

# Sustainable Supply Chain Management Practices: A Review

Sri Yogi Kottala, SVKM's Narsee Monjee Institute of Management Studies (Jadcherla Campus), Hyderabad, India

## ABSTRACT

This paper made an effort to compile the relevant research articles in the last 18 years on sustainable supply chain management practices. The author has classified the review based on sustainability in manufacturing and supply chain aspects using the dimensions of sustainability (i.e., economic, environment social aspects, and sustainable supply chain management performance evaluation). The authors summarized the relevant work published in noted refereed national and international journals and conference proceedings. The work suggested some research directions as well as propositions for researchers, especially with reference to the Indian context.

## KEYWORDS

Economic, Environment, Manufacturing, Social Responsibility, Supply Chain, Sustainability

## 1. INTRODUCTION

According to Al-Odeh. & Smallwood (2012), ever changing business environment and complexities in regulating an organization's environmental issues have resulted in methodical regulations and helped in improving the customers' awareness. Customer's consciousness put pressure on organizations to adopt sustainable strategies in Supply chain management. Organizations develop sustainable supply chain management strategies seriously considering the consumers awareness and interest. Organizations also spent more efforts to meet their buyer's specifications. Organizations have also been developing, assessing and monitoring procedures to achieve sustainability in SCM. The emerging technological developments have played a significant role in improving the quality of SSCM practices for implementation.

### 1.1 Sustainable Development

Sustainability concerns the environmental influence on future generations. Sustainability is an endeavor to protect the extensive expression of functioning of a company, its supply chains, and its society. Architecturing a sustainable supply chain compels acute emphasis on long-term strategies; preserving a sustainable supply chain demands emphasizing on operational supremacy and management of jeopardy in the supply chain. In fact, active risk management is a fundamental ingredient of any sustainability maneuver.

The concept of sustainable development serves an outline for the economical usage of resources, productive development of infrastructure, preservation and improvement of quality of life, economic or business development whilst safeguarding the environment. Sustainable development can also be defined as a process of change to bring a new order of development to achieve sustainability. This

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nuclear term is not only limited to corporal values, economic advancement, material flows and physical environmental progression, but also comprises the public well-being and quality of social existence.

According to Elkington (1997), the three pillars of the triple bottom line concept include economy, social development and environmental quality, in the administration process. Sustainability has been defined as the objective of sustainable development, which are “types of economic and social developments that safeguard and enrich the natural environment and social fairness” (Diesendorf, 2000). Hence concept of sustainable development is being practiced or emerging to build better organizational structure, as well as considering all dimensions of sustainability, in operational parlance Sahu et al., 2017a,b,c,d,e;2018a,b.

The objectives of our current work is to review the sustainability issues in manufacturing, to review the literature based on three dimensions of sustainability, to review performance evaluation concept as a sustainable supply chain management perspective and to frame a relevant propositions in line of the above research objectives.

## **2. SUSTAINABLE SUPPLY CHAIN**

The concept of sustainable development is very closely linked with supply chain systems. Supply chains are responsible for transferring raw materials to useful products finally into the hands of consumer. Large numbers of intermediate processes are involved such as transportation, manufacturing, distribution etc. All these processes affect the surroundings in more than one ways. Therefore, sustainable supply chains are considered to be an important aspect of business which ensures minimum negative impact of business processes on the surroundings.

Numerous definitions have been proposed for the term sustainable supply chain. Here are a few simplistic and more common definitions for better understanding of the term sustainability in context of supply chains.

According to Business for Social Responsibility (2007), “sustainable supply chain is a system of aligned business activities throughout the life cycle of products that creates value to stakeholders, ensures ongoing commercial success, and improves the well-being of people and the environment”.

According to Carter & Rogers (2008), Sustainable supply chain refers to an integration of social, environmental, and economic issues in a traditional supply chain.

According to Srivastava (1995), the potential for reducing long term risks in a supply chain is associated with resource depletion, fluctuations in energy costs, product liabilities, and pollution and waste management.

According to New Zealand business council for sustainable development NZBCSD (2003), “management of raw materials and services from suppliers to manufacturer/service provider to customer and back with improvement of social, economic and environmental impacts are necessary for sustainable supply chains”. NZBCSD (2003), “states in general that a supply chain considers the social interactions between a business and its customers and suppliers. The greatest benefits are derived by extending the focus as far as possible upstream towards the raw materials, downstream towards the consumer and then back again as the products and wastes are recycled”.

