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Development and validation of a scale for measuring Sustainable Supply Chain Management practices and performance

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ABSTRACT

The present study is an attempt to conceptualize, develop and validate a scale for the purpose of measuring Sustainable Supply Chain Management (SSCM) practices adopted by an organization and also evaluating its performance on different dimensions of SSCM. Based on extensive review of literature, the study has identified five constructs of SSCM practices, namely *Environmental Management Practices, Operations practices, Supply Chain Integration, Socially Inclusive Practices for Employees, and Socially Inclusive Practices for Community* and another five constructs of SSCM performance namely *Environmental Performance, Operations Performance, Competitiveness, Employee-centred Social Performance, and Community-centred Social Performance.* A survey instrument was designed based on the extant literature and relevant data was collected on this instrument from 255 organizations. The data analysis primarily involves application of confirmatory factor analysis for validating the instrument in respect of unidimensionality, reliability, convergent validity, discriminant validity, nomological validity and criterion-related validity. The outcome of the analysis gives rise to a parsimonious instrument which makes a significant contribution to SCM literature. The instrument would enable an organization to implement different elements of SSCM practices, monitor the status of its implementation and finally assess organizational performance on the dimensions of SSCM.

1. Introduction

Traditionally, most of the Operations and Supply Chain managers are simply concerned with the economic goals of an organization and do not feel motivated enough to pay much needed attention to the environmental and social issues faced by an organization. However, contemporary developments in business environment since the last decade indicate that merely pursuing economic motive is not a sound decision alternative for an organization from long-term sustainability and profitability point of view, if the actions of the organization cause irreversible damages to the eco-system and fail to secure safety, security, minimum wage, healthcare, better working conditions for employees, improved living condition for the surrounding community, and the society at large. This phenomenon has motivated both researchers and practitioners towards Green and Sustainable Supply Chain Management (SSCM). Adoption of environmental or green supply chain management (GSCM) practices by a firm does not merely mitigate negative environmental impact on the surrounding area, it also results in significant positive impact on firm economic performance (Golicic and Smith, 2013). Similarly, implementation of corporate social responsibility (CSR) practices by a firm does not confine itself to only addressing the needs of the employees and the local community, it mostly gives rise to significant positive impact on firm financial performance (Zhu et al., 2016). Sustainable Supply Chain Management (SSCM) blends the goals of both CSR and GSCM, which in turn, helps organizations achieve its economic goals, environmental goals, and societal goals at a micro level and ultimately improve the image of the firms in the eyes of the stakeholders.

Literature is replete with a number of studies on environmental and GSCM (Zhu and Sarkis, 2004, 2007; Zhu et al., 2007, 2008a; 2008b, 2008c; 2012; Darnall et al., 2008; Rao et al., 2009; Giovanni, 2012; Green Jr. et al., 2012; Mitra and Datta, 2014) in terms of the development of specific constructs of GSCM practices and how the same influence economic and environmental performance of an organization. GSCM primarily captures two dimensions of a supply chain: economic and environmental. However, the above studies have not attempted to identify and

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address the needs of the people across the supply chain which is an integral component of sustainable development, as mentioned in the Brundtland report (WCED, 1987). Since last decade, academic community in operations domain has also started paying attention to social dimension along with the economic and environmental ones simultaneously (Kleindorfer et al., 2005; Linton et al., 2007; Carter and Rogers, 2008; Seuring and Müller, 2008; Vachon and Mao, 2008; Pagell and Wu, 2009; Carter and Easton, 2011; Winter and Knemeyer, 2013). Kleindorfer et al. (2005) argued that sustainable operations management must help companies become agile, adaptive, and aligned in balancing the needs of three Ps, people, planet, and profit. Linton et al. (2007) attempted to link sustainability and supply chains by considering both environmental and societal aspects. Their study merely provides an overview of sustainable supply chain and has not covered the development of scales or constructs of SSCM. Carter and Rogers (2008) suggested a theoretical framework of SSCM based on resource dependence theory, population ecology, transaction cost economics, and resource-based view of the firm. Seuring and Müller (2008) developed a conceptual framework of SSCM based on extensive review of literature. However, these findings lack the development of specific constructs of SSCM. Pagell and Wu (2009) attempted to provide a conceptual model of SSCM using case studies of 10 exemplar firms. Gupta and Palsule-Desai (2011) provided an overview of conceptual foundation of SSCM. Carter and Easton (2011) highlighted the evolution and future research directions of SSCM through a systematic review of literature. Winter and Knemeyer (2013) pinpointed the lack of integrated approach between the dimensions of sustainability and the elements of SCM. Beske and Seuring (2014) identified SSCM practices based on existing literature and grouped them under five categories. However, this is merely a conceptual paper and no attempt has been made to apply the framework in a real-life setting.

There are very few empirical studies on SSCM, which have attempted to capture all relevant constructs of SSCM. Pullman et al. (2009) revealed that environmental and social sustainability practices have positive and indirect impact on firm performance. However, their findings do not encompass all relevant elements of SSCM. Wu and Pagell (2011) demonstrated how the organizations attempt to balance the achievement of profitability goal, environmental goal, and social goal under conditions of uncertainty by adopting a case study approach. The set of propositions recommended by them have not been empirically tested. Gold et al. (2013) explained how multinational corporations (MNCs) utilize the concepts of SSCM to integrate 'Base of the Pyramid' (BoP) in creating sustainable value by involving the local community with the help of a case study research carried out in several firms engaged in food sector. However, the findings of this study might not be applicable to other industries and might also be difficult to generalize in the food industry as a whole.

As regards the availability of previously established scales, extant literature reveals the existence of several scales pertaining to SCM (Chen and Paulraj, 2004a; Li et al., 2005), environmental/GSCM (Zhu et al., 2008a; Rao et al., 2009), social sustainability in supply chain (Lu et al., 2012; Mani et al., 2016a, 2016b; Zhu et al., 2016) etc. The SCM scale developed by Chen and Paulraj (2004a) and Li et al. (2005) includes only economic dimension across the whole supply chain and does not incorporate environmental dimension, nor social dimension. As mentioned in the beginning, environmental/GSCM scale (Zhu et al., 2008a; Rao et al., 2009) represents environmental and economic aspects of the supply chain but does not account for social dimension of the supply chain. Socially responsible scale developed by Lu et al. (2012) in the context of supplier development includes the practices pertaining to the employees, customers, suppliers, community, investors, and the environment. However, operations or the economic facets have not been captured in this scale. Moreover, this scale has not considered the measures of performance for evaluating social or economic performance. The scale developed by Mani et al. (2016a, 2016b) include the development of only social construct in a supply chain encompassing suppliers, manufacturers, and customers with reference to supply chain sustainability and cover neither economic dimension, nor environmental dimension. CSR scale developed by Zhu et al. (2016) includes majorly the practices relating to the employees and the community and certain practices relevant to the environment. It does not capture operations or economic practices. The study has also tried to investigate the impact of the practices on social performance and financial performance. However, neither operations performance nor environmental performance has been explored. Marshall et al. (2014) developed a scale comprising sustainable environmental practices and sustainable social practices. However, the economic dimension was not included in their scale. Moreover, they did not attempt to identify relevant measures of performance for evaluating environmental or social sustainability performance. Esfahbodi et al. (2016) confined their study to the trade-offs between environmental and cost performance and have not incorporated social performance in the same. Thus there exists a considerable gap in literature in respect of the availability of a proper scale which includes all three dimensions of sustainability in terms of both SSCM practices and SSCM performance. The present study seeks to fill this gap.

Another motivation of choosing this particular research problem is the growing emphasis of several journals on this current theme. Examples include the special issue of the *Journal of Cleaner Production* titled 'Sustainability and Supply Chain Management' (Huisingh, 2008), special topic forum of *Journal of Supply Chain Management* on Sustainable Supply Chain Management (Krause et al., 2009), special issue of *International Journal of Operations & Production Management* titled 'Sustainable Operations Management: Recent trends and future directions' (Walker et al., 2014), and more recently another special topic forum of *Journal of Supply Chain Management* devoted towards theory building surrounding SSCM (Markman and Krause, 2016). All these special editions emphasize upon the fact that SSCM is a contemporary problem confronting both the academic community and the practitioners. However, we hardly came across a paper which is devoted towards the development of SSCM scale. This, of course, involves borrowing relevant items from a somewhat fuzzy domain of sustainability and an evolving field of SCM. Both the concepts of Sustainable Development (SD) and SCM, in isolation, are quite rich in terms of extant literature, with SD being applied to the broad macro-environment while SCM is relevant to the micro-environment. The interface between SD and SCM is an emerging area of research. The challenge lies in how to make the broad concepts of sustainability relevant, applicable and operationalizable to SCM at firm level.

With this background, the present study attempts to develop and empirically validate a scale combining both SSCM practices and SSCM performance measures. This study contributes to the existing body of SCM literature by way of developing a parsimonious scale incorporating the relevant elements of SSCM. This would enable the decision-maker in measuring the practices of SSCM encompassing economic, environmental, and social dimensions and at the same time would allow him to evaluate SSCM performance on the above three dimensions. In the present study, operations performance has been used as a proxy to measure economic performance. The remainder of the paper is as follows. Section 2 provides an overview about the theoretical foundation on Sustainability and SCM. Section 3 discusses the building blocks of SSCM covering both SSCM practices and SSCM performance. Section 4 covers research method in detail. Section 5, considered the heart of the paper,

presents data analysis and interpretation of the same. Section 6 presents discussion, theoretical contribution of the work and its managerial implications. The paper concludes with a comparison of SSCM practices between Indian and Chinese companies, scope for widening the boundary of the scale, its limitations, and future research directions.

2. Theoretical foundation of SSCM

The present study draws on the literature of both Sustainable Development (SD) and SCM. SD is concerned with meeting the needs of present without compromising the ability of future generations to meet their needs (WCED, 1987). It covers the broad macro dimensions of economy, environment, and society. SCM is a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time in order to minimize system-wide costs while satisfying service level requirements (Simchi-Levi et al., 2008). The focus of SCM is on improving the operational efficiency. The challenge lies in integrating the philosophy and principles of SD into the whole supply chain. However, before integrating the concept of SD into SCM, it is necessary to delve into the crux of these two different concepts.

