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RESEARCH ARTICLE

Analysing the critical success factors for implementation of sustainable supply chain management: an Indian case study

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Abstract Critical success factors (CSFs) are the enablers to address the successful implementation of sustainable supply chain management (SSCM) practices in organizations. This study identifies and consolidates various relevant factors to develop the SSCM constructs conducive to supply chains in the Indian steel sector. A comprehensive framework of sustainability measurement has been developed through successive stages of data collection, analysis and refinement. Data have been collected from various departments of Tata Steel, SAIL, Essar and Jindal in India. The outcome of this research is a set of reliable, valid and unidimensional first-order measurements that can be subsequently used in conceptualization and measurement of the sustainability of supply chains in steel industry. Using factor analysis, we identify four constructs, namely favourable organizational environment, sustainable procurement initiatives, compliances to sustainability standards and external environmental pressures, which the organizations need to focus on. Additionally, using relative importance index ranking based on the survey data, the top three CSFs are compliance to environmental standards (ISO 14001 certification), safety and health focus (OHSAS 18001 certification) and top leadership commitment and support-all of which are within the organization's own control. This study contributes to the continuing research of supply chain sustainability and provides supply chain managers with a practical approach for measuring and implementing sustainability practices across the steel supply chains.

Keywords Critical success factors · Sustainable supply chain management · Factor analysis · Indian steel sector

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Introduction

Sustainability, from a practitioner's perspective, is simply about having the potential to be around for the long term. While the term "long term" indicates

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financial viability, the other aspect of it is to take care of needs arising out of demand in future. The World Commission on Environment and Development (1987)—also known as the Brundtland Commission—defined sustainability as "meeting the needs of the present without compromising on the ability of the future generation to meet their own needs". Since then, this subject has drawn considerable importance in policy, research and industry. The long-term viability and competitiveness of business is increasingly being evaluated with respect to its sustainability indices that focus on inclusive, equitable and sustainable industrial growth. Nations across the world are introducing legislations with a focus on sustainability that is enforceable and becoming more proactive in terms of implementation. For a developing country such as India which is in transition from agrarian economy to an industrialized society, the legislations on stricter environmental norms and social compliances are fast catching up. With an enhanced emphasis on sustainability, the debate in the industry is on how organizations meet the challenge of sustainability.

This is also drawing the attention of supply chain management practitioners and researchers alike. In view of the realization that the organization is no more sustainable than its supply chain, the current ways of functioning of supply chains are being reviewed with sustainability filters. In the past, supply chain management only focused on the efficient and responsive system of supply, production and distribution from raw material stage to the final customer (i.e. from point of origin to point of consumption). The aspects of product selection/design, use/consumption at customer end, disposal of end product and how supply chain treats its employees, customers, vendors and the community at large are the new focus areas which have given rise to the concept "sustainable supply chain management (SSCM)". In general, SSCM is defined as "the management of supply chain operation, resources, information and funds in order to maximize the supply chain profitability while at the same time, minimizing the environmental impacts and maximizing social well-being" (Hassini et al. 2012). This definition very well incorporates the three dimensions of the definition of "sustainability", namely economic, social and environmental. Supply chain performance is now measured not only according to economic performance but also against its social and environmental performance. Sustainable supply chain management, thus, encourages a socially responsible way to conduct business and managing resources and environment. A focus on supply chains is a step towards wider adoption and development of sustainability (Ashby et al. 2012).

Perceptions often vary on what and how to implement. Carter and Rogers (2008) noted that there is a lack of consensus on the understanding of the term "sustainability" and more specifically "sustainable supply chain management". Sustainable supply chain management in India is at a very nascent stage, and companies in India have just started embracing it for themselves and their supply chain partners. Practices and implementation of SSCM vary from one organization to another. There are limited studies on the level of adoption of SSCM practices in Indian organizations, and this motivates us to focus on this line of research. The level of awareness on the subject, extent of implementation and impact of factors affecting the implementation in Indian organizations are, thus, the newer research areas to pursue. It is necessary for managers to identify the critical success factors which are relevant and important for their organization.

Currently, there is a dearth of studies in supply chain management (SCM) area which empirically examine relationships among various factors. In India, legislation (government regulation) has been one visible driving force for SSCM implementation. Organizations are motivated for adopting SSCM either due to external pressures from government, stakeholders or customers or due to internal organizational factors, such as culture, vision, systems and practices. In the context of Indian steel sector, since the legislations so far are not all inclusive and binding and due to demand–supply gap, the customer and market pressures are somewhat muted; it is the organizational call to take cognizance of external pressures or adopt a proactive strategy. Once an organization decides to be proactive, it gains the first-mover advantage, improves competitiveness and displays commitment for economic, environmental and social concerns. The push varies from organization to organization and accordingly affects the extent and pace of implementation of SSCM and consequent sustainability performance. Hence, the organization's sustainability performance outcome is influenced to a considerable extent by organization's internal environmental structures and its supply chain practices (see, for instance, Prasad 2017).

The steel industry in India is justified for this critical case study to examine the structures and processes which influence adoption of SSCM for a variety of reasons. The challenges in supply chains, particularly in emerging economies such as India, have become even more acute given that customers and suppliers are now located globally (Avittathur and Jayaram 2016). India is fast emerging to be the second-largest steel producer in the world, and there is a rising demand of steel for infrastructure development as well as for automobiles and housing, thus making steel critical to economy and one of the highest users of energy in manufacturing sector (WSD 2016; WEO 2016). A key driver of the implementation of SSCM is the perception of stakeholders that steel products are as much a part of the problem in relation to environment as part of the solution. It is critical that the steel industry supply chain implements SSCM solutions and influences performance outcome. This study makes an attempt to identify the critical success factors and prioritize them through statistical analysis of the survey response data from Indian organizations.

The rest of this paper is structured as follows: "Literature review" section presents a literature review and provides a rationale for the analysis; "Identification of critical success factors" section highlights the critical success factors for effective implementation of SSCM; "Empirical strategy" section describes the empirical strategy; "Results and analysis" section provides the results and analysis; "Discussion" section presents discussions; "Conclusion" section presents conclusions; and "Limitations and future research directions" section mentions the limitations of this study and future scope of research.

Literature review

The issue of sustainability has seen a growing interest in the field of SCM, both from the academic and corporate world (Seuring and Muller 2008). This led to a new paradigm of SCM, incorporating the sustainable dimension within the traditional SCM, the sustainable supply chain management (SSCM).