Genovese et al., (2017) argues that a qualitative and quantitative issue in SSCM has been addressed largely. Khodakarami et al., (2015) theorize that TBL concepts are embedded into core business process of SC to achieve exceptional market area at international level. Busse et al., (2017) contend that to achieve superior customer satisfaction firms are moving towards practice of SSCM from conventional SCM to exceed the existing sustainability commitments. Govindan et al., (2015) ascertained that firms transforming their business process across SC into a devoted sustainable perspective.

The above perspective explicitly explains the importance of each element of sustainability triple bottom line (TBL). However, to encapsulate SSCM as collaboration of social, environmental and economic issues at the different levels of management an optimistic implication along the traditional supply chain is essential.

## 2.1 Sustainability in Indian Manufacturing Industry

According to Choudary (2015) “Only 10 percent of the manufacturing sector is actually on a sustainability framework as businesses are still deciding if they want to adopt sustainable measures or not. In developed countries, pressure from either consumers or the government compels corporations to become sustainable in their approach”.

Parasnis (2007) new rules of sustainability cover profitability, quality, environmental, corporate social responsibility, and corporate governance. Ever increasing demand of new products by consumers leads to waste generated by consumers, shortage of waste handling & managing capacities, increase in e-waste, water shortage, energy shortage, GHG emissions and climate change. Cost of environmental damage by Asian region is 5% of annual GDP, China 10% annual GDP, India 5% of GDP. Estimated worldwide expenditure for purchasing and maintaining end of pipe technologies is over US \$ 3 billion. Sustainability thus emerges a crucial component of any successful paradigm to guide development in the new millennium. Thus new practices to be incorporated by process oriented industries in India are eco-efficiency, eco-sustainability, eco-design, product life cycle and green productivity. Indian industries should focus on responding to the demands from (overseas) buyers, maintaining standards of higher quality, eliminate waste in production process, promoting innovative designs, new market opportunities, reduce liabilities and new opportunities. ([www.igpn.org/workshop/india\\_0701/pdf/Mandar\\_PuneUniv1.pdf](http://www.igpn.org/workshop/india_0701/pdf/Mandar_PuneUniv1.pdf))

Tata group companies achieved high levels of business excellence the group has institutionalized Tata Business Excellence Model (TBEM). The TBEM provides each company with an outline to help it improve business performance and attain higher levels of efficiency. The government of India has also taken a bent towards sustainability by proposing guidelines for corporate social responsibility (CSR) in Companies Bill 2009. ([www.tataquality.com/MPage.aspx?pid.SectionId](http://www.tataquality.com/MPage.aspx?pid.SectionId)).

Confederation of India argues that sustainable business in India is dynamic and evolving using different internal and external tools to review the sustainability goals and proposed sustainability value framework. According to Council on energy, environment and water (CEEW) top south Asia's top energy and resource policy –Think Tank 3% industrial emissions intensity decreased in 2007-12. Only 96 clusters out of estimated 400 energy intensive clusters have been mapped in terms of their energy consumption. Three inherent elements of the manufacturing sector are energy use, resource use, and carbon emissions – to support the country's growth as well as sustainability aspirations. Pande (2017), outlook is developing nations failed to implement national and international criterion and governance. Ever increasing awareness among consumers on production and consumption pattern grows the emphasis on social and environmental production issues weightage also increase. Thus there is a need of Sustainability concept to be addressed locally considering global standards among Indian manufacturing industries.

## 3. METHODOLOGY

Internationally available referred scholarly journals and publications related to the topic for this review have been considered. Focus is laid on the years 2000 to 2018. The search for major journal publications was carried out on sciencedirect, emerald insight, and Springer link and referred international conferences. Keywords used in the search were sustainability, sustainable supply chain, reverse logistics, sustainable manufacturing, green supply chain management, social sustainability, economic sustainability, and green supplier development. For this search, the most relevant papers published during 2000 to 2018 in terms of technical content were considered. It was found that total 120 relevant papers pertinent to sustainability, and supply chains that have been analyzed or this study.

### 3.1 Sustainability in Manufacturing

Manufacturing is one of the important drivers of economic growth. Role of manufacturing cannot be undermined in any way. Manufacturing is an important part of almost all supply chains. Automobiles, Electronics, Garments and are a few important sectors where entire supply chain is guided by manufacturing processes (Table 1). Unaware from the negative results of various manufacturing activities, organizations in manufacturing activities were continuously using natural resources without any consideration, similarly wastes were also discharged without much thought.