2.1. Sustainability

Sustainable Development (SD) is a contested concept with divergent views and perspectives (Giddings et al., 2002). It primarily conveys the concept as the intersection of economy, environment, and the society. Although the term sustainability was coined in early 1980s, global community started paying attention to the concept only after the publication of the classic definition of SD provided by the Brundtland report (WCED, 1987). Researchers in the domain of SD have presented the three dimensions of sustainability as being composed of three interconnected rings, also known as 'Common three-ring sector view of sustainable development' (Barton, 2000; Giddings et al., 2002). Although this model is conceptually simple, it suffers from several weaknesses. The focus of this model is on the intersection of the economy, environment, and the society. However, in reality, economy dominates both the environment and the society. Further sectoral view of this model encourages a technical fix approach to SD issues and does not involve proper investigation of the relationship between economy, environment, and the society. As such the environmental and social issues often fall off the SD agenda (Giddings et al., 2002). The concept of 'triple bottom line' (TBL) introduced by Elkington (2004) received worldwide recognition and became a reference point for research in the domain of sustainability. Both the concepts of TBL and sectoral view of the model served as triggers for the development of SSCM framework (Carter and Rogers, 2008; Carter and Easton, 2011; Winter and Knemeyer, 2013). TBL attempts to treat all three dimensions of sustainability with equal importance and thus could be considered an integrative theory of sustainability. Similarly natural resource based view of the firm introduced by Hart (1995), another form of sustainability, is also considered integrative in nature, although it has not explicitly addressed the needs of all stakeholders of the society. Porter (1991) introduced 'win-win' perspective with reference to the conflict between environment and the economy. He argued that the firms can be environmentally-friendly and at the same time can make profit. Porter and Kramer (2011) introduced another concept titled 'creating shared value'. They explained that this policy can enable a firm to enhance its competitiveness and at the same time advance the economic and social conditions of the community in which the firm operates. This concept, somewhat analogous to the TBL concept, also attaches equal importance to all three aspects of sustainability. However, the economic outcomes are always prioritized first before social or environmental issues are addressed in both academic research and practice in almost all the above three approaches (Markman and Krause, 2016).

Another model termed as 'Nested sustainable development' was suggested by Giddings et al. (2002), in which the economy is shown to be nested within society, which in turn, is nested within the environment. Similar kind of model was also proposed by Montabon et al. (2016) with specific reference to SSCM. This is named as 'Ecologically dominant logic'. Montabon et al. (2016) argued that the economic system is subservient to the social system, which, in turn, is subservient to the ecological system. This implies that the ecological environment serves as a broad framework or constraint within which the social system should operate and social environment acts as the second constraint within which the economic system should function. In other words, this means that the ecological constraint and social goals must be fulfilled first before economic goals are satisfied. This sounds highly ambitious and somewhat difficult to operationalize for an individual firm. However, Montabon et al. (2016) provided a framework of ecologically dominant logic, which would enable a firm to move towards realizing the goal of true sustainability. This ecologically dominant logic and the associated framework would trigger academic research which, in turn, is expected to motivate the firms to put in efforts towards the direction of achieving true sustainability. In this context, it is relevant to mention the contribution of Haughton (1999) who advocated five principles of equity from the perspective of SD. These five principles are: (i) equity (intergenerational equity), (ii) social-justice (intra-generational equity), (iii) transfrontier responsibility (geographical equity), (iv) procedural equity (people treated fairly), and (v) inter-species equity (importance of biodiversity). These principles essentially convey the spirit of SD. A sustainable supply chain should contain most of these elements of equity and justice.

2.2. Supply chain management

The concept of SCM started receiving increasing attention from researchers and practitioners since late 1990s in response to the competitive pressure in terms of improved quality, reduced cost, increased responsiveness, and shorter lead time. The genesis of SCM seems to be an evolutionary phenomenon with the development of total quality management (TQM), just in time (JIT), and lean production in Japanese manufacturing plants. Few authors (Corbett and Klassen, 2006; Mitra and Datta, 2014) also argued that the practices of TQM, JIT, and lean operations have culminated into GSCM. The main aims of TQM are to design quality into the products and services by institutionalizing a corporate wide culture emphasizing customer focus, continuous improvement, employee empowerment, and data driven decision making (Kannan and Tan, 2005). The literature on TQM is quite vast. For instance, Flynn et al. (1994) introduced seven dimensions of quality management while Ahire et al. (1996) developed 12 constructs of TQM. In both the works, most of the quality management practices construct was found to be identical in nature. For instance, top management commitment, customer focus, usage of process control, product design quality, employee involvement, supplier involvement etc. are present in both the findings. Kaynak (2003) made use of similar type of TQM constructs while investigating the impact of TQM practices on firm performance. Further Kim et al. (2012) utilized almost same type of constructs while exploring the relationship between quality management practices and innovation.

"Just-in-Time" means making "only what is needed, when it is

needed, and in the amount needed." (www.toyota-global.com/...../just-in-time.html). Mehra and Inman (1992) introduced 20 elements of JIT implementation practices which were grouped under four factors: (i) management commitment, (ii) JIT production strategy, (iii) JIT vendor strategy, and (iv) JIT education strategy. White et al. (1999) identified 10 JIT practices in which 'total quality control' constitutes one of the important practices. The concept of lean production is considered an extension of JIT and sometimes both of them are used interchangeably. The distinguishing feature of lean production from JIT is its focus on elimination of waste by simplifying production processes (Womack et al., 1991). It is also viewed from the perspective of customer value. The philosophy of lean production suggests that every step in the production process must add some value that the customer actually wants and for which the customer is willing to pay (Chase et al., 2014). The success of both JIT and lean manufacturing depends on coordination of production schedule with supplier deliveries, and high level of service from suppliers both in terms of quality and reliability. This involves the development of close relation with the suppliers and integration of production plan with the suppliers. Further right quality of materials is required to be delivered by the suppliers for ensuring uninterrupted operation. Thus quality is considered an essential pre-requisite for successful implementation of JIT and lean manufacturing. Snell and Dean (1992) observed that it is quite difficult to distinguish between TQM and JIT, since both of them have many common elements. Further Yang et al. (2011) showed that the construct of lean manufacturing consists of JIT, TQM, and employee involvement. There exist divergent views in literature although there are some commonalities. The specific focus of TQM seems to be on quality while JIT emphasizes on quality, cost and delivery time. Lean production adds one more dimension, namely the evaluation of each activity as value-adding or non-value-adding from the customer's perspective.

A close look at the elements JIT and lean production reveals that all these are explicitly or implicitly present in SCM as well. The concept of SCM encompasses the operations of an organization both upstream and downstream including its internal operation. Council of Supply Chain Management Professionals (CSCMP) has defined SCM as the planning and management of all activities involved in sourcing, procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers (https://cscmp.org.....). SCM literature is quite rich in terms of the development of SCM practices construct. Tan et al. (1999) broadly identified three components of SCM practices: (i) TQM practices, (ii) supply base management practices, and (iii) customer relations practices for proper implementation of SCM practices. In another study, Tan et al. (2002) developed six constructs of SCM practices, namely (i) supply chain integration, (ii) information sharing, (iii) supply chain characteristics, (iv) customer service management, (v) geographical proximity, and (vi) JIT capability while investigating its different facets. Chen and Paulraj (2004a) introduced five constructs of SCM driving forces and seven constructs of SCM practices for successful implementation of SCM. The findings of this study reveal that customer focus and quality maintained through supplier relationship constitute important elements of SCM implementation. Further Li et al. (2005) introduced six constructs of SCM practices. The findings of this work indicate that partnership with suppliers for improvement of quality, customer relationship, and lean practices are important constructs of SCM practices.

Thus there are divergent findings in terms of the development of constructs of SCM practices. However, there exists resemblance across these constructs at least in terms of some observable items, although the nomenclature of the constructs given by different researchers turned out to be different. Careful observation of the items and constructs of SCM practices of the above findings reveal that most of them have considered customer relations/customer focus, quality management, JIT and lean operations to be part of SCM practices. All these practices essentially lead to the improvement of operational efficiency across the whole supply chain.

3. Building blocks of SSCM

Initial research in the domain of SSCM mostly dealt with environmental management/GSCM practices adopted by a firm and its impact on firm performance while the later research also includes social dimension into the GSCM practices and investigates different dimensions of SSCM practices on firm performance. Since the aim of the present study is to design an appropriate scale for SSCM practices and SSCM performance, this section is discussed broadly under two heads: SSCM practices and SSCM performance.

3.1. SSCM practices

The motivation to include all three dimensions of sustainability into SSCM practices has emanated from the concept of TBL introduced by Elkington (2004), the principles of equity in SD as propounded by Haughton (1999), the ecologically dominant logic as suggested by Montabon et al. (2016), and finally the concept of SCM. Thus in tune with the principles of sustainability and the concept of SCM, SSCM practices considered in the present study have been grouped under four building blocks: environmental management practices, socially inclusive practices, operations practices, and supply chain integration. These four building blocks are intended to capture the whole essence of SSCM practices. A conscious attempt was made to choose the items of SSCM practices cited in academic literature in such a manner which would allow them to necessarily fall in one of the four building blocks of SSCM practices. Further the justification to categorize them under four building blocks is to have clearly distinguishable and operationalizable practices and finally develop an empirically validated scale of SSCM practices.

3.1.1. Environmental management practices

The rationale behind considering environmental management practices (EMP) as one of the important factors influencing the performance of an organization and its competitiveness can be traced back to the findings of Porter and Linde (1995), Hart (1995), Shrivastava (1995), Klassen and McLaughlin (1996), and Klassen and Whybark (1999). The broad findings of the above works reveal that environmental elements have an important bearing on overall performance and competitiveness of an organization. The above findings have encouraged a number of researchers across the globe to carry out in-depth studies in the domain of environmental and GSCM and identify relevant items which would capture the practices relevant to environmental or green construct. While evaluating the impact of environmental proactivity on business performance, González-Benito and González-Benito (2005) identified several items: substitution of hazardous materials, designs focused on reducing the consumption of energy, resource and generation of waste, recyclable or reusable packaging in logistics etc. A number of items relating to green practices across the whole supply chain were identified by Zhu and Sarkis (2004, 2007) and Zhu et al. (2007; 2008a; 2008b; 2008c). Some of these items are: existence of IS0 14001 certification or comparable environmental management systems; providing design specification to suppliers for supplied items that include environmental compliance; suppliers' ISO 14001 certification; co-operation with customers for eco-design, cleaner production, and green packaging; design of

products for reduced consumption of materials and energy; design of products to avoid or reduce the use of hazardous materials; design of products for reuse, recycle and recovery of materials; utilization of renewable sources of energy etc. Most of the above items of EMP have also been reflected in the findings of Rao and Holt (2005), Rao et al. (2009), Diabat and Govindan (2011), Green Jr. et al. (2012), Zailani et al. (2012), Laosirihongthong et al. (2013), Marshall et al. (2014) and Mitra and Datta (2014). Further Beske and Seuring (2014) and Beske et al. (2014) suggested the adoption of environmental standards and certification (e.g. ISO 14001) by the focal company and its suppliers for minimizing risk due to adverse environmental impact. They also recommended the inclusion of pro-activity through life-cycle assessment which essentially implies reuse and recycle of products. Based on the above discussion, most of the items have been adapted and included in the present study.

