et al.* (2017)

Table V.
Governance perspectives

4.5 Performance measurement perspectives of SSCM

In order to assess the level of sustainability that a firm or an SC as whole has reached, it is crucial to set adequate performance metrics to measure their sustainability performance. SSCM roots itself to the realization of the strategic importance of procurement and other SC activities which leads to improved firm's performance, and also addresses sustainability issues (Hall and Matos, 2010). It is seen that companies adopt sustainable initiatives into their business models in various ways and the approach to TBL also differs (Bocken *et al.*, 2013). They also emphasize on their short-term and long-term goals for performance measurement and report it is various ways (Taticchi *et al.*, 2013). Researchers stated that research on SC metrics is inadequate (Gunasekaran *et al.*, 2004). Authors have argued that there are compatibility issues between the existing performance monitoring measures and the SC dynamics (Lehtinen and Ahola, 2010). Therefore, adequate research is necessary to develop performance measurement frameworks for SC.

There have been various studies which have found a relationship between the firm's performance and the aspects of SSCM (Krause *et al.*, 2009), however, the direction of this relationship has not been clear. There is still an uncertainty of whether firm's economic performance is a direct result of the adoption of sustainable practices or it is those forms that are performing well have adopted these practices. Considering the triple bottom line in a single analytical framework and measuring them is a challenge (Winter and Knemeyer, 2013). According to some authors, audit, assessment, and standardization are the key players for performance assessment that help companies to measure and monitor their

performance and achieve sustainability (Dubey *et al.*, 2016; Acquaye *et al.*, 2017). Authors have argued that performance assessment of SC processes has a direct bearing on the sustainability performance (Spence and Bourlakis, 2009; Foerstl *et al.*, 2010).

Research papers on SSCM have also highlighted that the environmental audit and standardization management systems like ISO 14000 and Eco-Management help enterprises in achieving process and product quality control (Kleindorfer *et al.*, 2005; Curkovic and Sroufe, 2011). Standardization and traceability should be considered along with lean and green while designing the products and collaborating with supplier to practices to achieve high sustainability performance (Ching and Moreira, 2014). Authors have presented a framework of methods to achieve high sustainability performance with third party certifications, supplier auditing, assessing and monitoring risk and supplier training (Grosvold *et al.*, 2014). Authors have argued that standardization and audit helps to reduce risks and increase sustainability performance in real terms (Roehrich *et al.*, 2014). It has been found that compliance, monitoring, and auditing are the building blocks in SSCM for performance improvement, risk avoidance and supplier selection by studying sustainability reports of nine companies (Turker and Altuntas, 2014). It is revealed that sustainability accounting and sustainability assessment can be utilized to assess the financial implications and benefits of sustainable practices (Schaltegger and Burritt, 2010). Researchers conducted a study in 86 Italian manufacturing firms to probe how they attain their environmental and social practices and sustainability performance and found that with development in SSCM the organization's sustainability performance increases (Gualandris and Kalchschmidt, 2016).

It has been stated in the literature that the stringent environmental regulations, which define specific processes of SCs to attain a particular outcome, cripple the economic performance of the organization (Ramanathan *et al.*, 2010). The research focuses that organizations can become instrumental to reverse the hindrance by innovative utilization of resources and capabilities. Authors have evaluated that if various organizational factors such as SC actors' nationality and associated national risks affect the relationship between sustainability governance and environmental, social and governance (ESG) performance (Ramanathan *et al.*, 2010). They stressed that collaborative governance mechanisms result in high ESG performance. Authors have studied the direct and indirect effects of eco-innovation on environmental performance of firms in terms of minimization of greenhouse gas (CO_2, NOx, and SOx) emissions and stated that there is strong positive impact of eco- innovation on the environmental performance of firms (Costantini *et al.*, 2017). The details of the review papers on SSCM from performance perspective are presented in the Table VI.

4.6 Modeling approaches in SSCM

In the present context, sustainability criteria, i.e. the environmental, social, and economic considerations are addressed in an integrated manner with SCM. Modeling approaches that can effectively handle this addition of sustainability concepts to the SCM functions requires focus. SSCM models are basically the simplified version and presentation of reality (Brandenburg *et al.*, 2014). Research on SSCM modeling can be divided between conceptual models that are defined as a set of concepts to represent without actually explaining the real-life scenarios and quantitative models which employ a set of variables and analyze their causal relationships (Bertrand and Fransoo, 2002). There is an involvement of a number of decision variables, parameters, constraints, and cost criteria which makes the research problem in SSCM more complex. So, there is a need to identify the existing methodologies and the associated tools and techniques which can be used to formulate, evaluate and create potential solutions for the SSCM (Tonelli *et al.*, 2013). Authors have insisted over a period of time that MCDM methods are most suitable to address the multifaceted issues of sustainability which involves complex socio-economic systems (Wang *et al.*, 2009).