**Table 1. Significant Contribution on Sustainability in Manufacturing**

Author (s)	Methodology used	Findings/Significant Contributions
Ocampo & Clark (2017)	Qualitative	Classical theories of manufacturing strategy for a sustainable manufacturing strategy.
Zhu <i>et al.</i> (2007)	Empirical	GSCM practices are truly progressive in internal environmental management supported by management across Chinese manufacturers.
Bemon (2005)	Qualitative	Potential conflicts that arise from ethical decision making in SCM design.
Zhu & Sarkis (2006)	Empirical	Strong drivers and pressures to implement GSCM among Chinese companies.
Zhu (2008)	Empirical & Modelling	Suggested both first order and second order models of GSCM implementation among Chinese manufacturers.
Zhu & Geng (2013)	Empirical	Extended supply chain practices among Chinese manufacturers are still in early stage.
Jayal <i>et al.</i> (2010)	Optimization	Improved sustainability scoring methods in manufacturing process of tool
Iwata & Okada (2010)	Empirical	GHG reduction increases ROE among Japanese Manufacturing firms
Zhu <i>et al.</i> (2010)	Empirical	Implementation of GSCM practices among Japanese manufacturers
Cruz (2009)	Qualitative & Modeling	Executed emission and risk penalizing weights were variable and dependent on the value of emission and risk purpose.
Baskaran <i>et al.</i> (2012)	Grey Methods	Long working hours will play an important role in evaluating suppliers, Employing child labor a critical criterion
Unnikrishnan & Hegde (2007)	Empirical	Environmental training and cleaner production to generate a positive environmental change for a better tomorrow.
Muduli <i>et al.</i> (2012)	GTMA	Factors hindering GSCM implementation
Gupta & Palsule-desai (2011)	Review	Growing concept of Cleaner Development Mechanism (CDM) in Indian industry.
Kumar, <i>et al</i> (2012)	Qualitative	Overview of sustainability assessment methodologies.

It is conclusive evidence that above literature includes qualitative, quantitative and case study based sustainability issues in manufacturing especially amongst Chinese, Japanese and Indian industries. Chinese companies practicing the GSCM focus on long term relationship as well as constant monitoring, in contrast to small sample investigated in Japanese market. However, a few researchers discussed the relation of financial context but could not be able to cover all the financial

variables and environmental performance concerning Japanese manufacturers. Dominant evidence from Chinese manufacturers is available due to the reason of Chinese manufacturers being dominant in manufacturing since a couple of decades. However in Indian context very few significant studies have been found in literature covering sustainable perspective in textile, mining sector. Studies on the importance of environmental training for cleaner production, growing concept of CDM in Indian manufacturing industry. Thus the above discussion proposes first proposition.

**Proposition 1:** Environmental awareness among stakeholders of supply chain, practice of cleaner production and cleaner development mechanisms facade to sustainable manufacturing.

#### **4. SUSTAINABLE SUPPLY CHAIN MANAGEMENT AND DIMENSIONS OF SUSTAINABILITY**

Literature review has been classified into three dimensions of sustainability and performance evaluation of sustainable supply chain management.

- **Economic:** Compliance, risk and crisis management.
- **Environmental:** Material consumption, energy use, water use, toxics, pollutants and land use.
- **Social (External):** Labor practice indicators, supplier standards and stakeholder engagement.

##### **4.1 Economic Aspects in SCM**

One of the key dimensions of sustainability economic aspects, researchers are not addressed congruously in sustainable supply chain management has lot of scope in improving the body of knowledge to the literature. However, relevant significant research presented from literature (Table 2, also refer Figure 1).

As of the discussion, it was consummate that previous studies focused on adoption of green purchasing, sustainable network design models for economic and social benefits, and importance of business as a driver in interpreting economic importance among food supply chains. The other allied areas include Overall Business Impact Assessment (OBIA) for economic analysis of environmental issues in SCM, economic aspects among production and distribution for understanding the effect of variables. Significant studies using mathematical modeling for better decision-making in Emission trading scheme (ETS) considering economic and environmental dimensions in aluminum industry have been done. Interestingly it was found that economic aspects and production variables are key drivers of SC system while examining performance of an organization. Therefore, the present paper has considered these economic variables as parameters to further to evaluate sustainability of a supply chain in an empirical approach. Thus above discussion architectures second proposition.