British Standards Institute gave a very relevant definition of SSCM encompassing all the major activities carried out in the supply chain. Sustainable supply chain management also includes consideration of the environmental, social and economic consequences of design, non-renewable material use, logistics, service delivery, material handling, inventory management, use, operation, maintenance, reuse, recycling options, disposal and supplier capability to address these consequences throughout the supply chain (BS 8903 2010).

The literature acknowledges that an organization can only be as sustainable as its supply chain (Krause et al. 2009). There is a growing belief that the idea of sustainable business is positive, visionary and strategic (Larson 2000). All managerial practices and activities that intend to achieve sustainable supply chains consequently form the concept of SSCM (Pagell and Wu 2009; Seuring and Muller 2008). Thus, SSCM describes how organizations actively expand the concept of corporate sustainability from their intra-organizational boundaries into their supply chains (Sarkis 2012).

SSCM also emerged because of integration of corporate sustainability with supply chain management. This implies that organizations practising sustainable supply chain management strive to satisfy multiple, possibly conflicting objectives. While maximizing profits calls for reducing operational costs, minimizing environmental impacts and maximizing social well-being can increase supply chain operational costs. However, many researchers such as Rao and Holt (2005) and Carter and Easton (2011) believe that implementing SSCM can also lead to cost reduction. Others such as van Hock and Erasmus (2000) assert that by applying SSCM, organizations will achieve marketing advantages, and improve corporate image and reputation.

Carter and Easton (2011) summarize how SSCM adds to the organizational advantage by reducing packaging through more effective design for reuse and recycling; lowering health and safety costs; reducing turnover and workforce costs due to safer warehousing and transport; and improving product quality and lowering disposal costs.

The literature on supply chain sustainability has mostly focused on environmental impacts, while some researchers have put together the environmental, economic and social impacts to form the widely known TBL (Hacking and Guthrie 2008). There are also a few studies that address the institutional and technical impacts of sustainable supply chain management practices (see, for instance, Hussain et al. 2016).

Linton et al. (2007) argued that sustainability in supply chain management should be moved from optimization of environmental factors to consideration of the entire supply chain, i.e. production, consumption, customer service, disposal of products. They posed several questions for the future supply chains, such as (1) type of resources to be used, (2) level of pollution, (3) extent of renewable resources, (4) use of technology and (5) the role of government policies in achieving a competitive rank in sustainability.

Morali and Searcy (2013) studied corporate sustainability reports of 100 companies and found that the most commonly reported supply chain indicator was policy, practices and proportion of spending on locally based suppliers. Although at the global level, certain indicators such as Global Reporting Initiative (GRI) and Dow Jones Sustainability Index (DJSI) are available which are used to gauge corporate sustainability, there is a lack of standardization of metrics for measuring sustainability in supply chain. GRI provides international standards for long-term corporate sustainability using comprehensive questions relevant to social, economic and environmental dimensions (Delai and Takahashi 2013; Turcu 2013) and consists of approximately 100 indices. DJSI measures corporate sustainability using industry-specific and general sustainability indicators based on TBL. The sheer number of indices is overwhelming in practice and costly for many small firms. As a result, only a few large organizations opt for them.

Seuring and Muller (2008) acknowledged the growing significance of sustainability in supply chain literature. It also offered a conceptual framework for studying the relationship between stakeholders in a supply chain to improve its performance and avoid the risks involved. It observed that research is still dominated by green/environmental issues. Social aspects and the integration of the three dimensions of sustainability are still rare.

Al Zaabi et al. (2013) analysed the barriers in implementation of SSCM and advocated a strong need for identification of the dominant factors and their impact on adoption of SSCM practices in organizations. More researchers in India have traditionally focussed on environmental concerns and green business practices and very few on societal concerns (Mangla et al. 2014; Rao 2002; Mudgal et al. 2009; Muduli and Barve 2011, 2013; Luthra et al. 2011, 2014). The need for a comprehensive study on SSCM practices and its implementation in Indian organizations thus emerged as a gap area to pursue further research

Kuei et al. (2015) identified the critical factors influencing the adoption of green supply chain practices in Chinese firms using partial least squares. They found that customer pressures, regulatory pressures, government support and environmental uncertainty are the most important factors in adopting green practices.

Luthra et al. (2015a, b) identified 26 CSFs using interpretive structural modelling (ISM) to implement green supply chain management (GSCM) in Indian mining industry. They found scarcity of natural resources to be the most important CSF which could force industries to implement GSCM practices to ensure their business sustainability.

Raut et al. (2017) used ISM and identified 32 CSFs for implementing SSCM in Indian oil and gas industry. Global climatic pressure and ecological scarcity of resources were found to be the most important ones.

Garg (2017) selects the operational disclosures related to sustainability by analysing the current items in the prominent global indices. The disclosures consist of parameters related to economic, environmental and social reporting. Applying the factor analysis technique, sustainability reporting index (SRI) has been formed using all the disclosures combined systematically. The paper discusses the whole procedure to frame the index/questionnaire beginning from categorizing initial disclosures to complete the disclosure for the index.

Over and above, several studies (see Table 12 in Appendix 1) have identified different indicators of supply chain sustainability in different industrial setups. Yet, little attention has been given to formulate a comprehensive framework for their implementation to enhance organizational performance. Although the literature contains a good number of research papers studying the performance measures of manufacturing organizations, not much attention has been paid to exploring the respective indicators in the steel industry. Hence, this paper builds on the reviewed literature of SSCM and attempts to contribute to the following research gaps:

- To develop a holistic understanding of sustainable supply chain management.

- To identify and prioritize the critical success factors for the implementation of SSCM in the context of Indian steel sector.
- To group and prioritize the CSFs using factor analysis for grouping and relative importance index ranking.