Serial No.	Factors	Description	References
1.	Audit and assessment	To adopt and improve sustainability, tools such as eco-labeling, environment management systems, environmental and social audits are necessary. A supplier assessment plan consists of monitoring, auditing and evaluating the SC operations periodically. Frequent assessment and auditing improve SC performance. Firms need to impose these procedures on their suppliers to promote sustainable behavior	Hassini *et al.* (2012), Taticchi *et al.* (2013), Grosvold *et al.* (2014), Dubey *et al.* (2015), Gunasekaran *et al.* (2015)
2.	Standardization and traceability	Firms stress on the standardization of economic, social and environmental working conditions of their suppliers through compliance. A standardized performance in the SC can be attained by promoting product traceability	Ching and Moreira (2014)
3.	Certifications	Environmental certification controls the impact of a practice on the environment. Voluntary adoption of environmental certifications by firms promotes sustainability in production processes	Grosvold *et al.* (2014)
4.	Government regulations	Government regulations to reduce environmental degradation are required. However, obsolete laws and regulations that hinder the adoption of sustainable practices in SCs need transformation	Ramanathan *et al.* (2010)
5.	Eco-innovation	Eco-innovation focuses on innovating newer technologies that are cost effective as well as preserve the environment. Encouraging eco-innovation leads to adoption of technologies that improve environmental performance which attains global competitiveness	Costantini *et al.* (2017)

Table VI.
Performance measures

Authors have concluded that research on SSCM is dominated by qualitative research methods such as case study, interview and conceptual/theoretical model, i.e. 61.89 percent of the study in comparison to the quantitative research (31.42 percent) (Ansari and Kant, 2017). It is a fact that maximum studies in the literature have qualitative study (case study) in comparison to quantitative study (Tajbakhsh and Hassini, 2015; Seuring and Muller, 2008). A detailed description of the modeling trends in SSCM over the period has been represented in the following Table VII.

4.6.1 Quantitative models in SSCM. It has been found from various reviews that there is a dearth of theoretically grounded research in SSCM field (Carter and Easton, 2011; Carter and Rogers, 2008). This can be concluded by observing the number of reviews on literature published in this area by researchers. Some of the literature reviews are for example the study of literature on quantitative models for SSCM (Brandenburg *et al.*, 2014; Eskandarpour *et al.*, 2015); the study on theoretical dynamics in SSCM (Touboulic and Walker, 2015) and the review on SSCM practices (Khalid *et al.*, 2015).

MCDM and mathematical programming have often been chosen as the preferred modeling techniques to investigate SSCM in order to optimize a single objective function (Gunson *et al.*, 2010; Yura, 1994). Literature has recommended that various tools could be used to model the environmental factors in the processes and the implementation of effective environmental measurement systems have also been suggested (Smith and Ball, 2012). Quantitative methods can be used to generate sustainability benefits of collaboration, coordination, information sharing, and communication within an SC (Kainuma and Tawara, 2006).

References	Focused paradigm	Used modeling technique	Focus	Sustainability dimensions addressed
Acquaye *et al.* (2017)	SSCM	Multi-regional input output (MRIO) modeling	An environmental performance measurement approach for economic sectors. MRIO model used to calculate the direct and indirect environmental effects such as bio-diversity, water consumption, pollution, etc.	Economic, environmental
Alinovi *et al.* (2012)	GSCM	Analytical model, economic order quantity (EOQ)	Determination of optimal return policies in a stochastic environment	Economic
Azadi *et al.* (2015)	SSCM	Data envelopment analysis (DEA)	Sustainable supplier performance evaluation and selection	Economic, environmental, Social
Balaman *et al.* (2018)	SSCM	Hybrid fuzzy set theory	Developing a decision support system comprising two multi-objective mathematical models to optimize the configuration of multi-technology bio-product SCs and design co-model transportation networks	Economic, environmental
Battini *et al.* (2014)	None	Life cycle assessment (LCA) and analytical model (EOQ)	Integrated inventory management for SC cost optimization by assessing the impact of sustainability perspectives on procuring decisions	Economic, Environmental
Besiou *et al.* (2012)	CLSC	Single objective simulation	Influence of scavenging on the operations of the formal recovery system of waste electrical and electronic equipment with three regulatory measures applying the system dynamics methodology	Economic, environmental, social
Borchardt *et al.* (2011)	None	Ecological foot printing and input-output analysis	Eco-design implementation to reduce environmental impact and cost of production and assembly in footwear industry	Economic, environmental
Bouchery *et al.* (2012)	SSCM	Carbon foot printing and analytical model (EOQ)	Sustainable order quantity model and its multi echelon extension and effectiveness of regulatory policies to control carbon emissions	Economic, environmental, social
Boukherroub *et al.* (2015)	SSCM	Multi-objective linear programming (MOLP)	Integrated approach for transposing sustainable development principles to SC planning models by linking sustainability performance on SC decisions	Economic, environmental, social
Chaabane *et al.* (2012)	SSCM	LCA and MOLP (Optimization)	Evaluation of trade-offs between economic and environmental objectives under various cost and operating strategies in an aluminum industry and highlights efficient carbon management strategies	Economic, environmental
Choi and Chiu (2012)	SSCM	Single objective analytical model (Newsvendor)	Understanding the mean downside-risk (MDR) and mean-variance (MV) newsvendor models under both the exogenous and endogenous retail price decision cases; comparison of levels of sustainability of retailers that employ mean-risk and risk-neutral models	Economic, environmental