3.1.2. Socially inclusive practices

An organization cannot afford to remain impervious to the issues affecting the economic condition, working condition, health, safety, equity, and education of its employees and the surrounding community. However, the research findings linking socially inclusive practices adopted by a firm with its performance are limited. The early finding can be traced back to the seminal work of McGuire et al. (1988) in which it is revealed that the firms performing low in CSR would experience lower return on assets. Mackay et al. (2007) demonstrated that the firms engaging themselves in socially responsible activities tend to maximize their market value. Welford and Frost (2006) revealed that CSR leads to direct cost reduction which is achieved through reduction in energy usage, water consumption, waste reduction, and efficient use of raw materials. However, the study argues that CSR would remain confined to a small number of large companies. Saeidi et al. (2015) argued that the positive effect of CSR on firm performance is due to the positive effect CSR has on competitive advantage, reputation, and customer satisfaction. Socially inclusive practices could be classified under two heads: Socially inclusive practices for employees (SPE) and socially inclusive practices for community (SPC). SPE includes provision for fair wages and perquisites; safe, healthy, and positive working environment; health care benefits; leave and other fringe benefits; and opportunities for growth (Welford and Frost, 2006; Hutchins and Sutherland, 2008; Lu et al., 2012; Marshall et al., 2014; Mani et al., 2016a, 2016b; Zhu et al., 2016). In addition, prohibition of child labour and protection of labour rights (Mani et al., 2016a, 2016b; Zhu et al., 2016) have also been considered under SPE. SPC refers to the investments made by a firm in creating opportunities for the surrounding community in terms of generation of employment and business and also in providing education, training, and healthcare facilities with a view to making the firm progressive in the eyes of the stakeholders (Hutchins and Sutherland, 2008; Lu et al., 2012; Mani et al., 2016a, 2016b; Zhu et al., 2016). Review of the above findings has enabled us to identify the items relevant to SPC and SPE and include the same in the present study with suitable adaptation.

3.1.3. Operations practices

Operations practices (OP) involve introduction of operations management techniques for enhancing efficiency, improving quality, reducing inventory, and minimizing waste across the entire value chain. Some of the well-known OP includes TQM, six sigma, value engineering, JIT, lean production, inventory management etc. Kaynak (2003) demonstrated the positive effects of TQM practices on firm performance. However, he argued, the support of the top management is a necessary pre-requisite for successful implementation of TQM. Yang et al. (2011) proved that lean manufacturing practices lead to improved market performance and improved financial performance. Yang et al. (2010) indicated that the implementation of supply chain practices and continuous improvement like JIT and TQM leads to the manufacturing competitiveness of a firm in terms of its cost, quality and delivery. Specific items relating to quality management considered in the earlier works include implementation of quality management system (QMS) to build quality into the product, selection of suppliers based on quality rather than cost, facilitating suppliers implement TQM/Six sigma etc. (Flynn et al., 1994; Ahire et al., 1996; Kaynak, 2003; Chen and Paulraj, 2004a, 2004b; Kannan and Tan, 2005; Kim et al., 2012). Some researchers (Ibusuki and Kaminski, 2007; Behncke et al., 2014) recommended the focal company to help suppliers implement value engineering for reducing the cost of components. Several other researchers (Tan et al., 2002; Kannan and Tan, 2005; Yang et al., 2011) suggested the adoption of scientific inventory control technique and implementation of JIT in the supply chain for improving efficiency and reducing inventory. Further for minimizing waste, lean production system was proposed (Kleindorfer et al., 2005; Li et al., 2005; Simpson and Power, 2005; Mefford, 2011; Yang et al., 2011). For improving efficiency in transportation, Wu et al. (2015) and Sheu and Chen (2014) advocated the application of economies of scale in transportation. Based on the above discussion, most of the above items have been included in the present study with suitable modification.

3.1.4. Supply chain integration

Supply chain, being inherently complex, includes numerous activities spread over multiple functions within an organization and also across different organizations both upstream and downstream. The challenge in SCM is met not merely by coordinating production, transportation and inventory decisions but, more generally, by integrating the front end of the supply chain, customer demand, to its back end, production portion of the supply chain (Simchi-Levi et al., 2008). Supply Chain Integration (SCI) implies the integration of both upstream suppliers and downstream customers and also the integration of various internal functions (Vickery et al., 2003). Several researchers (Pagell, 2004; Power, 2005) defined SCI as an approach for the forward and backward integration of information among suppliers, manufacturers, distributors, and customers. Further Cagliano et al. (2006) argued that SCI is a coordination mechanism that simplifies internal and external business processes. Lii and Kuo (2016) divided SCI under three heads: customer integration, supplier integration, and internal integration. Some of the items of SCI suggested by them include sharing of information on customer demand by the downstream partners, sharing of customer demand with the suppliers, sharing of production plan with the suppliers, sharing of inventory with suppliers, integration and connection among all internal functions etc. Further most of the items relating to SCI were also identified by Tan et al. (2002) and Kannan and Tan (2005). Some of these items are: establishing frequent contact with supply chain members, estimation of customers' future needs, communicating customers' needs to the suppliers, improving integration activities across SC, responding to the needs of customers by keeping adequate inventory etc. Based on the aforementioned discussion, most of the above items have been suitably adapted and utilized in the present study.

3.2. SSCM performance

There are primarily three dimensions of SSCM performance for capturing the spirit of sustainability in organizational performance: economic performance, environmental performance and social performance. In addition, researchers included few other

dimensions as well. For example, operations performance was considered in the works of Zhu et al. (2007; 2008a; 2012), Green Jr. et al. (2012), and Zailani et al. (2012). Competitiveness dimension was added by Tracey et al. (1999), Rao and Holt (2005), Li et al. (2006), Rao et al. (2009) and Yang et al. (2010). It is found that several items considered by different researchers under economic performance, operations performance and competitiveness overlap with each other. Further the connotation of the term 'economic performance' is somewhat macro in nature and therefore, in the present study, we have utilized the term 'operations performance' in lieu of 'economic performance' within the framework of organizational performance. Following the principles of sustainability, SSCM performance in the present study has been considered under four dimensions: environmental performance, social performance, operations performance, and competitiveness. The items of SSCM performance cited in the extant literature have been selected in such a manner which would allow them to come under one of the four SSCM performance dimensions. This has helped us in operationalization of the items and finally empirical validation of the same.

3.2.1. Environmental performance

Organizations adopting EMP or GSCM practices are likely to engage themselves in evaluating their environmental performance (EPR). There are several performance metrics through which EPR is measured. It is reflected through reduction in the discharge of solid waste, liquid waste, gaseous waste, toxic materials; reduction in the cost of effluent treatment and discharge; reduction in the frequency of environmental accident (Zhu and Sarkis, 2004, 2007; Zhu et al., 2007, 2008a; Rao et al., 2009; Harms et al., 2013; Esfahbodi et al., 2016) and so on. Welford and Frost (2006) suggested another item: reduction in the occurrences of accident in the shop-floor. In addition, protection of bio-diversity was considered by Pullman et al. (2009) and Harms et al. (2013). Based on the above revelation, almost all the above items have been considered in the present study for evaluating environmental performance.

3.2.2. Social performance

Impressive performance of a firm on social dimension becomes a source of competitive advantage as propounded through Resource based view of the firm (Barney, 1991; Grant, 1991). However, the evaluation of firm performance on social dimension for both employees and the community requires sufficient amount of time during which the management needs to monitor as to what extent the investment made in SPE and SPC has actually contributed towards improving the capabilities of employees and creating enabling environment for the surrounding community. The performance of an organization in this domain is normally covered under employee-centred social performance (ESP) and community-centred social performance (CSP). ESP is reflected in terms of reduction in inequity in employees' remuneration (Welford and Frost, 2006; Boyd et al., 2007; Hutchins and Sutherland, 2008; Zhu and Zhang, 2015; Mani et al., 2016a, 2016b; Zhu et al., 2016), improvement of employees' health, working condition, and living condition (Hutchins and Sutherland, 2008; Zhu and Zhang, 2015; Mani et al., 2016a, 2016b; Zhu et al., 2016) which enable the employees to develop their capabilities within the organization. CSP is indicated in terms of corporate social image (Duarte et al., 2014), enhancement of opportunity in employment/business of the surrounding community, improvement in their level of education, literacy level, and health. (Hutchins and Sutherland, 2008; Zhu and Zhang, 2015; Mani et al., 2016a, 2016b; Zhu et al., 2016). The above items revealed through the review of related works have been suitably adapted and included in the present study.

3.2.3. Operations performance

Operations performance (OPR) implies the extent of improvement in organizational performance in terms of decrease in cost and improvement of efficiency across the whole supply chain. The findings of González-Benito and González-Benito (2005) reveal significant positive association between advanced operations management systems and mass operational and lean operational performance. Decrease in cost of purchased materials/cost of production was suggested by Chen and Paulraj (2004a, 2004b), Zhu et al. (2007, 2008a), Pullman et al. (2009), Green Jr. et al. (2012), Wittstruck and Teuteberg (2012), Zailani et al. (2012), Harms et al. (2013), Laosirihongthong et al. (2013), and Esfahbodi et al. (2016). Decrease in the energy consumption/cost of energy consumption was recommended by Zhu et al. (2007, 2008a), Green Jr. et al. (2012), Wittstruck and Teuteberg (2012), Zailani et al. (2012), and Esfahbodi et al. (2016). Further improvement of logistics efficiency was utilized by Zhou et al. (2008) and Park and Lee (2015). Most of the items discussed above have been suitably adapted and included in the present study.

3.2.4. Competitiveness

Competitiveness of a firm indicates those capabilities that differentiates itself from its competitors and is an outcome of a critical management decision (Tracey et al., 1999; Li et al., 2006). Elements of competitiveness suggested in literature include price/cost (Tracey et al., 1999; Li et al., 2006; Yang et al., 2010), quality (Tracey et al., 1999; Rao and Holt, 2005; Li et al., 2006; Yang et al., 2010; Mitra and Datta, 2014), delivery dependability/fill rate (Tracey et al., 1999; Li et al., 2006; Yang et al., 2010) and improvement in productivity/capacity utilization (Rao and Holt, 2005; Mitra and Datta, 2014). The element of cost performance has also been treated under Operations Performance in some findings as revealed in Section 3.2.3. In addition, several other items have also been incorporated in the present study for improving the competitiveness of a firm. These include differentiation in competition/products (López-Gamero et al., 2009; Wittstruck and Teuteberg, 2012), retention of customer base (Wittstruck and Teuteberg, 2012), new market opportunities (Rao and Holt, 2005; Rao et al., 2009) and improvement in corporate image (González-Benito and González-Benito, 2005; Rao et al., 2009; Wittstruck and Teuteberg, 2012). The traditional dimension of competitiveness only includes those attributes that interface between the firm and the market and do not consider environmental practices. The seminal work of Porter and van der Linde, 1995 reveals that a firm can become immensely competitive by undertaking green initiatives. Similar kind of argument was also articulated by Rao and Holt (2005) who mentioned that environmental stewardness has become an important element in improving the competitiveness of a firm with the growing awareness of the customers towards environmental issues. Based on the above discussion, most of the items have been adapted and included in the present study.