Identification of critical success factors

Critical success factors (CSFs) are the conditions, features or variables that when properly nurtured, sustained, maintained or managed can have a significant effect on the success of an enterprise or its endeavour (see, *inter alia*, Oloruntoba 2001; Yadav and Barve 2015). The theory of CSFs has its foundation within research strategy by Daniel (1961), Rockart (1979) and Dinter (2013). According to Rockart (1979), CSFs are areas or activities that should receive constant and careful attention from management. In general, CSFs are simply defined as *the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance of the organization* (see, for instance, Alvarez et al. 2010; Dinter 2013; Kim and Rhee 2012; Koh et al. 2012; Trkman 2010; Zhou et al. 2011). CSFs can be applied to develop strategic planning, perform environmental analysis and carry out strategy evaluation (Munro and Wheeler 1980; Leidecker and Bruno 1984). Although not a precise instrument, it is a reliable tool which can be used for organization-specific and industry-specific analysis. Greater managerial participation helps in ensuring that better CSFs are identified (Quesada and Gazo 2007).

CSFs are generally enablers for effective implementation of sustainable supply chain management in organizations. They have been frequently used in SCM literature in general, but rarely implemented in a holistic sustainable supply chain management (El Khouli et al. 2011). Some of the notable works in this domain are: CSFs for reverse logistics implementation (Luthra et al. 2017), green supply chain management practice in mining industry (Luthra et al. 2014), GSCM in automobile industry (Luthra et al. 2015a, b), SSCM in manufacturing sector (Dubey et al. 2015a, b, c), SSCM practices in textile sector (Diabat et al. 2014) and SSCM practices in oil and gas sector (Raut et al. 2017).

Besides supply chain management, the CSF approach has also been linked with core competency (Hooley and Saunders 1993; Lowes et al. 1994), value chain (Johnson et al. 2008), business process (Peppard and Ward 2003; Watson 1993), enterprise resource planning (Nah et al. 2001; Akkermans and van Helden 2002) and total quality management (Yusof and Aspinwall 1999; Antony et al. 2002) perspectives.

Literature review helped in initial identification of critical success factors which were validated with industry experts for relevance and applicability. These CSFs were grouped as external factors, organizational internal factors, sustainable supply chain management factors and sustainability performance factors.

This study identifies twenty critical success factors associated with sustainable supply chain management implementation, based on literature review and inputs from industry experts. Factor analysis has been subsequently deployed to identify the most important critical success factors. These CSFs are then grouped into four main clusters, namely external factors, organizational internal factors, sustainable supply chain management factors and sustainability performance factors. These identified CSFs are summarized and presented in Table 1.

Empirical strategy

The aim of this paper is to identify and prioritize the critical success factors for the implementation of sustainable supply chain management practices in the context of Indian steel industry. Factor analysis has been used in this study to investigate the stated objectives. The detailed description of steps involved in this empirical process is presented in Fig. 1.

The empirical strategy includes the sample, questionnaire development and data collection, and an analysis of collected data using descriptive statistics and factor analysis.

Sample

For assessing sustainable supply chain management implementation and its performance outcome, it is important that the target sample demonstrates a certain level of awareness in the SSCM implementation journey. We target the Indian manufacturing and processing industrial sectors which are viewed as

Table 1 Identified CSFs from literature review

Dimensions	CSFs	References
External	Government pressure	Walker and Jones (2012)
	Market and social pressure	Expert opinion
	Consumer concern	Faisal (2010)
Organization	Top leadership commitment and support	Faisal (2010), Luthra et al. (2015a, b)
	Organizational culture for proactive adoption of SSCM	Luthra et al. (2015a, b)
	Organizational financial health	Mohanty and Deshmukh (1997)
	Employee training and preparation	Expert opinion
	Safety and health focus (OHSAS: 18001)	Diabat et al. (2014), Expert opinion Dubey et al. (2015a)
	Investment in technology and resources	Luthra et al. (2015b), Mudgal et al. (2009)
	Governance structure for sustainability	Expert opinion
SSCM	Sustainable procurement policy	Expert opinion
	Supplier selection strategy	Luthra et al. (2015a), Grimm et al. (2014)
	Well-defined metrics for sustainability tracking	Luthra et al. (2015b), Rao and Holt (2005)
	Identified SP initiatives (green purchasing, reverse logistics)	Dubey et al. (2015c)
Performance	Contribution to profit and resource	Zhu et al. (2012)
	Energy savings	Dubey et al. (2015a)
	Resource savings (water/materials)	Dubey et al. (2015b)
	Compliance to social	Dubey et al. (2015c)
	Accountability, etc.	
	Carbon footprint reduction	Expert opinion
	Compliance to environmental standard	Diabat et al. (2014)

CSFs critical success factors, *SSCM* sustainable supply chain management, *OHSAS* occupational health and safety assessment series

manufacturing units with the most direct and observable impacts on sustainability considerations. The steel sector, in particular, was chosen as it is increasingly facing stricter environmental and statutory compliance norms. These industries are also exposed to foreign market which is sensitive to sustainability compliances. To check sectoral bias, power, steel processing units and utility sector were also included in the target respondent list. The study plan is developed based on an empirical study of Tata Steel in India. Primary data are collected through a survey distributed to a sample of selected firms.

Questionnaire development, data collection and data reliability

The study was carried out in several phases. The first phase consisted of planned interaction with industry experts to solicit their views on the issues of SSCM implementation in the organization. A proposed questionnaire was administered to 30 practising professionals. Based on the feedbacks received, multiple refinements were made and the final questionnaire was developed. This questionnaire was developed on 20 critical success factors, which were identified on the basis of industry experts' inputs and literature survey (see, for instance, Zhu et al. 2005; Carter et al. 2000; Walton et al. 1998; Zsidisin and Hendrick 1998).

We developed the questionnaire to indicate the importance of these twenty identified CSFs on a five-point Likert scale. On this scale, 1–5 represent very low importance/strongly disagree to very high importance/strongly agree for any critical success factor. Likert scales have been previously used in several sustainability measurement studies (see, for instance, Mani et al. 2016; Miao et al. 2012; Zhu et al. 2008; Carter and Jennings 2004, 2002)