(*continued*)

Table VII.
Modeling techniques in SSCM and sustainability dimensions addressed

References	Focused paradigm	Used modeling technique	Focus	Sustainability dimensions addressed
Devika *et al.* (2014)	SSCM	MOLP (Optimization)	Quantitative modeling of social impacts combined with environmental and economic impacts in a network design problem	Economic, environmental, social
Diabat and Al-Salem (2015)	SSCM	Single objective linear programming (SOLP); genetic algorithm(GA)	Addressing joint location inventory problem with focus on reduction of carbon emissions	Economic, environmental
Geldermann *et al.* (2007)	SSCM	Pinch analysis and multi-criteria decision making (MCDM)	Consistent assessment method in a comprehensive manner to optimize the system's performance	Economic, environmental
Govindan, Khodaverdi and Jafarian (2013)	SSCM	MCDM technique for order of preference by similarity to ideal solution (TOPSIS)	Sustainable SC initiatives for evaluation of supplier performance considering the triple bottom line	Economic, environmental, social
Hsueh (2015)	SSCM	MOLP (variational inequality)	Optimal performance levels of corporate social responsibility (CSR) and compensation for all SC actors to enhance SC profitability	Economic, environmental, social
Jakhar (2015)	SSCM	Carbon footprinting and AHP and MOLP (optimization)	Attaining economic stability, social and ecological protection by developing sustainable SC performance measures for partner selection through flow allocation decision-making model	Economic, environmental, social
Ji *et al.* (2015)	GSCM	Single objective analytical model (Game theory)	Supplier relationship management to formulate trade strategies and payoff functions of the suppliers and manufacturers and assess their recycling capacity for estimation of sustainability level	Economic, environmental
Kostin *et al.* (2015)	SSCM	LCA and MOLP (optimization)	Optimization of logistics task and identification of redundant objectives that can be omitted without affecting the problem structure	Economic, environmental
Kuo *et al.* (2010)	GSCM	Artificial neural network (ANN) and Multi attribute decision analysis (MADA) (DEA and ANP)	Developing a green supplier selection model integrating ANN and MADA to overcome the limitations of data accuracy and evaluation of the supplier's green performance	Economic, environmental, social
Li (2013)	SSCM	MOLP (Optimization)	Production evaluation model to evaluate product reliability and time utility value and extension of the same to sustainable purchasing while considering the trade-offs between cost, environment and quality	Economic, environmental
Li and Li (2016)	SSCM	Analytical model (game theory)	Derivation of equilibrium structures for two supply chain competing for product sustainability; analyzing sustainability degrees, demands and profits under three structures of this two-chain system	Economic, environmental

Table VII. (*continued*)

References	Focused paradigm	Used modeling technique	Focus	Sustainability dimensions addressed
Mazhar *et al.* (2007)	SSCM	ANN; reliability assessment method	End-of-life treatment of products by assessing their reliability; understanding the product's service requirements and its ability to be reused and remanufactured	Economic
Mirkouei *et al.* (2017)	SSCM	LCA, MCDM	Developing a mixed SC for enhancing sustainable benefits of bio-energy. A stochastic optimization model to explore the effects of uncertainty	Economic, environmental
Moktadir *et al.* (2018)	SSCM	Blended gray-based DEMATEL	Identification of barriers to SSCM in context of leather industry and analyze the interactions among them	Economic, environmental, social
Mota *et al.* (2015)	SSCM	LCA and MOLP	Design and planning of SCs by integrating the three dimensions of sustainability; ReCiPe: an environmental assessment method is employed for SC design optimization; a social indicator to assess the impact strategic decisions and political concerns	Economic, environmental, social
Nagurney and Yu (2012)	SSCM	Analytical model (game theory)	Development of a model of oligopolistic competition for fashion supply chains in the case of differentiated products with the inclusion of environmental concerns and its effects of changes in the demand functions; in the total cost and total emission functions, and also in the weights	Economic, environmental
Neumüller *et al.* (2015)	SSCM	MCDM; analytic network process (ANP)	A combined methodology for selection of distribution centers (DCs) by integrating and balancing the triple bottom line. Evaluation of possible DCs on the basis of a situation-specific decision structure	Economic, environmental, social
Pishvaee *et al.* (2014)	SSCM	LCA and MOLP (optimization)	Designing a sustainable medical SC network under uncertainty considering conflicting economic, environmental and social goals	Economic, environmental, social
Rager *et al.* (2015)	SSCM	MOLP, GA	Energy-oriented scheduling approach for a parallel machine environment with the objective to minimize the demand of final energy sources using resource levelling for optimization	Economic, environmental
Rybicka *et al.* (2015)	None	Material flow analysis (MFA)	Understanding the scale of scrap created in individual composites manufacturing processes to assess its potential value in terms of reuse/recycle capabilities by bridging of the gap between manufacturers and waste processors in composites to address the lack of infrastructure and lack of waste material specification barriers	Economic, environmental
Sitek and Wikarek (2015)	SSCM	SOLP	A robust and effective hybrid approach to modeling and optimization of SSCM and GSCM problems, implemented with the HSF which considers two environments. There is	Economic, Environmental