**Proposition 2:** Economic prospective in every stage of supply chain entities leads to sustainable supply chain.

##### **4.2 Environmental Aspects in SCM**

Central dimension of sustainability has been addressed by researchers eminently using different research methodologies, tools as environmental consciousness has global attention in manufacturing sector. However, researchers made significant efforts to embed the importance of environment in supply chain activities. Some eloquent research work has been presented in Table 3.

Conclusions emerging from the preceding discussions on the environmental issues related to SCM include observations on improvement of eco-efficiency in logistics network.

**Table 2. Significant Contributions on Economic Sustainability in SSCM**

Author(s)	Methodology/ Tools used	Findings/Significant Contributions
Bouchrika et al., (2018).	Quantitative	Evaluated the actual water policy management in macroeconomic level an economic sustainability view
Carter &Easton (2011)	Qualitative	Supply chain professional must think for appositeness by enactment of SSCM activities
Zailani et al., (2012), Ortas et al., (2014)	Qualitative	accentuates to accomplish the strategic economic benefits by incorporating social and environmental sustainability actions in Supply chain
Dubey et al., (2016)	Qualitative	Synergetic relationship through information sharing, enhanced logistics support and profitability to promote economic sustainability.
Dam & Petkova (2014), Glover et al., (2014)	Qualitative	Suggested that financial incentives, loans, low pay back periods are expedient by application of SSCM energy efficient practices an economic perspective.
Min & Galle (2001)		Adoption of green purchasing integral part of purchasing
Dehghanian & Mansour (2009)	LCA,AHP	Economic and social benefits and negative environmental impacts among end of life products.
Ilbery & Maye (2005)	Qualitative	Businesses are driven by strong economic imperatives.
Clift & Wright (2000)	OBIA	Economic value decreases through SC in developing economies
Hernandez & Jorge (2004)	Qualitative, GWP	Economic, EI effect collecting distance on GWP and recycling rate among Mexican bottle manufacturers.
Chaabane <i>et al.</i> (2010)	Mathematical Modeling: MIP,LCA	Efficient carbon management strategies to achieve economic sustainability.

Corporate environmental responsibility in supply chain, optimization of environmental impact on design and evaluation of sustainable logistics network Thus they infer that environmental aspects also impact SSCM. Organizations influenced by external drivers, algorithms based model for decision-making in a supply chain network a CSR perspective, system dynamics model used for sensitivity analysis for understanding the ecological motivation covering compliance and regulatory issues. Also point out in the similar direction and motivate those aspects to be taken as key ingredient to be an integrated part of the study. In addition, studies on factors influencing green innovations and determination of factors in conceptualizing environmental strategies were also observed. Use of OBIA for understanding the supply markets and marginal effects on environmental performance and importance of supplier evaluation for implementation of EMS among SC of automobile industry is also witnessed. It is interesting to note that in Australian context customers consider green Supply chain in a hierarchical manner.

Rise in environmental pressures in future should be linked with purchasing function. Apparently lack of it seems that there is a lack of studies on environmental purchasing and a firm's performance. For sustainable development adoption, business should have bottom line incentives. Frame work suggested in the studied literature has not considered the business and environmental relationship explicitly, factors for decision-making in a green supply chain and extension of work on analytical models of carbon emissions in multi echelon supply chain.

Impact of demand, information sharing and lead time, has been playing a vital role in evaluating lean green supply chain. Mathematical models have been developed for SC cost optimization. Cooperation between purchasing and environmental functions has been observed in ISO 14001 companies of Thailand which again provides a direction.