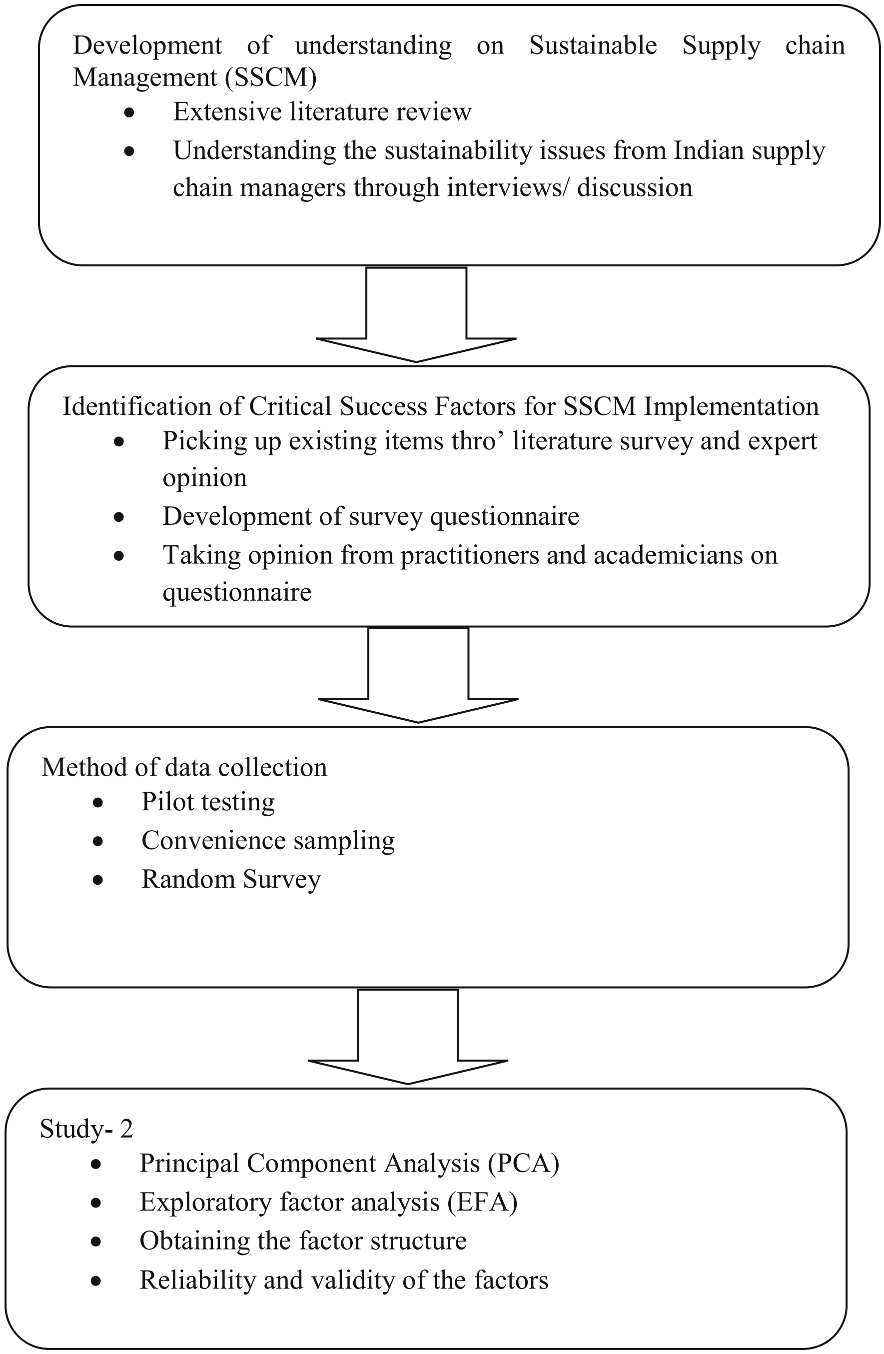

Fig. 1 Steps involved in the research process. *Note*: adapted with modification from Mani et al. (2016)

The respondents are working professionals in the steel sector. They are basically supply chain managers, plant personnel, CEOs and other managerial staff. The survey instrument was first emailed to 400 respondents. The respondents were randomly selected from Tata Steel, SAIL, ESSAR and Jindal in India. Out of 400, survey emailed to these industry professionals, only a few responded and some were found to be incomplete. However, with personal reminders, phone calls and emails, 145 valid responses were finally received, which is a judicious sample size for this study.

Data analysis methods

For data analysis, factor analysis (FA) is used. The purpose of using FA is to describe the possible covariance relationship between observed variables in terms of a few, but unobservable random qualities called the factors. In other words, this technique analyses the interrelationships among a large list of indicators in order to understand their underlying structure, making it possible to reduce it to a small number of aggregated variables. This can be done either through confirmatory factor analysis (CFA) or exploratory factor analysis (EFA). CFA is used to verify the factor structure of a set of observed variables. It allows to test the hypothesis that a relationship exists between the observed variables and their underlying latent constructs (see, for instance, Hussain et al. 2016). On the contrary, EFA is used to disclose the underlying structure of a large set of variables. In other words, there is no prior theory and one uses factor loadings to intuit the factor structure of the data. In this study, we employed EFA[1] to identify the key dimensions of external and internal factors on organization's sustainable supply chain processes and its performance outcomes.

Results and analysis

This section presents the descriptive statistics, correlation statistics for CSFs and the results of factor analysis. Descriptive statistics, alpha coefficients and item-total correlation were used to initially analyse the survey data. Exploratory factor analysis (EFA), as given in Hair (2007) and Hair et al. (2010), was then used to summarize the identified CSFs of sustainable supply chain management into a new, smaller set of uncorrelated dimensions with a minimum loss of information.

Descriptive statistics and correlation matrix

The descriptive statistics of these 20 critical success factors and their correlation matrix are presented in Tables 2 and 3. We find that most of the critical success factors are sufficiently normally distributed with skewness and kurtosis coefficients within the range of -2.00 and $+2.00$[2] (see Table 2). Furthermore, the correlation coefficients are positive and significant at 0.01 level for all possible CSF pairings (see Table 3).

Non-response bias

The set of questionnaire has been emailed to 400 probable respondents. They are selected at random from multiple Indian steel producing units. With personal reminders, phone calls and emails, 145 valid responses were finally received out of 400, which is a judicious sample size for this study. The statistical test details of non-respondent bias are discussed in Appendix 2 (see Table 15)

Exploratory factor analysis

An exploratory factor analysis was deployed to derive the groupings of twenty critical success factors identified from the survey data. The main goal was to summarize these CSFs into a new and smaller set of uncorrelated dimensions with as little loss of information as possible. It was also used to identify a meaningful underlying structure of the CSFs for SSCM implementation and to reduce the dimensionality of the CSFs set as a prelude to further analysis.