(*continued*)

Table VII.

References	Focused paradigm	Used modeling technique	Focus	Sustainability dimensions addressed
			a substantial reduction in number of decision variables, number of constraints, computing time (up to ten times)	
Soysal *et al.* (2015)	SSCM	SOLP	Enhancing the traditional models for the inventory routing problem to boost their usefulness in food logistics management by involving truck load dependent distribution costs for a comprehensive evaluation of CO2 emission and fuel consumption, perishability, and a service level constraint for meeting uncertain demand	Economic, environmental
Su *et al.* (2016)	SSCM	AI (Grey theory) and MCDM decision-making trial and evaluation laboratory (DEMATEL)	Identification and evaluation of criteria and alternatives in case of incomplete information situations in supplier prioritization which includes criteria like aspects as a sustainable plan, communities for sustainability, sustainable operational process control and sustainable certification and growth	Economic, environmental, social
Tajbakhsh and Hassini (2015)	SSCM	MCDM (DEA) +SOLP (optimization)	Developing a multi-stage framework to assess a general performance of a SC and evaluating the overall efficiency and the individual efficiencies at the same time	Economic, environmental, social
Tseng and Hung (2014)	SSCM	SOLP	Developing a strategic decision-making model considering both the operational costs and social costs caused by the carbon dioxide emissions from operating a SC network for SSCM in apparel manufacturing	Economic, environmental, social
Tsao *et al.* (2018)	SSCM	Fuzzy probabilistic multi-objective programming (two phase stochastic programming)	Designing of a sustainable SC network under uncertain conditions. Its objective is to make decisions for selection of production technologies, raw materials, number of locations, distribution centers etc.	Economic, environmental, social
Validi *et al.* (2015)	SSCM	MOLP (optimization) and MCDM (TOPSIS)	Prioritization of the realistic solutions, while focusing on alternate transportation scenarios of a NP hard SSCM distribution model	Economic, environmental

Table VII.

It has been found that quantitative research is required to justify the decision-making process while integrating sustainability and SCM (Seuring, 2013). Authors have advised that it is vital to identify the current status of the field to be researched upon if it is driven by qualitative or quantitative process (Ansari and Kant, 2017). Some of the modeling approaches for SSCM in literature are presented in Table VIII.

4.7 Enablers and barriers

The SSCM is affected by a number of factors. Some of them help in achieving the sustainability goals which are called as the drivers or the enablers of SSCM. The factors that critically hinder the adoption of SSC practices into the core SC functions are called as

Modeling approaches	Model description	Typical approach/ components addressed	References
Life cycle assessment (LCA) based models	Systematic methods for investigating the potential environmental impacts associated with a product, process, or activity, by identifying and quantifying materials used, energy consumed, and wastes discharged to the environment	Evaluating environmental issues and attempting to minimize their impacts along a supply chain	Cholette and Venkat (2009), Ferretti *et al.* (2007), Sonneson and Berlin (2003), Abdallah *et al.* (2012), Pishvaee and Razmi (2012)
Applications of the analytic hierarchy process (AHP)	A structured technique for simplifying, organizing, and analyzing complex and multi-objective decisions	Evaluating complex decision situations where environmental and economic goals are assessed simultaneously	Faisal (2010a), Saaty (1990)
Equilibrium models	Standard and well established methodologies on evaluating and assessing sustainability issues in supply chains	Balancing of environmental and economic issues by utilizing relevant equilibrium or optimum solution(s)	Corbett and De Croix (2001), Kainuma and Tawara (2006), Nagurney and Toyasaki (2003), Saint Jean (2008), Seuring (2013)
Multi-criteria decision-making (MCDM) models	Disciplines that explicitly deliberate multiple conflicting criteria, which require to be evaluated in decision-making processes	Optimizing environmental and economic criteria by balancing trade-offs or proposing optimal solutions	Geldermann *et al.* (2007)
Input-output analysis (IOA) based models	Techniques in which relationships between outputs of some performance measures and the supply chain's input parameters alongside their related decision factors can be analyzed	Evaluating outputs of environmental capital (e.g. renewable and non-renewable ecological goods, material use, and impact of emissions on human health) and economic goals (i.e. lowering costs and/ or maximizing profits) along supply chain networks	Bonney and Jaber (2013)
Composite metrics	Practical tools in focusing attention through their abilities to summarize complex and multifaceted problems into single metrics	Policy prioritization, decision-making, and communication with respect to various levels of system performance	Hassini *et al.* (2012), Singh *et al.* (2009)