Building blocks of SSCM practices, discussed under four heads namely environmental management practices, socially inclusive practices, operations practices, and supply chain integration, reflect the essence of the practices which are unique to SSCM. They are not disparate or mutually exclusive in nature. Rather they are essentially complementary in nature and together they represent the holistic practices adopted by a firm from the point of sustainability. Managers working in an SSCM environment are not merely concerned with implementing the practices relating to cost reduction or waste reduction. They are sensitized to keep in mind the environmental and social impact of operations practices and are, therefore, encouraged to apply socially and environmentally-friendly operations practices in the organization. Further the building blocks of SSCM performance, discussed under four heads,

cannot be considered as combination of several disjointed dimensions of organizational performance. All four SSCM practices are likely to have an impact on operations performance, environmental performance, and social performance. They, in turn, are likely to affect the competitiveness of a firm. This would become evident once the scale of both SSCM practices and SSCM performance are empirically validated and subsequently an investigation is made with regard to the impact of SSCM practices on different dimensions of SSCM performance. Several researchers (Rao and Holt, 2005; Rao et al., 2009; Mitra and Datta, 2014) have attempted to investigate the impact of environmental/green practices on organizational performance and competitiveness. The findings of the above works mostly indicate significant positive relationship between green practices and business performance and in turn, between business performance and competitiveness. The outcome of the present study would also serve as a basis for investigating the impact of SSCM practices on different dimensions of SSCM performance and finally the competitiveness of a firm.

4. Research methodology

The key issue involved in carrying out this research revolves around the development and validation of a scale for implementation of SSCM practices in an organization and performance evaluation on different measures of SSCM.

4.1. Design of survey instrument

A list of items pertaining to SSCM practices and another list of items relating to performance measures of SSCM, as discussed in Section 3, were derived from the extant literature. Appendix A and B presents the list of SSCM practices (33 items) and SSCM performance measures (26 items) respectively. These items helped us in designing a preliminary questionnaire of SSCM based on the research goal of the present work. The questionnaire was presented to three experts comprising one knowledgeable professional each from the domain of SCM, environmental management, and CSR with a view to seeking their opinion on the adequate and appropriate coverage of the items concerning SSCM. The professionals involved in the activities relating to environmental management and CSR had a holistic view of business operations and therefore, they were also involved along with the SCM professional for the purpose of enlisting their suggestions into the questionnaire. Questionnaire was divided into three sections. The first section of the questionnaire contains questions relating to the demographic information of the respondents, the type of the industry the organization belongs to, size of the organization in terms of manpower, and turnover. The second section contains questions pertaining to the perception of the respondents on the level of adoption of SSCM practices. The third section contains questions relating to the perception of the respondents on different aspects of performance relating to SSCM. A five-point Likert scale was used as a response format for both items of SSCM practices and SSCM performance with the assigned values ranging from 1 = *Not at all True* to 5 = *Absolutely True* (Malhotra and Dash, 2009). The questionnaire was presented to the same experts once again. They stated that few questions need to be rephrased for ease of understanding. Accordingly the relevant questions were rephrased. The entire exercise ultimately helped us in achieving the content validity of the questionnaire.

4.2. Reliability of the survey instrument

In order to find out the reliability of the survey instrument, a pilot survey was carried out amongst 30 respondents involved in procurement, production and operations, logistics and distribution, environment, health and safety (EHS), marketing and sales functions from different organizations. It was found that 16 respondents out of 30 could not provide responses on three items of SSCM practices relating to reverse logistics function. On further investigation, it was found that these respondents belong to those industries (power generation, power distribution, petroleum refining and distribution, engineering goods, steel, aluminium, cement etc.) in which reverse logistics functions are not practiced or are not popular. Accordingly these three questions were dropped from the list of SSCM practices thereby reducing the total number of variables of SSCM practices to 30. Scale reliability of the instrument was inspected for the variables of both SSCM practices and SSCM performance using Cronbach's coefficient alpha. A scale is said to be reliable, if Cronbach's coefficient alpha of the scale is well above the threshold value of 0.700 and the acceptable minimum of 0.600 (Cronbach, 1951; Hair et al., 2009). Cronbach's coefficient alpha of the scale of SSCM practices and SSCM performance measures turned out to be 0.918 and 0.951 respectively with high corrected item-to-total correlations indicating the presence of high internal consistency in the measurement scale.

4.3. Target organizations and target respondents

The survey was carried out in manufacturing and process industries operating in India. The list of the companies in which the study was planned to be carried out was initially gleaned from ET-500 list (www.economictimes.indiatimes.com/marketstats/pid-56.....year-2014.cms). This list contains top 500 Indian companies for the year 2014 across all major sectors. Subsequently a working paper containing corporate sustainability initiatives of India's most valuable companies was analyzed (www.iimb.ernet.in/research/sites/default/files/WP%20No.%20428_0.pdf). This paper contains sustainability initiatives of India's top 100 companies across manufacturing, process, infrastructure, realty, and service sector. Only manufacturing and processing firms were shortlisted from this list of 100 companies. In addition, more number of manufacturing and processing firms was picked up from ET-500 list. Home pages of these organizations were visited and their mission and vision statement, value system and goals were reviewed particularly in terms of their initiatives in the domain of environmental sustainability, CSR, supplier relationships, and SCM functions before selecting them in the current study. Further a large number of suppliers of these companies practicing CSR and environmental stewardship were also added to the list of survey. Thus essentially the sampling process adopted in the current study constitutes judgmental sampling. The target organizations in this study include those which are engaged in manufacturing automobiles, auto-components, engineering goods, consumer electronics and electricals, IT and telecom products, textiles, consumer goods; processing steel and steel products; processing oil, gas and petroleum products; generating and distributing power etc.

Within each candidate organization, several senior level professionals were identified as prospective respondents in order to maximize the likelihood of securing at least one response from each organization. These professionals are considered to have sufficient knowledge and or experience in the activities encompassing operations and supply chain, environmental sustainability, and CSR. For securing responses from the prospective respondents, questionnaire was administered in both offline and online mode. In case of offline mode, a prior appointment was sought from the respondents. They were then sent a soft copy of the questionnaire and a separate background note (shown in Appendix C) on SSCM through e-mail in order to enable them to have better understanding on different facets of SSCM practices and SSCM

performance. In addition, they were verbally briefed about the purpose of the study. On the day of the interview, the researcher carried the hard copy of the questionnaire in person and secured responses from the respondents through face-to-face interview. In case of online mode, initially the prospective respondents were contacted telephonically and requested to provide their valuable inputs. Those giving consent to participate in the survey were sent questionnaire online along with the background note on SSCM. They were also verbally explained the purpose of the study. Once the responses in online mode were received, the filled-in questionnaires were checked to see whether meaningful inputs were provided by the respondents. In case of any ambiguous response, clarification was sought from the concerned respondents. Low to moderate responses were obtained through online questionnaire while most of the responses were obtained through offline mode. Additionally, some responses were also obtained through e-mail as attachment of filled-in questionnaire. In the data analysis, only one response from each organization was considered. Approximately 1200 professionals from the survey list were contacted through mails and telephone calls and requested to take part in the study.

4.4. Tests for potential bias in survey data

Non-response bias was assessed by performing a *t*-test on the scores of early and late respondents based on the assumption that the opinions of late respondents are representative of the opinions of non-respondents (Krause et al., 2001). Respondents were divided into two groups: 141 responses received towards the beginning of data collection phase and the remaining 114 responses received during middle and the end of the data collection period. T-test was carried out between early respondents with 141 responses and late respondents with 114 responses on all individual items which did not reveal any significant differences between the two groups. This indicates that the data was relatively free from non-response bias. As this study relied on single respondents for doing the final analysis, the potential for common method bias to influence the results needed to be evaluated (Podsakoff et al., 2003). Based on Harman's one factor test, it is found that unrotated factor solution does not reveal a single factor which accounts for more than 50% of the variance in the data set either in case of SSCM practices or SSCM performance measures. Harman's one-factor test was further applied into the items of SSCM practices and those of SSCM performance separately using confirmatory factor analysis. Test indices of 30 items of SSCM practices by considering them under one-factor model are: $\chi^2 = 1697.344$, df = 405, CFI = 0.687, NFI = 0.631, RMSEA = 0.112. Further test indices of 26 items of SSCM performance measures by treating them under one-factor model are: $\chi^2 = 2066.605$, df = 350, CFI = 0.667, NFI = 0.628, RMSEA = 0.139. The above results indicate that the common method bias is not a major concern in this study.

5. Data analysis and interpretation

A total of 276 responses were obtained from all the sources out of which 21 questionnaires were improperly or incompletely filled in. Thus the effective number of responses came out to be 255. Once the data was collected, it was checked for missing values and inconsistency. The data analyses present an overview of the respondents' demographic profile, descriptive statistics, and finally confirmatory factor analysis of SSCM practices and SSCM performance measures.

5.1. Demographic profile

Demographic profile of the responding organizations includes respondents' affiliation to organization types, number of responding organizations based on manpower and annual turnover. The collected data represented the following industries: 53 automobile and automotive (20.8%); 24 engineering goods including heavy engineering, metals, and glass (9.4%); 22 steel, aluminum, and cement (8.6%); 19 consumer electronics and electricals (7.5%); 20 computer/IT and telecom hardware (7.8%); 27 consumer goods including pharmaceuticals (10.6%); 21 petroleum, oil, and gas (8.2%); 36 power generation and distribution (14.1%); 16 textiles and packaging (6.3%) and 17 miscellaneous goods (6.7%). The profile of the respondents in terms of their position in the organization is as follows: 16 CEO/Director/President/VP (6.3%); 101 GM/DGM/AGM (39.6%); 138 Senior Manager/Manager (54.1%). Further the organizations surveyed were also categorized in terms of the number of people and annual turnover as shown in appendix D and E. It is found that the maximum number of organizations surveyed in terms of the number of people and annual turnover was in the range of 20,000 to <50,000 and Rs. 20,000 Cr. to < Rs. 50,000 Cr. respectively.

5.2. Descriptive statistics

The respondents were requested to indicate their responses on individual items of SSCM practices and SSCM performance. The responses on 30 variables of SSCM practices and 26 variables of SSCM performance are shown in appendix A and B respectively in terms of minimum score, maximum score, mean and standard deviation. Scale reliability was again inspected using Cronbach's coefficient alpha. In this study, the Cronbach's coefficient alpha of the scale consisting of 30 variables of SSCM practices was 0.942 with high corrected item-to-total correlations. Further Cronbach's coefficient alpha for the scale consisting of 26 variables of SSCM performance was found to be 0.953.

5.3. Confirmatory factor analysis (CFA)

Review of related literature carried out in Section 3 (Building blocks of SSCM) has enabled us to uncover the hidden constructs of both SSCM practices and SSCM performance. Section 3.1 clearly reveals that SSCM practices consist of five constructs namely Environmental Management Practices, Socially Inclusive Practices for Employees, Socially Inclusive Practices for Community, Operations Practices, and Supply Chain Integration. The individual items constituting these constructs have been discussed in this section and shown in appendix A. Further section 3.2 demonstrates that SSCM performance comprise another five constructs namely Environmental Performance, Employee-centred Social Performance, Community-centred Social Performance, Operations Performance, and Competitiveness. The items belonging to these constructs have been described in this section and shown in appendix B. This revelation has motivated us to directly apply confirmatory factor analysis (CFA) instead of initially subjecting the items of SSCM practices and SSCM performance to exploratory factor analysis (EFA).