Before conducting EFA, two tests were performed to check the possible presence of multicollinearity or correlation among the CSFs: the Kaiser–Meyer–Olkin (KMO) measure for measuring sampling adequacy and the Bartlett test of sphericity for testing the presence of correlation. IBM SPSS was used to perform these tests. Results from both of these tests demonstrated that the sample met the factor analysis criteria. The KMO value of 0.882 is greater than the

[1] The advantages of using EFA are: (1) it is not so expensive and simple to run and can be used for a wide variety of situations; (2) it can be used to identify lots of important factor which are not possible through other statistical technique; (3) it is very useful for lots of survey questions; and (4) it is the basis for other instruments (regression analysis with factor scores) and easy to combine with other instruments (confirmatory analysis). However, the use of EFA has some disadvantages: (1) interval scale variables need to be used; (2) it is always difficult to design good set of questionnaires which covers all types of gateway for variation; (3) it is difficult to decide how many factors to be chosen; and (4) sample size should be more than three times than the number of variables.

[2] This validation is as per the recommendation of Field (2009).

Table 2 Descriptive statistics of critical success factors

CSFs	*N*	Min	Max	Mea	SD	Ske	Kur	JB
E1	145	1.00	5.00	3.386	0.987	0.037	− 0.493	4.64***
E2	145	1.00	5.00	3.800	0.894	− 0.184	− 0.551	4.79***
E3	145	1.00	5.00	3.738	0.905	− 0.252	− 0.447	8.60*
O1	145	2.00	5.00	4.366	0.695	− 0.763	− 0.095	13.9*
O2	145	1.00	5.00	4.124	0.781	− 0.754	0.896	17.6*
O3	145	1.00	5.00	3.862	0.847	− 0.358	− 0.118	5.19**
O4	145	1.00	5.00	3.944	0.848	− 0.587	0.225	8.34*
O5	145	1.00	5.00	4.421	0.822	− 1.605	3.024	111.0*
O6	145	1.00	5.00	3.959	0.934	− 0.797	0.368	15.6*
O7	145	1.00	5.00	4.248	0.804	− 0.888	0.683	20.9*
PS1	145	2.00	5.00	4.221	0.672	− 0.431	− 0.178	4.68***
PS2	145	1.00	5.00	4.228	0.743	− 1.073	1.964	45.1*
PS3	145	2.00	5.00	4.186	0.736	− 0.521	− 0.284	7.03**
PS4	145	1.00	5.00	3.952	1.089	− 0.722	− 0.161	12.6*
PS5	145	2.00	5.00	4.021	0.777	− 0.396	− 0.343	5.33***
PS6	145	3.00	5.00	4.441	0.706	− 0.870	− 0.515	4.56***
S1	145	1.00	5.00	4.138	0.769	− 1.262	3.202	93.9*
S2	145	1.00	5.00	4.028	0.833	− 0.710	0.517	13.2*
S3	145	2.00	5.00	4.248	0.693	− 0.756	0.818	16.9*
S4	145	2.00	5.00	4.034	0.777	− 0.331	− 0.566	4.68***

CSFs is critical success factors, E1 is government pressure, E2 is market and social pressure, E3 is consumer concern, O1 is top leadership commitment and support, O2 is proactive adoption of sustainable supply chain management, O3 is organizational financial health, O4 is employee training and preparedness, O5 is safety and health focus, O6 is investment in technology and resources, O7 is governance structure for sustainability, S1 is sustainable procurement policy, S2 is supplier selection strategy, S3 is well-defined metrics for sustainability tracking, S4 is identified strategic procurement initiative, PS1 is contribution to profit and resources, PS2 is energy savings, PS3 is contribution to resource savings (water), PS4 is compliance to social accountability, PS5 is carbon foot print reduction and PS6 is compliance to environmental standard

N is sample size, Min is minimum, Max is maximum, Mea is mean, SD is standard deviation, Ske is skewness, Kur is kurtosis and JB is Jarque–Bera statistics

*, ** and ***Estimates are statistically significant at the 1, 5 and 10% levels, respectively

minimum acceptance value of 0.5 (see Table 4). The Bartlett test was also statistically significant with an approximate Chi-square value of 1528.6. The results of both tests confirmed that the sample is adequate for factor analysis to be conducted on the 20 CSFs.

The strength of relationship among the variables in the data set is shown by correlation matrix, and to check whether it is appropriate to do factor analysis, we should have considerable number of paired correlation of at least 0.3 or greater. The correlation matrix generated from simulation showed considerable number of attributes with the value above 0.3 as highlighted in Table 3. Thus, the data set is found to be suitable to carry out factor analysis and reduce correlations.

Principal component analysis (PCA) is a statistical technique to reduce original factors into relatively lower number of factors to represent the relationships among a set of many interrelated variables. The 20 factors have been reduced to four dimensions using varimax rotation. Tables 5 and 6 provide the results of PCA. Table 5 provides the loading of each attribute with respect to four principal components, while Table 6 gives only the significant loadings on the four above-mentioned dimensions.

As a large number of CSFs were considered in the study, we have to find out the commonalities set.

Table 3 Correlation matrix

CSF	E1	E2	E3	O1	O2	O3	O4	O5	O6	O7	S1	S2	S3	S4	PS1	PS2	PS3	PS4	PS5	PS6
E1	1.00	0.41	0.46	0.07	0.14	0.04	0.19	0.05	0.18	0.11	0.21	0.22	0.17	0.26	0.12	0.24	0.15	0.19	0.24	0.15
E2		1.00	0.56	0.36	0.41	0.30	0.40	0.17	0.47	0.40	0.49	0.42	0.32	0.35	0.31	0.27	0.33	0.35	0.36	0.28
E3			1.00	0.30	0.40	0.25	0.39	0.06	0.43	0.28	0.41	0.50	0.38	0.32	0.31	0.28	0.38	0.14	0.35	0.18
O1				1.00	0.57	0.37	0.36	0.34	0.61	0.64	0.46	0.58	0.36	0.31	0.41	0.40	0.50	0.37	0.45	0.38
O2					1.00	0.39	0.31	0.15	0.58	0.60	0.63	0.58	0.33	0.36	0.49	0.37	0.38	0.28	0.43	0.27
O3						1.00	0.45	0.20	0.50	0.43	0.37	0.32	0.34	0.44	0.38	0.33	0.38	0.11	0.39	0.15
O4							1.00	0.20	0.51	0.38	0.30	0.32	0.37	0.36	0.34	0.39	0.38	0.23	0.42	0.19
O5								1.00	0.28	0.23	0.18	0.21	0.22	0.28	0.17	0.30	0.35	0.44	0.25	0.62
O6									1.00	0.48	0.57	0.52	0.39	0.47	0.45	0.50	0.55	0.29	0.55	0.29
O7										1.00	0.45	0.53	0.33	0.28	0.37	0.31	0.32	0.38	0.34	0.28
S1											1.00	0.49	0.42	0.35	0.49	0.38	0.47	0.31	0.38	0.37
S2												1.00	0.53	0.32	0.40	0.42	0.43	0.25	0.43	0.31
S3													1.00	0.40	0.52	0.44	0.51	0.14	0.47	0.40
S4														1.00	0.44	0.50	0.64	0.11	0.59	0.28
PS1															1.00	0.46	0.48	0.16	0.47	0.38
PS2																1.00	0.67	0.19	0.68	0.28
PS3																	1.00	0.20	0.59	0.48
PS4																		1.00	0.12	0.54
PS5																			1.00	0.31
PS6																				1.00