**Table 3. Significant Contributions on Environmental Aspects in SSCM**

Author(s)	Methodology/ Tools Used	Findings/Significant Contributions
Neto <i>et al.</i> (2009)	Multi objective linear problem	Selecting preferred solution of Business and environmental indicators in logistics network – eco efficiency perspective.
Kovacs' (2008)	Case study (Cross Industrial)	Environmental responsibility downstream in the supply chain assigned to suppliers; Environmental demand has no effect on supplier criticality.
Neto <i>et al.</i> (2008)	DEA.MOP	Companies aim to decrease Environmental impacts (EI) by trade off's between EI and logistics costs in their respective SC network..
Walker <i>et al.</i> (2008)	Exploratory Study	Organizations are influenced by external drivers.
Cruz (2008)	Mathematical Modeling	Discrete algorithm to approximate continuous time adjustment process for static and dynamic supply chain networks with CSR.
Georgiadis & Besiou (2008)	Network modeling	Firm's compliance to regulatory measures and green consumerism.
Tseng <i>et al.</i> (2008)	Empirical Study	Explicitness and accumulation of green practices.
Benito & Benito's (2008)		Control variables consideration in conceptualizing environmental strategies.
Mehalik's(2008)	Case Study (Textile Industry)	Collaborative allies for responsiveness, technology sharing in network's contingency
Walley Stubbs (1999)	Context-process-control (C-P-C) framework in SME	Greening initiatives to quality systems.
Florida & Davison (2001)	Empirical	Adoption of Environment management systems (EMS) for effectiveness in managing environmental costs.
Michelsen (2007)	Case Study/OBIA	Supply markets marginal effects on environmental performance.
Ahsen (2007)	Empirical	Environmental criteria crucial part in process of supplier evaluation.
Rao (2002)	Empirical	Greening suppliers significantly enhance environmental performance.
Simpson <i>et al.</i> (2007)	Empirical (Australian Industry)	Customers perception in Green supply chain programmes has hierarchical approach.
Vermeulen & Seuring (2009)	Empirical	Climate change, energy provision.
De Brito & Vandeer Laan (2008)	Behavioral Theory/ Adductive Reasoning	Lack of Integration in sustainability.
Sarkis (2001)	Empirical	Manufacturing strategy is influenced by evolution of organizational structures.
Lamming & Hampson's (1996)	Qualitative	Purchasing function should be linked with environmental pressures.
Carter <i>et al.</i> (2000)	Empirical	Purchasing function creates value and affects environmental actions.
Tsoufas & Pappis (2006)	Qualitative	Business should have bottom line incentives for Sustainable Development
Hines & Johns (2001)	Empirical	Environmental supply chain management change in suppliers.
Sarkis (2003)	ANP	Inter organizational implementation for better decision framework in green supply chain.
Sundarkani <i>et al.</i> (2010)	MILP	Carbon emissions across stages of SC a significant threat.
Pan & Ballot (2010)	Mathematical Modelling	Supply network pooling is an efficient approach to reduce CO <sub>2</sub> .
Kainuma & Tawara (2006)	Multiple attribute utility theory approach	Impact of Demand on information sharing and lead time is vital in green supply chain evaluation.
Maria <i>et al.</i> (2009)	MILP	Minimization of total SC costs.
Lindhqvist & Nawrocka (2009)	Focused group Technique	Cooperation should be present between purchasing and environmental functions.
Tsoufas & Pappis (2006), Kainuma & Tawara (2006),	Qualitative	Integration of sustainability in SCM research is well documented. There is an alarming need for sustainability, and SSCM governance.
Allali <i>et al.</i> , (2017)	Quantitative	Comparative investigation connection between carbon dioxide (CO <sub>2</sub> ) emission per capita and economic growth of energy consumption in over the period for two centuries in Algeria & Morocco.

**Proposition 3:** Using sustainable business models, minimizing carbon emission across SC, integrating suppliers, information sharing leads to positive greener supply chain management practices.

### 4.3 Social Issues in Supply Chain Management

With ever increasing pressures by government, consumers, group of producers societal issues are integrated as a indispensable in supply chain management activities. Substantial research work has been done by researchers using empirical, qualitative, multiple case study, content analysis and review papers presented with significant contribution/ findings from literature in Table 4.

Hence from above social aspect related arguments of SSCM, it corroborates the purchasing related social sustainability which comprises of individual values, people oriented organizational culture in Asian environment, insights into innovation with company's CSR framework, critical analysis of environmental and social standard system and their potential integration in the business process. On the distinct view especially among European firms, there is a relation between CSR and certain accounting indicators, which manifests the performance. Frequently recited work of Seuring & Muller (2008), for a markedly better understanding along with the literature of SSCM advocates work on distinct strategies like supplier management risks and performance. At last from the Carr & Smeltzer (1997), significant studies it can be abridged that there is a positive relation between status of purchasing function and strategic purchasing, reasons for reverse auctions and traditional communication methods for significant improvement in buyer's performance.