Before carrying out CFA on the items of SSCM practices and SSCM performance, *content validity* of the constructs was evaluated. *Content validity* indicates whether the instrument contains measurement items that cover all important aspects of a research question (Nunnally, 1978). Its evaluation is primarily a rational judgement process. The content validity of the instrument was achieved while designing the survey instrument. This was carried out through extensive literature review followed by securing opinion from knowledgeable experts through in-depth interviews. The experts were specifically requested to review the questionnaire in respect of the content, coverage, clarity, ambiguity and structure.

This resulted in incorporation of minor changes in phrasing of few questions for overcoming ambiguity and ensuring ease of understanding by the respondents. The procedure thus followed resulted in content validity of the survey instrument. Subsequently CFA was carried out for evaluating *unidimensionality*, *reliability, convergent validity, discriminant validity, nomological validity,* and finally *criterion-related validity* of the constructs of SSCM practices and SSCM performance.

5.3.1. Unidimensionality

The concept of *unidimensionality* implies that the items considered are measuring a single theoretical construct as opposed to more than one construct (Gerbing and Anderson, 1988). The present study has utilized two different scales for measuring SSCM practices and SSCM performance. Unidimensionality of these two scales was established by carrying out CFA on the same separately. This led to the reduction in the number of items of SSCM practices from 30 to 20. The measurement model indicated very good fit to almost all goodness of fit (GOF) indices. GOF measures of the measurement model of SSCM practices are as follows: $\chi^2 = 262.295$, df = 153, p = 0.00, $\chi^2/df = 1.714$, RMR = 0.047, GFI = 0.906, AGFI = 0.871, NFI = 0.910, TLI = 0.950, CFI = 0.960, RMSEA = 0.053. The above values indicate fulfillment of threshold value on almost all GOF indices (Hair et al., 2009). Similarly CFA carried out on the items of SSCM performance reduced the number of items from 26 to 20. GOF measures of the measurement model of SSCM performance measures turn out to be: $\chi^2 = 346.378$, df = 149, p = 0.00, $\chi^2/df = 2.325$, RMR = 0.06, GFI = 0.883, AGFI = 0.835, NFI = 0.905, TLI = 0.927, CFI = 0.943, RMSEA = 0.072. This model also indicates reasonably good fit to almost all GOF indices. The results of the two measurement models establish unidimensionality of both the scales.

A composite measurement model combining the scales of both SSCM practices and SSCM performance measures was also found out by carrying out CFA on all ten constructs simultaneously. GOF indices of the composite measurement model are as follows: $\chi^2 = 1346.002$ df = 707, p = 0.00, $\chi^2/df = 1.904$, RMR = 0.064, GFI = 0.805, AGFI = 0.770, NFI = 0.830, TLI = 0.892, CFI = 0.905, RMSEA = 0.060. Conventional cut-off criteria of GOF indices seem to be excessively stringent as observed by Sharma et al. (2005). More liberal cut-off values should be used for normed fit indices such as GFI and TLI, where factors such as model complexity, number of observed variables and sample size are taken into account. A comparable result has also been reported in the extant literature (Rao and Holt, 2005; Vachon and Klassen, 2006; Zhu et al., 2008a; Singh et al., 2011). The present findings indicate reasonably good fit to the above indices. The results of this composite measurement model were utilized to establish construct reliability and all remaining measures of validity.

5.3.2. Reliability

In the present study, two estimates of reliability: Cronbach's alpha coefficient and construct reliability coefficient (Hair et al., 2009) were computed. Threshold value of Cronbach's ά. has already been mentioned earlier for a scale to be considered reliable. Similarly if the value of construct reliability coefficient turns out to be 0.7 or higher, the scale is considered reliable (Hair et al., 2009). The estimate of construct reliability is considered a composite measure of reliability. The calculated values of the composite measure of reliability are very close to the values of Cronbach's ά as reported in Table 1. It is observed that all coefficients are more than the threshold value 0.7 thereby indicating sound construct reliability of all constructs.

5.3.3. Convergent validity

Convergent validity requires that the indicator variables of a given construct share a high proportion of variance in common. It has been evaluated by following three different approaches. The first method involves inspection of estimated factor loadings of items on constructs in the final CFA model (Anderson and Gerbing, 1988). It is found that the standardized loadings of all items are greater than 0.5 and statistically significant ($p < 0.001$). The values range from 0.554 to 0.923, which, in other words, indicate that a very high proportion of variance is captured by each individual item. The second method involves assessment of convergent validity of each individual construct with the help of two GOF indices: Normed fit index (NFI) and Non-normed fit index (NNFI) (Ahire et al., 1996). These fit indices were obtained by specifying and assessing one-factor congeneric model for each individual construct of SSCM practices and SSCM performance separately. These fit indices indicate the proportion of improvement of the overall fit of the specified measurement model relative to a null model. Table 1 shows that NFI range from 0.918 to 0.968 and NNFI from 0.880 to 0.955. These values suggest satisfactory convergent validity of each construct. Finally convergent validity of ten constructs was also assessed with the help of average variance extracted (AVE). AVE indicates the average variance that a construct is able to extract from each measurement item that loads on it. The ten constructs have AVE ranging from 0.460 to 0.697 as shown in the last row of Table 2. AVE of 0.5 or more of a construct indicates satisfactory level of convergent validity (Hair et al., 2009). Nine constructs have more than the threshold level of AVE, thus indicating very strong convergent validity of the above constructs. Only Operations practices (OP) construct is found to have an AVE of 0.460, which is somewhat below the threshold value. However, since this construct meets the criteria of convergent validity in the first two methods, OP construct is considered to possess an acceptable level of convergent validity.

5.3.4. Discriminant validity

Discriminant validity is a measure of how a construct is distinct from other constructs in the same model and whether each construct is measuring different concepts (Hair et al., 2009). Discriminant validity was also assessed by following three different approaches. The first method involves investigation of correlation between each pair of constructs in the CFA model. If the correlations between constructs are well below 0.9, then there is very little possibility that a group of items loading significantly on one construct would also load on another construct (Kline, 2005). Table 2 indicates that none of the correlations are nearer to 0.9. This suggests that the items are unidimensional. The second method entails examining chi-square differences separately between all pairs of constructs of SSCM practices and SSCM performance by considering two constructs at a time. The two constructs would be considered distinct if the null hypothesis is rejected which states that the two constructs together form a single construct. A pairwise comparison of constructs was carried out by comparing the model with correlation constrained to one with an unconstrained model. A difference between chi-square values (d.f. = 1) of the two models that is significant at $p < 0.05$ level indicates support for discriminant validity (Anderson and Gerbing, 1988; Joreskog, 1971). Table 3 reports the results of 45 pair-wise tests of discriminant validity for SSCM practices and SSCM performance measures. All chi-square differences are found significant at $p < 0.001$ level, indicating strong support for discriminant validity.

The final method involves comparison of AVE of each construct with the shared variance of each pair of constructs as shown in Table 2. The diagonal values indicate square root of AVE while the off-diagonal values indicate correlation of each pair of constructs. If

Table 1
Assessment of reliability and convergent validity of the constructs of SSCM practices & SSCM performance.

Construct	Number of items	Alpha (ά) Reliability	Construct Reliability	NFI	NNFI
Environmental Management Practices (EMP)	6	0.893	0.886	0.918	0.880
Operations Practices (OP)	5	0.811	0.795	0.960	0.944
Supply Chain Integration (SCI)	3	0.751	0.753	0.951	0.955
Socially Inclusive Practices for Employees (SPE)	3	0.835	0.849	0.961	0.944
Socially Inclusive Practices for Community (SPC)	3	0.860	0.865	0.961	0.944
Competitiveness (CP)	6	0.909	0.908	0.956	0.942
Environmental Performance (EPR)	5	0.901	0.909	0.968	0.947
Operations Performance (OPR)	3	0.835	0.872	0.946	0.942
Employee-centred Social Performance (CSP)	3	0.821	0.829	0.954	0.933
Community-centred Social Performance (ESP)	3	0.842	0.844	0.954	0.933

Table 2
Results of Convergent, Discriminant, Nomological validity of the constructs of SSCM practices & SSCM performance.

Construct	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EMP (1)	0.752									
OP (2)	0.715 (***)	0.678								
SCI (3)	0.708 (***)	0.770 (***)	0.710							
SPE (4)	0.761 (***)	0.677 (***)	0.683 (***)	0.809						
SPC (5)	0.577 (***)	0.432 (***)	0.363 (***)	0.555 (***)	0.827					
CP (6)	0.638 (***)	0.625 (***)	0.630 (***)	0.529 (***)	0.343 (***)	0.788				
EPR (7)	0.498 (***)	0.442 (***)	0.325 (**)	0.487 (***)	0.355 (***)	0.593 (***)	0.817			
OPR (8)	0.449 (***)	0.468 (***)	0.500 (***)	0.296 (***)	0.232 (**)	0.739 (***)	0.432 (***)	0.834		
ESP (9)	0.424 (***)	0.556 (***)	0.291 (***)	0.518 (***)	0.388 (***)	0.521 (***)	0.705 (***)	0.372 (***)	0.787	
CSP (10)	0.558 (***)	0.416 (***)	0.377 (***)	0.490 (***)	0.677 (***)	0.604 (***)	0.715 (***)	0.422 (***)	0.665 (***)	0.802
Firm size	0.186 (**)	0.140 (*)	0.076	0.098	0.268 (*)	0.168 (*)	0.164 (*)	0.132 (*)	0.065	0.182 (**)
AVE	**0.566**	**0.460**	**0.505**	**0.655**	**0.684**	**0.622**	**0.668**	**0.697**	**0.620**	**0.643**

Diagonal elements (shaded) are the square root of average variance extracted (AVE) and the off-diagonal elements represent correlations between constructs.
***p < 0.001, **p < 0.01, *p < 0.05.

Table 3
Assessment of discriminant validity of the constructs of SSCM practices & SSCM performance.