CSFs is critical success factors, E1 is government pressure, E2 is market and social pressure, E3 is consumer concern, O1 is top leadership commitment and support, O2 is proactive adoption of sustainable supply chain management, O3 is organizational financial health, O4 is employee training and preparedness, O5 is safety and health focus, O6 is investment in technology and resources, O7 is governance structure for sustainability, S1 is sustainable procurement policy, S2 is supplier selection strategy, S3 is well-defined metrics for sustainability tracking, S4 is identified strategic procurement initiative, PS1 is contribution to profit and resources, PS2 is energy savings, PS3 is contribution to resource savings (water), PS4 is compliance to social accountability, PS5 is carbon foot print reduction and PS6 is compliance to environmental standard

The correlation coefficients are statistically significant at 1% probability level

Table 4 KMO and Bartlett's test

Kaiser–Meyer–Olkin measure of sampling adequacy		0.882
Bartlett's test of sphericity	Approx. chi square	1528.6*
	DF	144
	Significance level	0.000

DF degrees of freedom

*Statistically significant at 1% probability level

Table 5 Component correlation matrix (before rotation)

Items	Principal components			
	1	2	3	4
Government pressure	0.330	− 0.226	0.272	0.704
Market and social pressure	0.623	− 0.096	0.409	0.302
Consumer concern	0.582	− 0.347	0.339	0.353
Top leadership commitment and support	0.719	0.204	0.137	− 0.326
Organizational culture for proactive adoption of SSCM	0.710	− 0.056	0.299	− 0.315
Organizational financial health	0.578	− 0.169	− 0.107	− 0.314
Employee training and preparedness	0.596	− 0.153	− 0.012	0.014
Safety and health focus (OHSAS)	0.424	0.668	− 0.253	0.166
Investment in technology and resources	0.783	− 0.075	0.045	− 0.150
Governance structure for sustainability	0.654	0.137	0.324	− 0.368
Sustainable procurement policy	0.708	− 0.017	0.228	− 0.085
Supplier selection strategy	0.711	− 0.055	0.237	− 0.107
Well-defined practice for sustainability tracking	0.647	− 0.090	− 0.186	0.062
Identifying strategic	0.648	− 0.193	− 0.388	0.149
Procurement initiatives contribution to profit and resources	0.662	− 0.093	− 0.165	− 0.126
Energy savings	0.681	− 0.110	− 0.409	0.083
Resource savings (water)	0.747	− 0.004	− 0.407	0.081
Compliance to social accountability, etc.	0.428	0.647	0.295	0.177
Carbon footprint reduction	0.716	− 0.199	− 0.343	0.062
Compliance to environmental standards	0.545	0.630	− 0.128	0.253

Extraction method: principal component analysis

SSCM sustainable supply chain management, *OHSAS* occupational health and safety assessment series, *SP* strategic procurement

Kaiser normalization and analysis of scree plot were done as shown in Tables 7 and 8 and Fig. 2, respectively. The results obtained by Kaiser normalization and scree plot were compared to a random generated data set of same size using Monte Carlo's parallel analysis software. Monte Carlo PCA was used to generate random eigenvalues using 100 iterations. The eigenvalues of survey were compared to eigenvalues of random, and it was found that only first four components of eigenvalues of survey data exceeded the randomly generated data.

In order to ensure that the variables comprising each proposed research construct were internally consistent, a reliability assessment was performed using Cronbach's α. The values of Cronbach's α for all the four dimensions of the CSFs were above the recommended[3] value of 0.60 for exploratory results.

[3] See Nunnally (1978).

Table 6 Pattern matrix with component loadings (after rotation)

Principal components	1	2	3	4
E1				0.837
E2	0.423			0.658
E3				0.721
O1	0.709			
O2	0.802			
O3	0.550	0.405		
O4	0.410			
O5			0.772	
O6	0.652	0.401		
O7	0.810			
S1	0.608			
S2	0.626			
S3		0.505		
S4		0.791		
PS1	0.451	0.510		
PS2		0.705		
PS3		0.791		
PS4			0.745	
PS5		0.718		
PS6			0.808	

CSFs is critical success factors, E1 is government pressure, E2 is market and social pressure, E3 is consumer concern, O1 is top leadership commitment and support, O2 is proactive adoption of sustainable supply chain management, O3 is organizational financial health, O4 is employee training and preparedness, O5 is safety and health focus, O6 is investment in technology and resources, O7 is governance structure for sustainability, S1 is sustainable procurement policy, S2 is supplier selection strategy, S3 is well-defined metrics for sustainability tracking, S4 is identified strategic procurement initiative, PS1 is contribution to profit and resources, PS2 is energy savings, PS3 is contribution to resource savings (water), PS4 is compliance to social accountability, PS5 is carbon foot print reduction and PS6 is compliance to environmental standard

All the factor loadings are statistically significant at 1% probability level of significance

Extraction method is principal component analysis, and rotation method is varimax with Kaiser normalization

Table 9 shows that the "α" coefficients ranged from 0.733 to 0.829, which indicates that this instrument can be considered highly reliable and internally consistent.