Source: Ahi *et al.* (2016)

Table VIII. Quantitative analytical modeling approaches for assessing sustainability issues in the SC

inhibitors or barriers of SSCM. In order to successfully implement the SSC practices, it is necessary to understand and evaluate the enablers and barriers of SSCM (Moktadir *et al.*, 2018). A list of enablers and barriers of SSCM that have been identified from literature are represented in the Tables IX and X.

4.8 Integrated approaches in SSCM

Due to multiple types of pressures, be it from the competitive or legislative angle or due to customer pressure, SC managers are forced to comply with sustainability standards for value creation which poses a challenge in the decision-making process. Unfortunately, guidelines for a comprehensive or integrative analysis for the evaluation of environmental and social performance of decision alternatives in SSCM are lacking. Therefore, it is

Enablers	References
1. Top management support	Cetinkaya *et al.* (2011), Govindan *et al.* (2014), Chkanikova and Mont (2015), Dubey *et al.* (2015), Zhu and Geng (2013), Lorek and Spangenberg (2014)
2. Standards, collaborations and supply base rationalizations	Lee and Klassen (2008), Blome *et al.* (2014)
3. Supplier evaluation and process improvement	Igarashi *et al.* (2013)
4. Supplier assessment for improved environmental performance	Genovese *et al.* (2013), Govindan *et al.* (2015)
5. Corporate environmental activity and strategic level of purchasing	Ahi and Searcy (2013)
6. Trust and close relationship with supplier	Tejpal *et al.* (2013)
7. Organizations environmental missions and internal multinational policies	Dubey *et al.* (2015)
8. Technological integrations with suppliers and customers	Beamon (1999), AlKhidir and Zailani (2009)
9. Role played by project leaders and value champions	Vachon and Klassen (2007), Vachon and Klassen (2008)
10. Organizational contingencies such as size and nationality	Min and Galle (2001)
11. Customer interest and stake holder pressure	Hervani *et al.* (2005), Seuring and Muller (2008)
12. IT infrastructure and knowledge enhancing mechanisms	Walker and Jones (2012)
13. Employee and stakeholder orientation and support	
14. Supplier certification and non-traditional supplier development (sustainability, orientation, innovation capability, measurement systems)	Revell and Rutherfoord (2003)
15. Government support and Government regulations	Mudgal *et al.* (2009), Paulraj (2009), Bai and Sarkis (2010)
16. Performance measurement system	Walker *et al.* (2008)
17. Community development and social welfare	Zhu *et al.* (2013), Ortas *et al.* (2014)
18. Employee training, health, safety, compensation	Hutchins and Sutherland (2008), Matos and Hall (2007)
19. Social value and ethics	Carter and Jennings (2002)

Table IX.
List of enablers

imperative to derive a predictive and holistic approach for promoting sustainability along SCs. It has been seen that the integration of sustainability is one of the most crucial topics in the field of operations management (Jabbour and de Sousa Jabbour, 2016).

The literature review conducted by some authors focused on generating integrated sustainability concept (Carter and Rogers, 2008). A theoretical framework was devised by the authors about the future SSCM research directions. The review work done by some authors extended this work in greater details by adding recent research articles (Winter and Knemeyer, 2013). Researchers have provided a systematic literature review considering 80 top tier SCM journals which mostly described methodological and analytical portions of SSCM and omitted the managerial insights (Carter and Easton, 2011). The integration of sustainability concepts with SCM processes is not limited to the activities within a single firm rather it should occur across the entire SC involving all the stakeholders.