Fundamental concept of SSCM studies are not only limited to automobile, electronic industries but also extends to a few studies within the framework on application of CSR across the food supply chains. Investigations in addition revealed that among SME's there is an increasing awareness of customers to redistribute SC profits, also further work is to be explored for analysis of companies using informal systems to transfer CSR issues to suppliers and monitor their practices. Empirical studies comprehensively outline indicates the enhancing collaboration initiatives for building the sustainable chemical industrial parks and purchasing and supply management (PSM) function's assessment of a supply management process of chemical industry. Propositions on socially responsible practices among business organization's networks, regulatory systems, role of Governments and National environment in relation to diffusion of ISO 26000 are also instrumental in providing research directions. There is a scope of further work in the areas of transparency approach for sustainability. Managing supplier relations, building internal capacity has been validated using the model of a socially responsible purchasing process. Detailed investigation on implementation and control of CSR issues along SC using CSR reports of EU also is suggestive of a few aspects vital to the proposed study.

**Proposition 4:** Integrating suppliers, stakeholders and practicing corporate social responsibility enhance societal compensation for a sustainable supply chain oriented firm.

### 4.4 Sustainable Supply Chain Management Performance Evaluation

Research gaps are: Model considered a generic industry without emphasizing differences and regularities that exist in the sectors. Better specifications would lead to a clear understanding of the diversity among sectors and would allow the study of the co evolutionary processes underlying their dynamics in order to explain sectoral differences on environmental performance (Table 5).

Fine performance measurement is a successful tool in controlling and benchmarking among business processes. Thus, from the literature on SSCM performance suggests the need and importance of analysis of the potential link between environmental activities in the supply chain and internal quality management practices. They also described that there is a positive relation between supply chain strength and environmental performance.

Table 4. Significant Contributions on Environmental Aspects in SSCM

Author (s)	Methodology/ Tools Used	Findings/Significant Contributions
Salam (2009)	Empirical	Individual values and people oriented organizational culture are most powerful aspects in PSR for Asian environment.
Ansett (2007)	Qualitative	CSR in apparel retailer effective social sustainability indicators.
Kopling et al., (2007)	Empirical	Supply process, monitoring and supplier developments help in eliminating damages and social problems in SC's of a company.
Cote et al., (2007)	Empirical	Among European firms the relation between CSR and certain accounting indicators. Difference in performance, which is negative when sustainability practices are applied in the first year.
Lopez et al., (2007)	Qualitative Case Study	Significant difference in performance and negative when sustainability practices are applied in first year.
Seuring & Muller (2007)	Review Paper	Two distinct strategies: supplier management for risks and performance; and supply chain management of sustainable products demand.
Maloni & Brown (2006)	Qualitative	Framework for unique CSR in food supply chain.
Ciliberti <i>et al.</i> , (2010)	Qualitative	Code of conduct in SME's for rewards as socially responsible companies.
Reniers <i>et al.</i> , (2010)	Empirical	Collaboration as driver and partner features in chemical companies for enhancing collaboration initiatives for sustainable chemical industrial parks.
Foerstl <i>et al.</i> , (2010)	Qualitative (Multiple case Studies)	Supply management functions drivers in treating supplier sustainability risks in a supplier management process of chemical industry.
Wognum <i>et al.</i> , (2010)	Empirical	Information provision regards single isolated business actor.
Leire & Mont (2010)	Qualitative	Internal policies, setting purchasing criteria, social issues, assurance practices, supplier relation are vital phases for socially responsible purchasing.
Ciliberti <i>et al.</i> , (2010)	Qualitative/Content Analysis	Companies focus only on first – tier suppliers in implementing CSR issues in SCM.
Schmidt & Schwegler (2008)	Qualitative	Companies seek to fulfill ecological sustainability as a decision making aid.
Maxwell & Vorst (2008)	Qualitative	Framework for developing sustainable products and services.
Ciliberti <i>et al.</i> , (2008)	Qualitative/Case Study	Different management tools are effectively and simultaneously adopted by SME managers to get suppliers more involved in CSR.
Castka & Balzarova (2008)	Empirical	Differences in regulatory systems, role of governments and natural environments in Social responsible practices in organizations.
Hutchins & Sutherland (2008)	Mathematical Modeling	Strong relationship between business decision making and social sustainability.
Debrito <i>et al.</i> , (2008)	Empirical	Leveraging internal and external organizations in European supply chain.
Carr & Smeltzer (1997)	Empirical	Strategic purchasing has positive relation with status of the purchasing function.
Smeltzer & Carr (2003)	Qualitative	Primary steps to be followed in strategic sourcing.
Carr & Kayank (2007)	Empirical	Significant factors for improving buyers performance.
Stefan et al., (2011)	Qualitative (Case Study)	Social dimension of sustainability is neglected both in conceptual research and in corporate practice.