Validity of the constructs is measured by *convergent* and *discriminant* validity analysis. In order to verify the convergent validity, assessment of factor loadings (> 0.5) and statistical significance of construct item loadings are recommended (Falk and Miller 1992). Additionally, the value of average variance extracted (AVE) should also exceed the threshold value of 0.50 (Barclay et al. 1995). Our results indicate that maximum standard loadings in constructs are more than 0.5 and the value of composite reliability (CR) is greater than 0.7 (see Table 13 in Appendix 2). That means all these criteria are met and exceeded with a good margin and hence support convergent validity (Kline 2010).

Discriminant validity analysis is done to establish that there is an unrelated scale in between constructs and this has been evaluated by comparing the square root of latent variable AVE with latent variable correlation (see Table 14 Appendix 2). The correlation matrix shows that the square root of AVE is larger than the off-diagonal values (see Table 13 in Appendix 2), which is an indicator of discriminant validity (Kline 2010; Hulland 1999). So, all the constructs are reliable as well as valid. As all the rho-A of constructs are above 0.6, it indicates sufficient co-linearity among variables.

Four components were extracted which explain 62% of total variances in the original data set. It is further verified by analysing the component correlation matrix (Table 5). Correlations between all the four components are found to be low (i.e. below 0.3), and hence, the selection of four components is confirmed. The pattern matrix for factor loading on four components was generated using SPSS (Table 6). It was found that loading over 0.4 on all factors is adequate. To avoid repetition in loading, a choice was made between items of highly similar content based on loading size.

Items were arranged into factors based on the size of loading with respect to statistical analysis and a priori conceptual beliefs. After extracting four factors from the EFA procedure, results were interpreted by assigning labels to the factors (see Table 10). These are discussed as follows.

- *Favourable organizational environment* This dimension consisted of eight items, which were mostly categorized from the group of organization, barring two items which were from the group of sustainable supply chain management. It relates to a favourable organizational environment and accounts for 38.93% of the total variance.

Table 7 Eigenanalysis by Kaiser criterion

Component	Eigenvalue	Proportion of variance (%)	Cumulative proportion of variance (%)
E1	8.176	38.933	38.933
E2	1.828	8.706	47.639
E3	1.576	7.503	55.142
O1	1.378	6.562	61.704
O2	0.969	4.615	66.319
O3	0.857	4.079	70.398
O4	0.724	3.448	73.846
O5	0.713	3.395	77.241
O6	0.590	2.809	80.050
O7	0.547	2.605	82.655
S1	0.468	2.230	84.886
S2	0.450	2.142	87.028
S3	0.404	1.926	88.954
S4	0.385	1.834	90.787
PS1	0.368	1.752	92.540
PS2	0.363	1.730	94.269
PS3	0.326	1.553	95.823
PS4	0.283	1.346	97.169
PS5	0.206	0.980	99.294
PS6	0.148	0.706	100.00

CSFs is critical success factors, E1 is government pressure, E2 is market and social pressure, E3 is consumer concern, O1 is top leadership commitment and support, O2 is proactive adoption of sustainable supply chain management, O3 is organizational financial health, O4 is employee training and preparedness, O5 is safety and health focus, O6 is investment in technology and resources, O7 is governance structure for sustainability, S1 is sustainable procurement policy, S2 is supplier selection strategy, S3 is well-defined metrics for sustainability tracking, S4 is identified strategic procurement initiative, PS1 is contribution to profit and resources, PS2 is energy savings, PS3 is contribution to resource savings (water), PS4 is compliance to social accountability, PS5 is carbon foot print reduction and PS6 is compliance to environmental standard

Total variance is explained by rotation sums of squared loadings

Governance structure for sustainability has the highest factor loading here, while employee training and preparation has the lowest factor loading.

- *Sustainable procurement initiatives* This dimension consisted of seven items, which were mostly from the group of performance on sustainability front. These are about specific procurement initiatives and rightly so, "identified strategic procurement initiatives" had the highest factor loading under this dimension. It accounts for 8.71% of the total variance. Contribution to resource savings has the highest factor loading here, while contribution to profit and cost has the lowest factor loading.
- *Compliances to sustainability* It consisted of three items—two of which were from performance on sustainability front and one from the group organization. Due to its early adoption, "compliance to environmental standard" has the highest factor loading. It accounted for 7.5% of the total variance. On the contrary, contribution to profit and resource has the lowest factor loading here.
- *External environmental pressure* This dimension consisted of three items, which were from the group external environment. It accounted for 6.56% of total variance. Government pressure has the highest factor loading here, while consumer concern has the lowest factor loading.

Discussion

There are debates on what drives the adoption of SSCM practices. There is a need to examine whether external factors or internal organizational factors have causal impact on SSCM adoption and which in turn influence the relationship between SSCM practices and sustainability performance outcome, particularly from holistic perspective. This may explain why SSCM implementation is more successful in some organization than others despite both being in same industry. In Indian context, we correlate that external pressures do have a moderation effect on the organization, but it is the organization's own vision, internal structures and systems which drive SSCM adoption through SSCM practices and their resultant influence on organization's economic, environmental and social performance (see, *inter alia*, Prasad 2017).

This study intended to develop and validate a framework and an instrument for analysing the critical success factors for the implementation of sustainable supply chains in Indian steel sector. Through extensive literature review, four important instruments/indicators (favourable organizational environment, sustainable procurement initiatives, compliances to sustainability and external environmental pressure) were identified as the major indicators of sustainability

Table 8 Eigenanalysis by Monte Carlo's PCA

Component	Eigenvalue	Proportion of cumulative variance (%)	Proportion of variance (%)
1—E1	8.176	38.933	38.933
2—E2	1.828	8.706	47.639
3—E3	1.576	7.503	55.142
4—O1	1.378	6.562	61.704
5—O2	0.969	4.615	66.319
6—O3	0.857	4.079	70.398
7—O4	0.724	3.448	73.846
8—O5	0.713	3.395	77.241
9—O6	0.590 2.809	80.050	
10—O7	0.547	2.605	82.655
11—S1	0.468	2.230	84.886
12—S2	0.450	2.142	87.028
13—S3	0.404	1.926	88.954
14—S4	0.385	1.834	90.787
15—PS1	0.368	1.752	92.540
16—PS2	0.363	1.730	94.269
17—PS3	0.326	1.553	95.823
18—PS4	0.283	1.346	97.169
19—PS5	0.206	0.980	99.294
20—PS6	0.148	0.706	100.00

CSFs is critical success factors, E1 is government pressure, E2 is market and social pressure, E3 is consumer concern, O1 is top leadership commitment and support, O2 is proactive adoption of sustainable supply chain management, O3 is organizational financial health, O4 is employee training and preparedness, O5 is safety and health focus, O6 is investment in technology and resources, O7 is governance structure for sustainability, S1 is sustainable procurement policy, S2 is supplier selection strategy, S3 is well-defined metrics for sustainability tracking, S4 is identified strategic procurement initiative, PS1 is contribution to profit and resources, PS2 is energy savings, PS3 is contribution to resource savings (water), PS4 is compliance to social accountability, PS5 is carbon foot print reduction and PS6 is compliance to environmental standard

Total variance is explained by rotation sums of squared loadings

PCA principal component analysis

in steel industry. Similar to existing research, the initial focus of the study was on the three dimensions of the triple bottom line (economic, social and environmental). However, with experts' opinion, the study mostly focused on these four identified dimensions. In fact, these four dimensions are found to be more appealing to steel industry.