A review done by some authors has reported the benefits of integration of sustainability with SCM (Winter and Knemeyer, 2013). In another review work, authors have classified the literature into four categories, i.e. time period and journal wise distribution, types of research methodologies employed and the extent of incorporating sustainable practices (Seuring and Muller, 2008). Quite a few publications have been reviewed by some authors that were based on case studies and quantitative analysis (Gold *et al.*, 2010a, b). Authors have presented a

Barriers	References
1. Lack of job stability	Kuik *et al.* (2011), Gabzdylova *et al.* (2009), Bhaskaran *et al.* (2006)
2. Lack of healthcare and work safety measures	Carter and Rogers (2008)
3. Inadequate community welfare measures	Gabzdylova *et al.* (2009)
4. High environmental cost	Carter and Rogers (2008)
5. Lack of implementation of green practices	Govindan, Popiuc and Diabat (2013)
6. Lack of adoption of eco-purchasing	Mudgal *et al.* (2009)
7. Lack of eco-design strategies	Zhu *et al.* (2005), Vojdani and Lootz (2012)
8. Lack of stricter government rules and regulations	Zhu *et al.* (2005)
9. Lack of disaster management approaches	Waheed *et al.* (2009)
10. Lack of consumer satisfaction	Hussain (2011), Faisal (2010b)
11. Lack of enhancement of product features	Hussain (2011)
12. Inadequate infrastructural support	Kleindorfer *et al.* (2005), Elkington (1994)
13. Complex to measure environmental standards adopted by suppliers	Faisal *et al.* (2007), Mudgal *et al.* (2009)
14. Fear of failure and monetary losses	Rao and Holt (2005), Revell and Rutherfoord (2003)
15. Lack of skilled human resource	Hillary (2000)
16. Lack of proper technical expertise	Van Hemel and Cramer (2002), Hillary (2000), Revell and Rutherfoord (2003)
17. Lack of awareness about reverse logistics adoption	Ravi and Shankar (2005)
18. Skeptic about environmental benefits	Revell and Rutherfoord (2003)
19. Perception of "out of responsibility" zone	Hillary (2000)
20. Lack of green system exposure professionals	Mathiyazhagan *et al.* (2013)
21. Lack of environmental knowledge	Bowen *et al.* (2001), Hillary (2000)
22. High investment and less return on investments	Mathiyazhagan *et al.* (2013)
23. Non availability of bank loans to encourage green products/ processes	Mathiyazhagan *et al.* (2013)
24. High cost for disposing hazardous wastes	Mathiyazhagan *et al.* (2013)
25. Lack of training courses to train and guide the progress of each enterprise	Bowen *et al.* (2001), Carter and Dresner (2001)

Table X.
List of barriers

structured literature review focusing on three categories, i.e. research methodology, dimensions of sustainability and common factors (Ashby *et al.*, 2012).

In a study carried out in 14 anchor companies and 177 small- and medium-sized suppliers, authors observed that anchor companies' have an inclination towards initiatives for a cleaner production process (van Hoof and Thiell, 2014). They concluded that integration of anchor companies to environmental initiatives will result in enhancing supplier performance, cost minimization, environmental leadership, and good reputation. An author has conducted an integrated method of SEM, fuzzy AHP and fuzzy MOLP to an apparel industry and observed that decrease in the total cost can be attained when a firm adopts cost reducing strategies like sustainable purchasing, sustainable production, sustainable delivery and logistics (Jakhar, 2015).

4.9 Extending the SSC practices to suppliers

The success mantra for a successful sustainable SC lies in effective supplier relationships and proper collaboration. It is found that the quality and depth of relationship between an organization and its suppliers was the most frequently occurring factor in SSCM literature (Brammer and Walker, 2011). And supplier cooperation was seen as the best practice and a crucial component of SSCM implementation (Pagell and Wu, 2009). The collaboration within the members of the SC is essential in order to execute the business processes. Some supplier development initiatives are joint waste minimization approaches (Simpson and Power, 2005),

innovative environmental design (Verghese and Lewis, 2007), development of eco-friendly technologies (Vachon and Klassen, 2007), minimization of hazardous wastes (Pagell *et al.*, 2007), and collaborative efforts for recyclable products. The concept of collaboration that existed in the conventional SCM theory (Chen and Paulraj, 2004; Vachon and Klassen, 2006) is now a prerogative practice in SSCM theory. Authors have also highlighted the difference between the traditional supply management and the necessity of partnerships in the modern day (Nassimbeni, 2004) Researchers have conducted a case study analysis on a bag manufacturing company and found that applying reverse logistics or recycling techniques in the entire SC process can result in minimizing the product lead-time and supplier collaboration can boost sales and production efficiency (Ramanathan *et al.*, 2014).

The trust among the SC actors is a must for supplier collaboration, in contrast to compliance based partnerships which rely on power (Simpson and Power, 2005). In the past, authors have concluded that complying with strong forms of collaboration like partnerships results in effective SSCM implementation (Blome *et al.*, 2014). Nevertheless, compliance is also understood as negatively associated approach in relationship management.