**Table 5. Significant Contributions on Environmental Aspects in SSCM**

Author(s)	Methodology/Tool	Findings/Significant Contributions
Vachon & Klassen (2008)	Empirical Survey	Collaboration
Vachon & Mao (2008)	Empirical Survey	Relationship between supply chain strength and environmental performance
Jean (2008)	Simulation	Dynamic efficiency of emission standards
Bai et al., (2010)	TOPSIS	Roughset methodology to evaluate performance measurement in GSCM
Erol <i>et al.</i> (2010)	MCDM/FMAUT	MCDM for evaluation of SSCM performance
Artiach <i>et al.</i> (2010)	Qualitative	Corporate sustainability performance among US firms
Matos & Hall (2007)	Case Study (Focus Group Technique)	Rugged landscape is most appropriate approach to search for high performance in sustainable development.
Cerin & Dobers (2001)	Qualitative	Dow Jones Sustainability Group Index focuses more on technology sector compared with general Dow Jones Global Index.
Sevensonn (2007)	Modeling	n-order supply chains should be considered in business practices to enhance corporate efforts of SSCM
Bocken et al., (2013).	Qualitative	Implementing business models in sustainable perspective distinctively to Triple Bottom Line.
Taticchi et al.,(2013) Dubey et al.,(2016) Acquaye et al., (2017)	Qualitative	Audit, assessment and standardization are positive members for performance appraisal that helps to accomplish sustainability.
Spence & Bourlakis(2009), Foerstl et al., (2010)	Quantitative	Sustainability performance has been influenced by performance assessment of SC mechanism.
Ching & Moreira (2014)	Quantitative	Sustainable performance achieved by incorporating standardization, traceability using the concept of lean and green during product design stage and integrating suppliers.
Grosvold et al., (2014), Turker & Altuntas (2014).	Quantitative	Third party certifications, supplier auditing, assessing and monitoring risk and supplier education, compliance, monitoring, and auditing are the building blocks in SSCM for high performance improvement.
Gualandris & Kalchschmidt (2016).	Quantitative	A recognizable environmental, social practice leads to increase in sustainability performance of supply chain activities thus making organization's sustainable

Studies are also indicative of efficiency of emission using co evolution of technology, rough set as a methodology for performance measurement evaluation of GSCM. Application of fuzzy multi attribute utility theory for sustainable supply performance of a supply chain is also observed.

In recent literature, a fair amount of attention has been given to environmental considerations and the importance of sustainable development, and this has resulted in life-cycle thinking which has gained support over the more traditional view of seeking efficiencies in individual activities along the supply chain.

The concept of life-cycle management is involved with managing the impact of a product or service, and the resources used to produce it, on the environment at each stage of the product's life-cycle. Life-cycle assessment is formally defined by International organization for standardization (ISO 1997) as “a compilation and evaluation of the inputs, outputs and the potential environmental impacts

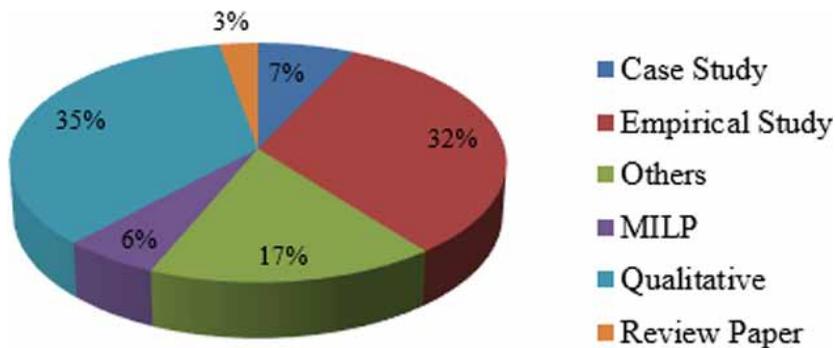
of a product system throughout its life-cycle". It has been widely accepted within the environmental research community as a good basis for comparing alternative materials, components, and services. (See Committee on Material Flows Accounting of Natural Resources (CMFANR), 2004, 57-58). Previous studies are also suggested that Life Cycle Assessment (LCA), Environmental Management System (EMS) as prosperous research tools for evaluation of product life cycle concerning a supply chain for achieving the sustainability.