Construct	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
EMP (1)	–									
OP (2)	67.9 (***)	–								
SCI (3)	58.1 (***)	48.4 (***)	–							
SPE (4)	51.2 (***)	40.0 (***)	64.4 (***)	–						
SPC (5)	50.3 (***)	58.5 (***)	74.7 (***)	55.4 (***)	–					
CP (6)	67.3 (***)	85.1 (***)	70.9 (***)	85.2 (***)	87.4 (***)	–				
EPR (7)	70.3 (***)	95.3 (***)	99.6 (***)	69.2 (***)	69.4 (***)	64.4 (***)	–			
OPR (8)	79.6 (***)	96.2 (***)	75.2 (***)	106.7 (***)	91.5 (***)	53.7 (***)	75.1 (***)	–		
ESP (9)	96.4 (***)	107.1 (***)	127.8 (***)	46.5 (***)	90.9 (***)	95.5 (***)	62.6 (***)	107.3 (***)	–	
CSP (10)	53.6 (***)	86.7 (***)	82.8 (***)	65.3 (***)	26.6 (***)	54.9 (***)	33.5 (***)	67.7 (***)	50.8 (***)	–

***p < 0.001.

the square root of AVE of each construct is more than the correlation of each pair of constructs, then this implies that the constructs account for a greater proportion of variance of the items that are assigned to them (Fornell and Larcker, 1981). Close observation of Table 2 reveals that almost all values of square root of AVE of the constructs are more than their corresponding correlation with all

other constructs. This indicates strong discriminant validity of all constructs.

5.3.5. Nomological validity

This test of validity seeks to determine whether the correlation between each pair of constructs in the measurement model is consistent with the existing theory and whether the correlations are significant and positive. The correlation between each pair of constructs considering both SSCM practices and SSCM performance measures has been shown in the off-diagonal elements of Table 2 along with their respective p values. It is observed out of 45 inter-construct correlations, 43 correlations are significant at $p < 0.001$ level and two correlations are significant at $p < 0.01$ level. It can thus be inferred that almost all inter-construct correlations are significant and positive. This phenomenon ensures support for nomological validity of both the scales of SSCM practices and SSCM performance (Hair et al., 2009; Singh et al., 2011).

5.3.6. Criterion-related validity

This test of validity indicates how well a scale representing the constructs of various practices is related to performance (Flynn et al., 1994; Ahire et al., 1996; Chen and Paulraj, 2004a). In other words, it attempts to ascertain whether the correlation between the pair of a predictor and criterion variable is significant. In the present study, the predictor variables are indicated through five SSCM practices: environmental management practices (EMP), operations practices (OP), supply chain integration (SCI), socially inclusive practices for employees (SPE), and socially inclusive practices for the community (SPC). The criteria variables are represented through five SSCM performance measures: competitiveness (CP), environmental performance (EPR), operations performance (OPR), employee-centred social performance (ESP), and community-centred social performance (CSP). To establish criterion-related validity, partial correlation is carried out between each pair of a predictor variable and a criterion variable after controlling for the effect of other predictor variables. For example, for finding out the partial correlation between EMP and CP, we controlled for the effect of other four predictor variables. This exercise was repeated for all pairs of predictor and criteria variables. For doing this, we initially considered the reduced set of variables of SSCM practices and also the variables of SSCM performance obtained through CFA. These observed variables of SSCM practices and performance were separately subjected to factor analysis which eventually gave rise to the same five constructs of SSCM practices and another five constructs of SSCM performance. All these constructs were treated as variables: the constructs of SSCM practices as predictor variables and those of SSCM performance as criteria variables. With the help of these predictor and criteria variables, partial correlation is found out. This is shown in Table 4.

The outcome of the whole effort reveals whether the relationship between the pair of a predictor variable and a criterion variable is significant or not which helps us in getting an insight about their possible association. Similar kind of approach was adopted by several researchers (Marrelec et al., 2007; Marrelec and Benali, 2009) in which partial correlation was first carried out in the relevant variables in order to uncover the significant or insignificant nature of relationships. Based on the outcome of partial correlation and previous knowledge of literature, SEM was applied amongst the selected variables. Marrelec et al. (2007) and Marrelec and Benali (2009) argued that this approach would enhance both empirical and theoretical support of the study findings.

The result of the present findings reveals that 12 correlations are significant out of 25 correlations. The insignificant nature of relationship between the remaining pairs of predictor and criteria variables suggests that they are somewhat unrelated and capture dissimilar elements of SSCM practices and SSCM performance. For example, if we consider the association between SPE and EPR, SPE indicates the social practices adopted by a firm for its employees while EPR represents environmental performance of a firm. The extant literature does not seem to indicate any significant association between these unrelated pairs of predictor and criteria variables. These revelations provide us an insight about identifying hypothesized relationships between specific pairs of predictor and criteria variables. Further out of 12 significant correlations, two are contrary to our expectations: one between EMP and CSP and another between OP and ESP. The contents of each pair of these constructs seem to be disconnected to each other. This does not invalidate the present findings since the theoretical support for the above association is unlikely to be found in the literature. At the same time, we observe that most of the significant correlations obtained in the present study have theoretical support as we discuss the same in the next section. We can thus infer that the constructs of SSCM practices and SSCM performance have an acceptable level of criterion-related validity. Appendix F shows the final parsimonious instrument containing both SSCM practices and SSCM performance.

6. Discussion and implications for theory and practice

The present study has tried to integrate the concepts of SCM, ISO 14001, and CSR by borrowing the elements from diverse literature. Subsequently it has developed and validated a scale comprising five constructs of SSCM practices and another five constructs of SSCM performance. The behavior of these ten constructs of SSCM was examined through 45 inter-construct correlations as shown in Table 2 and mentioned in the nomological validity section. The pattern of correlations revealed in the present findings resembles the pattern of relationships available in the existing literature. Further a close look at the ten significant correlations shown in Table 4 reveals that the correlation between EMP and EPR is positive and significant which supports the findings of Rao et al. (2009), Yang et al. (2011), and Green Jr. et al. (2012). The correlation between EMP and OPR is positive and significant which is mostly in tune with the findings of González-Benito and González-Benito (2005) and Rao et al. (2009). Further the correlation between EMP and CP is positive and significant which corroborates the

Table 4
Assessment of Criterion-related validity between the constructs of SSCM practices & SSCM performance.

Predictor Variable	Criteria Variables				
	CP	EPR	OPR	ESP	CSP
EMP	0.336 (***)	0.241 (**)	0.164 (**)	−0.047	0.244 (***)
OP	0.264 (***)	−0.001	0.141 (*)	0.242 (***)	−0.016
SCI	0.298 (***)	−0.011	0.251 (***)	−0.080	0.103
SPE	0.203 (**)	0.115	−0.089	0.331 (***)	−0.015
SPC	−0.069	0.072	0.018	0.053	0.561 (***)

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

findings of Rao and Holt (2005), Rao et al. (2009) etc. The significant positive correlation between OP and CP supports the findings of Kannan and Tan (2005) and Li et al. (2006) while the significant positive correlation between SCI and CP in the present study reinforces the findings of Kannan and Tan (2005) and Lii and Kuo (2016). The correlation between OP and OPR is significant and positive which is consistent with the findings of Kaynak (2003). Similar outcome is also obtained between SCI and OPR which echoes the findings of Lii and Kuo (2016). The pair between SPE and CP exhibits significant positive correlation in the present study. This is somewhat in harmony with the findings of Zhu et al. (2016) which reveals that the labour practices significantly influence financial performance of a firm. Finally the significant positive correlation between SPE and ESP closely resembles the findings of Zhu et al. (2016) which argues that the human rights of employees have significant positive association with the social performance of a firm. The above revelation suggests that although the survey was carried out amongst manufacturing and process-based organizations in India, the behavior of the constructs demonstrates a discernible pattern of relationships and thus the instrument could also be utilized among the companies in the developed countries including the E.U. and the U.S.

The first stage of the scale development involves identification of the items relevant to SSCM practices and SSCM performance from literature across diverse disciplines. This was followed by CFA through which the instrument was rigorously tested for unidimensionality, reliability, convergent validity, discriminant validity, nomological validity, and criterion-related validity. CFA results in purification of the constructs of SSCM practices and SSCM performance through which ten items of SSCM practices and six items of SSCM performance were discarded. However, the underlying theoretical constructs of the refined scale were not significantly affected. Thus the instrument developed in this study is considered to be parsimonious. The scale consists of five constructs of SSCM practices including one construct of environmental practices (EMP), two constructs of operations practices (OP and SCI) and two constructs of socially inclusive practices (SPE and SPC). Further the scale comprises another five constructs of SSCM performance including one construct of environmental performance (EPR), one construct of operations performance (OPR), one construct of competitiveness (CP) and two constructs of social performance (ESP and CSP).

When the present findings in respect of SSCM practices construct are compared with the earlier findings, it is found in the previous research that environmental/green practices construct alone is represented by five constructs (Zhu et al., 2008a, 2008b; 2012; Green Jr. et al., 2012), operations practices construct is shown through six constructs (Li et al., 2005, 2006) and social practices construct is manifested through nine constructs (Zhu et al., 2016). Although these constructs of the earlier findings individually cover almost all aspects of a particular dimension, they do not include all relevant elements of SSCM practices in isolation. The purpose of the present study was to develop a parsimonious scale which would include the relevant items of SSCM practices and SSCM performance. Thus the study initially incorporated all pertinent items of SSCM from literature along the whole supply chain. Subsequently the purification process resulted in elimination of few items. This, however, did not significantly alter the content of the scale and simultaneously maintain the parsimonious nature of the scale.

As regards the dimension of SSCM performance constructs, environmental performance construct in the current study findings is found to be in tune with the findings of Zhu and Sarkis (2007), Zhu et al. (2008a, 2008b, 2012), and Green Jr. et al. (2012). Operations performance construct of the present finding partially supports the findings of Zhu et al. (2008a, 2012) and Green Jr. et al. (2012). Similarly competitiveness construct of the present finding seems to be in harmony with the findings of Tracey et al. (1999), Rao and Holt (2005), Li et al. (2006), and Rao et al. (2009). The contents of social performance construct in the existing literature mostly reflect the improvement in organizational performance as a result of socially inclusive practices undertaken (Mani et al., 2016a, 2016b; Zhu et al., 2016). The present finding in respect of social performance construct is a departure from the earlier findings in the sense that it captures the improvement in the status of employees and the community in terms of their health, education, living condition and economic opportunities. This may be considered a new development in terms of identification of social performance construct. The improved social condition of the employees and the community would help researchers in investigating its impact on the competitiveness of a firm. Till date, there are very few studies available which have developed a scale considering the relevant constructs of both SSCM practices and SSCM performance. The scale developed in the current study combines both SSCM practices and SSCM performance and is expected to make a significant contribution to the existing body of SCM literature.

The study was carried out amongst manufacturing and processing companies which include automobiles, auto-components, engineering goods, consumer electronics and electricals, IT and telecom products, textiles, consumer goods; processing steel and steel products; processing oil, gas and petroleum products; generating and distributing power etc. The scale developed in this study is considered to be more or less generalized in nature and is applicable in the above categories of industries. As regards the applicability of the scale in certain sectors including food and beverages, perishable agricultural commodities, pharmaceutical products covering both drugs and vaccine, there are specific requirements for these industries in terms of safety, security and perishability of products which need to be considered during the scale development phase. These aspects should be considered in conjunction with the scale developed in the present study in order to make the instrument applicable to the above industries. Alternatively, a new scale of SSCM dedicated towards food and beverages sector or pharmaceutical sector could be developed keeping in mind the specificity needs of a particular industry. This may be considered as a scope for future research work.