For extending sustainability to suppliers, supplier development initiatives can be developed which are mentioned in the management literature as the practices which aim at increasing performance of the suppliers (Krause *et al.*, 2009). Some of these initiatives include supplier evaluation, supplier collaboration, supplier training, etc. For successful implementation of SSCM, suppliers must become environmentally and socially responsible (Zhu *et al.*, 2005). Several researchers have identified the need to evaluate the depth of collaborative relationships in SSCM context (Matopoulos *et al.*, 2007). However, it has been found that there is very little research done that analyzes the depth of collaboration like understanding power imbalances in the SC (Hoejmose and Adrien-Kirby, 2012; Walker and Jones, 2012). Authors believe that sustainable procuring plays a major role in company's all around success and it should not only be incorporated within the organization but also extended to all the stakeholders (Pagell *et al.*, 2010).

True supplier collaboration has been considered as the best way forward in literature; however, practicality to this is inadequate. The reason being, most research in this field has considered the sustainable practices of the larger corporations for whom small and medium enterprises (SME) are the suppliers (Lee and Klassen, 2008; Walker and Preuss, 2008). Hence, it is necessary to consider the sustainable practices of both large and small companies to achieve true collaboration (Touboulic and Walker, 2015).

Several traditional papers have addressed SC collaboration. Few authors have enlisted factors that strenghten collaborative spirit among SC members namely supplier coordination and associated benefits (Lehoux *et al.*, 2014), information sharing (Kache and Seuring, 2014), collaborative investments in technologies and performance audit systems (Nyaga *et al.*, 2010). "People issues" are inherent to SC collaboration such as culture, trust, willingness to change, and willingness to collaborate which are difficult to forecast and manage (Fawcett *et al.*, 2006). Between all the benefits from collaboration, some authors also warned that collaboration measures are vulnerable to fail owing to the wide ranging organizational culture and behavioral aspects (Emberson and Storey, 2006). Therefore, it is suggested that organizations must focus on inducing and sustaining a collaborative culture. Authors have argued that an organization's reputation is dependent on its suppliers' behavior towards environment and society (Foerstl *et al.*, 2010).

5. Managerial insights

This paper employs a systematic process to review the SSCM literature from the perspectives of environment sustainability, social sustainability and economic sustainability. This has also

addressed the perspective of performance metrics and the governance aspects for a sustainable SC. The major contribution of this paper lies in identifying the successful SC practices in the context of organizational culture, policies and regulations, supplier evaluation and relationships, green SC practices, economic efficiency, and social sustainability. The managerial insights from the literature review have been presented in the Table XI.

6. Gaps in literature and future directions

The research on SSCM is still at preliminary stage and major research works have not been supported by quantitative findings. The theories that are being utilized in SSCM fail to take into account all aspects of practices in the field. The firm's performance is associated more with the environmental and economic approaches and there is a lacuna on the social and human aspect of sustainability. As the research on SSCM mostly focuses on economic and environmental dimensions and there is lack of systemic sustainability research, the social and human aspect of sustainability can be addressed by borrowing theories from organizational behavior. There are not enough works which addresses the triple bottom line in an integrated manner. The SSCM research must move from the exploratory, atheoretical and descriptive research toward theory testing and implementing the conceptual frameworks to organizations. Research must be done to find technical management variables to quantify the impact of the sustainable initiatives on the economic performance.

There is a need for more SSCM research based on formulation of policy frameworks that can align the firms towards sustainability. The SC researchers must develop practical SSCM tools and techniques along with a guide for SC practices through various strategic models and frameworks. SSCM research should be aligned to develop constructs and metrics to examine the concepts SSCM. As most works are based on qualitative studies, collecting relevant data to substantiate the concepts is also an opportunity. Secondary data sources can be used to examine the relationship between the firm's environmental and social performance vs the economic performance and the relationship between regulatory compliance and economic performance across the SC members.

Research can be done to understand the outsourcing or purchasing decisions involved in SSCM and how the SC governance structures affect this decision-making process. Research focused on analyzing the decision-making process on how the supplier relationships are affected considering one stakeholder in the SC with the others in the network. Sustainability and behavioral management concepts could be studied conjointly like the trust building between all the stakeholders in the SC network beginning from the first supplier to the end customer. Issues in SSCM like cooperation and effective communication between the SC members can be addressed to attain the pre-determined sustainable goals. Association of managerial implications with sustainability concepts could be studied in a way to analyze how the managerial decisions affect the execution of the SSCM practices.