Papers that are related to SSCM were also found since these papers are focusing on allied areas, especially production and consumption Harry (2008), strategic decisions Hugo & Pistikopoulos (2005), were also considered for direction and analysis. Harry (2008), presented model that investigated supply chain from the consumption perspective providing insights into the contributions of regions and sectors in the production related in Dutch consumption. Outcome of the research is detailed picture consisting of region sector combinations with high contributions to the pressure of total Dutch consumption or specific supply chains. For complete sustainability analysis social and economic aspects to be considered. Developed Multi Regional Input Output Model (MRIO) used to determine for which final demand the production in a certain region-sector combination is intended.

Hugo & Pistikopoulos (2005), proposed a methodology utilizing mixed integer modeling techniques to address strategic decisions involving the selection, allocation and capacity expansion of processing technologies and assignment of transportation links required to satisfy the demand in the markets.

**Proposition 5:** Environmental conscious production consumption processes of firms have superior standards of sustainable performance evaluation.

Figure 1. Methodologies Used By Researchers in the Literature Review Covered in Current



## 5. CONCLUSION

Papers reviewed in this work give details of different dimensions of SSCM. Some of the papers explore different aspects of SSCM. The summarized aspects are: environmental performance in SCM, financial performance linked with SCM, eco efficiency, corporate social responsibility, carbon emissions, suppliers and purchasing partnerships. Researchers used different tools for analysis in their work such as frame work development, simulation, mathematical modeling, case study and empirical analysis. Most of the papers reviewed have followed modeling, empirical study, and case study as research design (Refer Figure 1). However the following gaps were identified in current

literature review. Zhu's developed scale has been validated only between Chinese manufacturers and not considered internal barriers in his study. Models developed have not addressed social issues, as well as have taken only a few activities in recovery network and have not delivered better results for uncertainty. Modeling of carbon emissions did not address all the dimensions of sustainability. There is a scarcity of models for an insight into improving the eco efficiency covering all the activity's distribution, transportation, and procurement. There is a need of integration of sustainability and governance in SCM. Particularly absence of analysis in business opportunity developments concerning the environmental burden is intriguing. Studies and solutions related to operationalisation indicators of corporate social sustainability in decision making related to supplier selection or supply chains did not produce desired results. There is a need for further study to find the potential link between environmental activities in the supply chain and internal quality management practices. Linking corporate environmental management measured at the country level using benchmarking to country risk ratings and foreign direct investments is also desirable and foreseen. Modeling for generic industry does not prominently include differences and regularities that exist in the sectors. Therefore, the need for the current study emerges for significant contribution to the body of knowledge and to the literature of SSCM. A large gap as is evident from the discussion of literature review is found. So, it became imperative that concerned sustainability issues, Supply chain performance as well as cost variables, environment, economic, business opportunity development and carbon emissions in case of Indian manufacturing industries/companies must be analyzed through an empirical study.

## **6. LIMITATIONS OF THE STUDY**

However, the current study could not be able to focus on large number of research papers, and the propositions may not be appropriate for all types of organizations. Observations, interpretation of findings of the research presented may vary among different researchers perception which cannot be generalized especially while doing an empirical based research. For better results use of bibliometric tools is encouraged.

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*Kottala Sri Yogi is Assistant Professor, Department of Operations at SVKM's Narsee Monjee Institute of Management Studies (Deemed to be University) Hyderabad Campus, Hyderabad, Telangana, India. He held a gLink Post-Doctoral Research Fellow in Business with Technology at the Log Dynamics & Faculty of Economics and Business Studies, University of Bremen, Germany. He received his PhD (2014) from Indian Institute of Technology Roorkee, Master of Engineering in Industrial Engineering and Management (2006) from Shri G.S. Institute of Technology and Science, Indore. He worked as Regional Editor (Asia Pacific) on a voluntary basis for Transnational Corporations Review, published by Taylor & Francis. He is Regional Editor (Asia Pacific) of Transnational Corporations Review, published by Taylor & Francis.*