The managers involved in implementing SSCM practices and evaluating the performance of a firm on SSCM dimensions would be in a position to keep track of the status of SSCM implementation practices and would also be able to assess the performance of the firm on different aspects of SSCM with the help of this validated instrument. Based on the status of SSCM practices followed and the performance outcome on different aspects of SSCM, managers would be able to suggest which particular aspects of SSCM require more attention by the top management and wherein more resources need to be allocated for satisfactory implementation and performance outcomes. Further depending on the competitive priorities of an organization, managers would be able to take a judicious decision in respect of resource allocation among the broad three dimensions of sustainability with the help of this instrument.

7. Concluding remarks

While developing the scale, the researcher has attempted to examine the overall level of SSCM practices amongst manufacturing and processing companies in India and China. Chinese manufacturing companies attach top priority to the economic performance which has resulted in severe ecological burden on the

surrounding environment. This has led to the emergence of market pressure, regulatory pressure, and competitive pressure which has prompted the Chinese companies to adopt GSCM practices (Zhu and Sarkis, 2007; Zhu et al., 2007, 2008b; 2008c; Liu et al., 2012). It is found that except 'internal environmental management', none of the elements of GSCM practices have received adequate attention by the Chinese companies. Further the level of adoption of GSCM practices varies across different industries in China (Zhu et al., 2008b). Overall the Chinese companies are still at a preliminary stage in respect of adoption of GSCM practices when the same is compared with the companies based in the US or the EU (Zhu et al., 2007, 2008b; 2008c; Liu et al., 2012; Esfahbodi et al., 2016). As regards the adoption of CSR practices among Chinese firms, it is found that the practices falling under employee rights and labour practices have received satisfactory attention while the same falling under community issues and fair operating practices have not received adequate attention by the Chinese state-owned companies (Zhu and Zhang, 2015; Zhu et al., 2016). As far as the adoption of GSCM practices by Indian manufacturing and processing companies is concerned, the same is still at an early stage. Regulatory environment in India does not enforce the companies to adopt GSCM practices. There are not enough pressures from customers and competitors. However, collaborative relationship with suppliers in respect of adoption of environmentally-friendly practices results in sustainable product design and logistics, which, in turn, leads to improved competitiveness and economic performance (Mitra and Datta, 2014). With regard to the social sustainability practices by Indian firms, it is found that the issues relating to the payment of minimum wages, equity, health and safety, working condition, labour rights, education and training are not properly addressed by the top management (Mani et al., 2016a, 2016b).

Despite the maturity level of sustainability practices of the companies located in the emerging economies being low, the same is getting more and more relevant in today's context in view of evolving environmental norms, sensitivity of customers towards environmentally-friendly products, regulatory pressure in respect of environment, and CSR in the globalized business environment. Companies can no longer afford to relegate environmental and social practices to the back seat, if they aspire to survive and grow in the long run. In this context, the scale developed in this paper is expected to be of great help to the practicing managers which would enable them to observe the level of environmental and social practices adopted by a firm and also evaluate firm performance on different aspects of SSCM.

The most pressing challenge faced by us in this study is the identification of the content of SSCM practices and SSCM performance for inclusion of the same in the instrument. The special issue of the *Journal of Cleaner Production* titled 'Sustainability and Supply Chain Management' (Huisingh, 2008) has defined SSCM as *"the management of material and information flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e. economic, environmental and social, and stakeholder requirements into account"*. The definition implies that the entire domain is very broad and encompasses a wide range of topics including environmental management, CSR, supply chain integration etc. These topics apparently seem to be disjointed and have emerged from different disciplines under different contexts. However, all of them are demonstrating a trend towards convergence in the context of today's supply chain environment. For example, Rao and Holt (2005) revealed that green practices adopted by a green supply chain leads to improved competitiveness and economic performance of a firm. Yang Chen-Lung et al. (2010) argued that environmental management in conjunction with continuous improvement and supplier management results in manufacturing competitiveness of a firm. In the context of CSR, Saeidi et al. (2015) empirically demonstrated that CSR practices of a firm have significant positive impact on customer satisfaction, reputation, competitive advantage, and firm performance. An organization which cares for its employees and recognizes their talent becomes one of the preferred employers of the talented workforce (Welford and Frost, 2006). On the contrary, Nike's unethical treatment of overseas workers had initially tarnished the image of Nike worldwide, although it was successful in achieving operational efficiency by outsourcing its manufacturing in the far east (https://en...../Nike-sweatshops). The above arguments indicate that an organization cannot afford to ignore its reluctance or inability to adopt green practices and ill-treat its workers and the surrounding community and at the same time merely focus on improving the operational efficiency of its supply chain. There is a compelling need to simultaneously incorporate both environmental and social aspects along with the economic aspect in today's supply chain. The present work is an endeavor towards that direction, although it is somewhat difficult to capture every facet of SSCM in its embryonic stage. We believe that the scale development is an ongoing process. The present study is an early attempt in developing and validating a scale of SSCM which can act as a trigger for future researchers in further enriching and refining the scale by carrying out experiments across different settings. We feel that the boundary of the domain of SSCM could be expanded further by incorporating several important elements: (1) mitigating risk of supply disruption due to reduced supplier base, (2) managing risks emanating from NGOs, competitors etc. (3) the practice of reuse and recycle and also recycling efficiency, (4) innovation for sustainability and (5) technology as an enabler of sustainability.

As supply chain partners collaborate and tend to develop long-term relationships, the overall supply base drastically reduces. Thus the supply chain becomes vulnerable which eventually increases the risk of supply disruption. Several researchers (Beske and Seuring, 2014; Beske et al., 2014) suggested the inclusion of this phenomenon into sustainable supply chain. Future study should take care of this issue. Further as the supply chain becomes sustainable, it comes under close scrutiny of several pressure groups including NGOs, competitors etc. Pagell and Wu (2009), Beske and Seuring (2014), and Beske et al. (2014) recommended the influence of pressure groups to be one of the important drivers of SSCM. Future researchers should endeavor to incorporate and operationalize this element into sustainable supply chain. Reuse and recycle of existing products are practiced in some specific industries. This includes automobiles, consumer electronics etc. Researchers (Ahi and Searcy, 2013, 2015) advocated the application of recycling efficiency in assessing the effectiveness of recycling. This particular element could be taken up for specific group of industries in which the practice of reuse and recycle is prevalent. As regards innovation for sustainability, the findings of Klewitz and Hansen (2014) revealed that sustainability-oriented innovation in terms of process innovation, organizational innovation, and product innovation greatly improves the sustainability goal of a firm. Thus sustainability-oriented innovation is considered to be one of the important drivers for achieving the goal of sustainable development (Kılkış, 2016). Janeiro and Patel (2015) argued that the choice of technology, specifically sustainable technology has a great bearing on the three dimensions of sustainability. Therefore, environmental, social and economic indicators need to be taken into account while choosing a sustainable technology. Thöni and Tjoa (2015) articulated that the information technology could act an enabler for achieving the goal of SSCM. The aforesaid discussion demonstrates that it is possible to incorporate the above elements into the scale of SSCM with suitable adaptation. This may be

considered as a scope for future research in expanding the boundary of knowledge of SSCM.

The study suffers from several limitations. First, the sample size of respondents belonging to different group of industries is not uniform which might make the study findings somewhat biased towards a particular sector. Second, the organizations chosen belong to heterogeneous sectors. The maturity level of SSCM practices varies widely across different types of industries. The study has tried to draw a generalization of the findings based on the responses of heterogeneous industries. Probably the findings would have shown more consistent pattern, had the study been confined to one type of industry and the responses were collected from those firms which belong to that particular industry. Third, the content of SSCM practices scale has tried to incorporate the items from all three dimensions of sustainability and at the same time it has attempted to become parsimonious. Thus the scale might not have included all relevant items of SSCM practices as already mentioned. However, the study findings, being one of the initial attempts in designing a scale of SSCM, could serve as a basis for future research in this direction.

Finally, a structural model is expected to be developed based on the findings of the measurement model. The structural model would attempt to investigate the impact of different dimensions of SSCM practices on operations performance, environmental performance, social performance, and firm competitiveness. This is being taken up in another study.

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Appendix A. Descriptive statistics of variables of SSCM practices

Variables relating to SSCM practices	Min score	Max score	Mean	Std. Dev.
With reference to the adoption of SSCM practices, the organization does the following				
(1) Not at all true, (2) Scarcely true, (3) Somewhat true, (4) Considerably true, (5) Absolutely true				
Top management is highly committed towards implementation of SSCM programs in our organization.	1	5	3.88	1.018
We receive adequate support from middle level managers for actual implementation of SSCM practices.	1	5	3.52	0.930
We follow Quality Management system (QMS) in its true spirit to build quality into the product.	1	5	3.89	0.972
We facilitate our suppliers implement TQM/Six sigma/TPM/TQC to build quality into the product.	1	5	3.62	0.984
We facilitate our suppliers in carrying out Value Engineering to reduce the cost of components.	1	5	3.58	0.883
We follow Just-in-time/Scientific inventory control technique consistently to keep inventory under control in the production environment.	1	5	3.60	1.010
We have implemented lean production and follow it consistently to minimize waste.	1	5	3.50	1.031
We attempt to achieve economies of scale in inbound and or outbound transportation.	1	5	3.63	0.886
We update our production plan as per the changing needs of customers and share the same with suppliers.	1	5	3.82	0.974
We establish frequent contact with supply chain members.	1	5	3.82	0.986
Our organization responds to the needs of customers fairly quickly by keeping adequate amount of finished goods inventory.	1	5	3.74	0.987
We estimate customers' future needs based on realistic assessment.	1	5	3.87	1.034
We communicate customers' future needs to the suppliers quickly.	1	5	3.92	0.965
Environmental management systems (EMS) are in place in our organization in terms of ISO 14001 certification or any comparable EMS.	1	5	3.98	1.016
We provide design specification to suppliers that include environmental compliance for purchased item.	1	5	3.67	1.109
We help suppliers set up environmental management system /get ISO 14001 certification.	1	5	3.64	1.088
We address environmental concerns of our customers in terms of eco-friendly design/distribution of products.	1	5	3.82	0.962
We address environmental concerns of our customers by adopting cleaner production.	1	5	3.82	1.018
We have successfully designed our products which consume reduced amount of input materials /energy.	1	5	3.71	1.027
We utilize a sizeable share of renewable sources of energy.	1	5	3.35	1.129
We have successfully avoided or reduced the use of hazardous materials in both product design and manufacturing process.	1	5	3.59	1.079
The safety measures undertaken by our organization are quite advanced and reduce the risk to accident.	1	5	3.97	0.928
Our organization provides safe, healthy and positive working environment for the employees.	1	5	4.10	0.932
Use of child labour and forced labour is not allowed in our organization.	1	5	4.50	0.943
Our employees enjoy the right to form and join trade unions and bargain collectively.	1	5	3.28	1.342
The wages and perquisites given out to the employees, particularly to the workers are sufficient to meet their basic needs in our organization.	1	5	3.96	0.999
Our employees are entitled to leave, provident fund, medical benefits and other facilities.	1	5	4.37	0.963
We provide employment/business opportunities to the surrounding community.	1	5	3.69	0.928
We provide health care facilities to the local community.	1	5	3.60	1.011
We provide primary education facilities to the surrounding people.	1	5	3.39	1.021
*We have sound network with retailers and 3 PL service providers to take back products from customers.				
*We address environmental concerns of customers through green packaging				
*We design products which are reusable/recoverable/recyclable				

*These items were dropped after carrying out initial pilot test.