Based on the detailed review of literature, a number of potential research avenues in the area of SSCM have been identified. These gaps are summarized below which would lead to a number of research directions for the future:

- the integration of social issues into the environmental and economic aspect of SSCM;
- lifecycle analysis and the concept of closed-loop SCs for a connected view of sustainability in SCs;
- addressing the issues of inventory management within sustainable SCs (as the traditional inventory models focus on economic aspects);

	References
A. Organizational culture The critical aspect for the SC to be sustainable is the top management support for the SCCM programs by allocating funds for sustainable practices and technologies. Each and every member of the enterprise must be encouraged and supported for innovative ideas for successful implementation of the sustainable practices. The implementation of SSC practices can be successfully realised by considering it as a ongoing and continuously evolving process, preferably within the framework of total quality management (TQM) and lean management	Bhool and Narwal (2013), Olugu *et al.* (2011), Mudgal *et al.* (2009), Simpson and Samson (2008)
B. Policy/regulations The enterprises need to have a structured SC policy and regulations followed by the awareness by each and every member. The government policies and regulations must be robust, which should provide guidelines for eliminating or controlling the environmental pollution. The government agencies through pollution control board should strictly monitor the pollution level of the enterprises on a regular basis and must impose penalties on the enterprises for violating the pollution norms even if the sustainable practices have been adopted. Stringent SSC practices should be reinforced if the enterprises are dealing with international customers	Luthra *et al.* (2011), Bhool and Narwal (2013), Rao and Holt (2005), Zhu *et al.* (2005)
C. Supplier evaluation and relationships The enterprises must consider the sustainability criteria during supplier selection process. For successful relationship, these enterprises should collaborate with the suppliers including technological collaboration for compatibility. These enterprises must engage in training and educating the suppliers for implementing the environmental guidelines including the social sustainability. These enterprises need to monitor review and audit the suppliers on a regular basis	Bhool and Narwal (2013), Wang *et al.* (2011), Agarwal and Vijayvargy (2012)
D. Green SC practices The enterprises along with their suppliers must take adequate measures for the implementation of green practices such as the minimization of the cost and usage of virgin raw materials, inventory level, energy and water usage. These enterprises must also focus on the minimization or elimination of the environmental accidents, health hazards and generation of solid wastes	Zhu *et al.* (2005), Deshmukh and Sunnapwar (2013)
E. Economic efficiency It is critical for the enterprises to minimize the utilization of the resources and optimize the overall logistics cost for high financial performance and profitability through strategic collaboration and information sharing	Attaran and Attaran (2007), Vachon and Klassen (2006), Ashby *et al.* (2012), Gimenez and Tachizawa (2012), Liu *et al.* (2012), Bai and Sarkis (2014), Blome *et al.* (2014), Brindley and Oxborrow (2014), Azadi *et al.* (2015)
F. Social sustainability The enterprises should engage themselves for maintaining social equity through proper code of conduct, protection of employee rights, developing suitable working conditions and employee welfare schemes. These enterprises should gain trust and confidence of their suppliers and customers through fair trade practices and CSR activities	Keating *et al.* (2008), Krause *et al.* (2009), Tencati *et al.* (2010), Mani *et al.* (2015)

Table XI.
Managerial insights

- collaborative relationships between suppliers and customers for better understanding and implementation of SSC initiatives and practices;
- linkage between sustainability initiatives and managerial practices for success or failure of SSC practices;

- guidelines, evaluation tools and techniques for SMEs and large enterprises to justify investment for SSC practices; and
- industry specific research on SSCM.

These distinctive features together would place SCM within the purview of the overall research area on sustainability.

7. Concluding remarks

The concept of sustainability is quite broad, and understanding its interactions with SCM has been critical for the business enterprises. SSCM encompasses the integrated perspectives of economic, environmental and social considerations in the SC along with the governance structures in a dynamic business environment. For the successful implementation of SSC practices, the business enterprises should collaborate with all its stakeholders while optimally utilizing the resources, information and funds to maximize the value propositions to the customers and SC profitability. In the process, it minimizes the environmental impacts and enhances the social equity and well-being on all the stakeholders. Owing to the dynamic nature of SSCM, the researchers in this field should dive into the literature periodically and identify the research opportunities (Winter and Knemeyer, 2013).

The current research has focused on a detailed and structured review of literature on various perspectives of SSCM such as the environmental, social, economic, governance and performance measurement. It has also focused on the various quantitative and empirical modeling approaches in literature including the dynamic capabilities of SSCM. This has resulted in identifying the parameters which enable and inhibit the implementation of SSC practices in bigger enterprises. This structured review has resulted in a number of key managerial insights for the practitioners and future researchers.

The study has identified a number of research gaps in the existing literature which provides enough scope for future investigations. More and more research needs to be conducted to accommodate the social perspectives to enhance the scope of triple bottom line in a SC context. The modeling approaches need to done across industries and in a more realistic uncertain decision environment to fully understand and integrate the SSCM practices across industries.

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