Appendix B. Descriptive statistics of SSCM performance variables

SSCM Performance variables	Min score	Max score	Mean	Std. Dev.
By adopting SSCM practices, the organization has achieved the following				
(1) Not at all true, (2) Scarcely true, (3) Somewhat true, (4) Considerably true, (5) Absolutely true				
Decrease in the cost of production.	1	5	3.36	1.081
Reduction in the cost of energy consumption.	1	5	3.72	0.890
Improvement in the efficiency of inbound logistics.	1	5	3.67	0.906
Improvement in the efficiency of outbound logistics.	1	5	3.63	0.891
Increase in on-time delivery of goods to its customers.	1	5	3.85	0.989
Improvement in the level of service with the same amount or even lesser amount of inventory.	1	5	3.79	0.989
Improvement in the quality of products and services.	1	5	3.82	0.912
Improvement in the overall productivity/capacity utilization of our organization.	1	5	3.82	0.894
Improvement in the competitive advantage of our firm in terms of providing differentiated products to its customers.	1	5	3.77	0.880
Retention of existing customer base.	1	5	3.82	0.894
Increased opportunity for our firm to target and capture new customers.	1	5	3.70	0.972
Improvement in the corporate image of our firm in terms of the same being green.	1	5	3.86	0.931
Reduction in the cost of effluent treatment and effluent discharge in our organization.	1	5	3.47	0.979
Reduction in the discharge of toxic materials (solid and liquid and gases).	1	5	3.79	1.000
Reduction in the frequency of environmental accident.	1	5	3.82	1.012
Reduction in the frequency of accidents occurring in the shop-floor.	1	5	3.70	0.972
Protection of bio-diversity in the surrounding area.	1	5	3.79	1.005
Improvement in the corporate image of our firm in terms of the same being responsible towards its employees.	1	5	3.81	0.955
Reduction in inequity in remuneration and other perquisites given to the employees of the same level.	1	5	3.42	1.050
Reduction in the differences in compensation package admissible to the employees of different hierarchy to a significant level.	1	5	3.10	1.183
Improvement in the working environment of our organization and morale of its employees to a considerable level.	1	5	3.55	0.898
Improvement in the living condition, education, nutrition and health of the employees in our organization.	1	5	3.54	0.939
Improvement in the corporate image of our firm in terms of the same being responsible towards the community.	1	5	3.84	0.920
Improvement in the opportunities of the surrounding community in respect of employment/business.	1	5	3.60	0.974
Improvement in the literacy/level of education of the surrounding people.	1	5	3.36	1.048
Increase in the proportion of time the surrounding people remain free from ailments due to improved health care facilities.	1	5	3.45	1.048

Appendix C. A brief note on Sustainable Supply Chain Management (SSCM) for the respondents

Sustainability or Sustainable Development is a burning issue in today's business and social environment in view of the rampant degradation of ecological environment and violation of human rights occurring all over the globe. The unbridled economic growth has led to the huge exploitation of natural and mineral resources and at the same time made the planet earth heavily polluted due to the emission of toxic gases and dumping of solid and liquid wastes. Keeping this trend of development in mind, World Commission on Environment and Development (1987) provided a classic definition of Sustainable Development as "the development that meets the needs of present generation without compromising the ability of future generations to satisfy their legitimate needs". This document, also known as Brundtland report, subsequently served as the basis for sustainability across the globe. Sustainability has got three dimensions: economic, social and environmental, which in other words, implies that all these three dimensions require adequate attention by the policy planners for maintaining harmony and achieving the goal of long-term development.

Mere pursuit of economic goal by an organization is not a sound decision alternative from long-term sustainability and profitability point of view if the same results in irreversible damages in the environment and fails to secure safety, security, healthcare, minimum wages, better working conditions for its employees, and better living condition for the surrounding community at large. Therefore, it has become imperative for any organization to behave in a socially and environmentally responsible manner while trying to achieve its economic goals.

Supply Chain Management (SCM) primarily focusses on the economic goals right from sourcing of inputs to the final delivery of products and does not incorporate social or environmental goals. Today's supply chain has to behave in a socially and environmentally responsible manner, which has given rise to the concept of Sustainable Supply Chain Management (SSCM). In other words, SSCM attempts to integrate all three dimensions of sustainability and then tries to achieve economic goal, social goal and environmental goal of an organization across its whole supply chain.

In reality, most of the organizations very often do not use the term SSCM explicitly while undertaking pro-active measures for minimizing negative environmental impact or addressing the needs of the employees and the community by practicing Corporate Social Responsibility (CSR). However, they do follow various dimensions of SSCM practices simultaneously. For example, there are many organizations which have already adopted ISO 14000 standards for environmental management systems and ISO 26000 standards for social responsibility while pursuing the activities in their supply chain. Similarly, there are other organizations which have implemented Green SCM (GSCM) in respect of environmental stewardship and simultaneously adopted CSR practices in their supply chain. These organizations seem to have introduced the components of SSCM practices although there might be lack of coordination between different departments responsible for institutionalization of GSCM practices and CSR practices. The present study considers these organizations undertaking both GSCM practices and CSR practices to have introduced SSCM practices and plans to confine the study to these organizations only. The study aims to assess the extent of introduction of SSCM practices on its different facets in an organization. In addition, it also attempts to evaluate the performance of the organization on all three dimensions of sustainability as a result of undertaking SSCM practices.

Appendix D. Number of Responding Organizations based on manpower

Manpower Strength	Frequency	Percentage
Less than 100	12	4.7
100 to <500	27	10.6
500 to <1000	19	7.5
1000 to <5000	48	18.8
5000 to <10000	43	16.9
10000 to <20000	11	4.3
20000 to <50000	63	24.7
Above 50000	32	12.5
Total	255	100.0

Appendix E. Number of responding organizations based on turnover

Turnover (in Cr. Rs.)	Frequency	Percentage
<Rs.100 Cr.	12	4.7
Rs.100 Cr. to < Rs. 500 Cr.	23	9.0
Rs.500 Cr. to < Rs.1000 Cr.	17	6.7
Rs.1000 Cr. to < Rs.5000 Cr.	61	23.9
Rs.5000 Cr. to < Rs.10000 Cr.	11	4.3
Rs. 10000 Cr. to < Rs.20000 Cr.	8	3.1
Rs.20000 Cr. to < Rs.50000 Cr.	89	34.9
Above Rs. 50000 Cr.	34	13.3
Total	255	100.0

Appendix F. Final parsimonious instrument

SSCM practices	
Environmental management practices (EMP)	
EMP1	EMSs are in place in our organization in terms of ISO 14001 certification or any comparable EMS.
EMP2	We provide design specification to suppliers that include environmental compliance for purchased item.
EMP3	We help suppliers set up environmental management system /get ISO 14001 certification.
EMP4	We address environmental concerns of our customers in terms of eco-friendly design/distribution of products.
EMP5	We address environmental concerns of our customers by adopting cleaner production.
EMP6	We have successfully designed our products which consume reduced amount of input materials /energy.
Operations practices (OP)	
OP1	We facilitate our suppliers implement TQM/Six sigma/TPM/TQC to build quality into the product
OP2	We facilitate our suppliers in carrying out Value Engineering to reduce the cost of components.
OP3	We follow Just-in-time/Scientific inventory control technique consistently to keep inventory under control in the production environment.
OP4	We have implemented lean production and follow it consistently to minimize waste.
OP5	We attempt to achieve economies of scale in inbound and or outbound transportation.
Supply chain integration(SCI)	
SCI1	We update our production plan as per the changing needs of customers and share the same with suppliers.
SCI2	Our organization responds to the needs of customers fairly quickly by keeping adequate amount of inventory
SCI3*	We estimate customers' future needs based on realistic assessment.
SCI4	We communicate customers' future needs to the suppliers quickly.
Socially inclusive practices for employees (SPE)	
SPE1	The safety measures undertaken by our organization are quite advanced and reduce the risk to accident.
SPE2	Our organization provides healthy and positive working environment for the employees.
SPE3*	Use of child labour and forced labour is not allowed in our organization.
SPE4	The wages and perquisites given out to the employees are sufficient to meet their basic needs in our organization.
SPE5*	Our employees are entitled to leave, provident fund, medical benefits and other facilities.
Socially inclusive practices for community (SPC)	
SPC1	We provide employment/business opportunities to the surrounding community.
SPC2	We provide health care facilities to the local community.
SPC3	We provide primary education facilities to the surrounding people.
SSCM performance measures	
Competitiveness (CP)	
CP1	Improvement in the level of service with the same or even lesser amount of inventory.
CP2	Improvement in the quality of products and services.

(*continued on next page*)

(*continued*)

CP3	Improvement in the overall productivity/capacity utilization of the organization.
CP4	Improvement in the competitive advantage of the firm in terms of providing differentiated products to its customers.
CP5	Retention of existing customer base.
CP6*	Increased opportunity for the firm to target and capture new customers.
CP7	Improvement in the corporate image of the firm in terms of the same being green.
Environmental performance (EPR)	
EPR1	Reduction in the cost of effluent treatment and effluent discharge.
EPR2	Reduction in the discharge of toxic materials (solid and liquid and gases).
EPR3	Reduction in the frequency of environmental accident.
EPR4	Reduction in the frequency of accidents occurring in the shop-floor.
EPR5	Protection of bio-diversity in the surrounding area.
Operations performance (OPR)	
OPR1	Decrease in the cost of production.
OPR2*	Reduction in the cost of energy consumption.
OPR3	Improvement in the efficiency of inbound logistics.
OPR4	Improvement in the efficiency of outbound logistics.
Employee-centred social performance (ESP)	
ESP1	Reduction in inequity in remuneration and other perquisites given to the employees of the same level.
ESP2	Reduction in the differences in compensation package admissible to the employees of different hierarchy.
ESP3	Improvement in the working environment of the organization and morale of its employees to a considerable level.
Community-centred social performance (CSP)	
CSP1*	Improvement in the corporate image of the firm in terms of the same being responsible towards the community.
CSP3	Improvement in the opportunities of the surrounding community in respect of employment/business.
CSP4	Improvement in the literacy/level of education of the surrounding people.
CSP5	Increase in the proportion of time the surrounding people remain free from ailments due to improved health care facilities.

*The items were dropped while carrying out CFA on the items.

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