Twenty associated indicators of these four latent variables were developed after consultation with the supply chain experts of the steel industry. After distributing the survey, 149 responses were received from the middle and top managements of this base industry in India. The reliability of the instrument has been measured through Cronbach's α, and unidimensionality has been measured through exploratory factor analysis (EFA) technique. The EFA outcomes revealed that all the four proposed latent variables adequately measure the constructs. Content validity was evaluated to check the degree to which the different approaches to measure the construct generated the same results and discriminant validity was evaluated to confirm that scale did not correlate with other conceptually distinct constructs. In short, the constructs of SSCM practice implementation appear to adequately fit with the collected empirical data.

In the extant literature, external pressures, internal organizational issues and supply chain practices have rarely been studied together and that too for Indian steel sector. This study presents the integrated impact of external pressures and internal organizational factors on SSCM implementation process and the related sustainable performance outcome. Being aware helps the managers in devising strategies to organization's best advantage. Below, we present the policy implications in order to have a better understanding of these four dimensions.

Favourable organizational environment

It aids in the pursuit and improvement in sustainable performance. The organizational culture, if favourable, proactive and progressive, helps in effective implementation and that too, much before the law mandates it, thereby gaining the first-mover competitive advantage (Porter and Van der Linde 1995a, b). In the long run, this might become one of the sustainable competitive advantages of the organization (Rao and Holt 2005). A good financial condition helps the pace and extent of implementation. The role of top leadership commitment has been highlighted in many studies, such as Bowen et al. (2001) and Zsidisin and Siferd (2001). The leadership role in creating governance structure for sustainability and issuing sustainability policy setting directions, allocating funds and resources, setting goals and monitoring

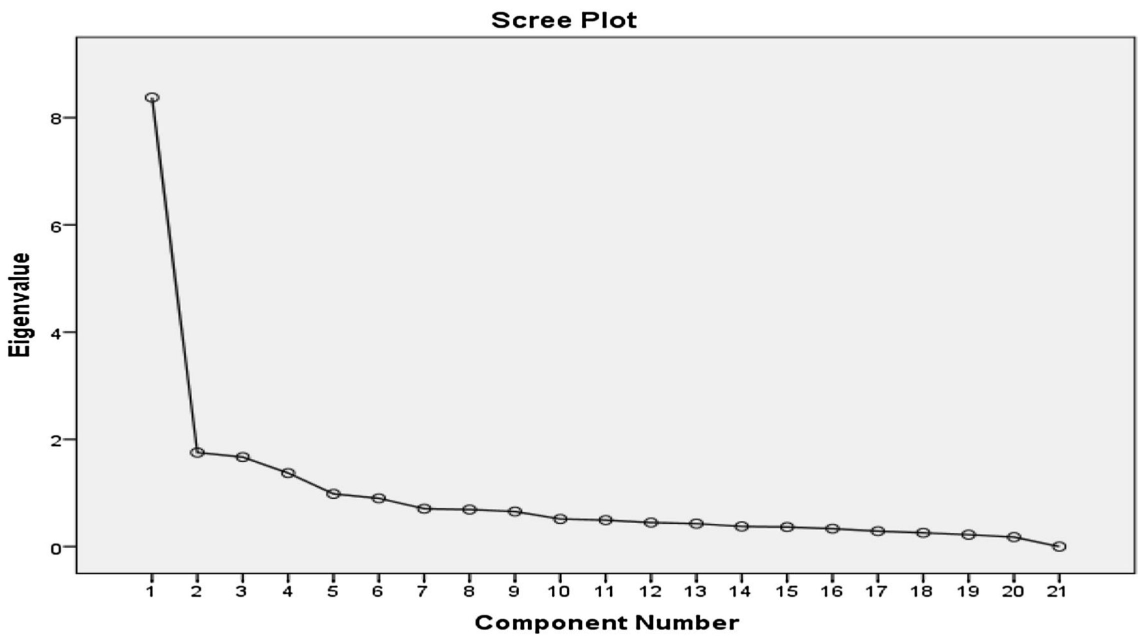

Fig. 2 Scree plot of eigenvalues over components

Table 9 Reliability statistics: Cronbach's alpha test

Component	Cronbach alpha	No. of items taken
1	0.829	7
2	0.742	6
3	0.798	4
4	0.733	3

The value of Croanbach's alpha ranges from 0 to 1. The high value denotes the greater internal consistency between the components loaded together

C.A > 0.9 denotes excellent, 0.9 > C.A > 0.8 denotes good, 0.8 > C.A > 0.7 denotes acceptable, 0.7 > C.A > 0.6 denotes poor and 0.5 > C.A denotes unacceptable

results will go a long way in making an organization's supply chain sustainable.

The role of suppliers has not been taken into our study scope, but what type of suppliers we deal with impacts our operating performance in a big way and organizations need to select suppliers who qualify on sustainability criterion. This is comparatively easy in private sector than the public sector due to the flexibility available to managers in the private sector. One organizational factor, namely employee training and preparedness, though not so explicitly mentioned in the literature, has been added in our study by industry experts who opined that success largely depends on how much the employees are involved and how they take it forward in their working (Walker et al. 2008). This has to be properly planned and executed. As all these factors are within organization's reach and control, managers must be conscious of them while devising strategies and making plans.

Sustainable procurement initiatives

The absence of standardized metrics makes inter-organizational comparison difficult, and all organizations have not yet started reporting to international GRI[4] standard. However, going by "what gets measured gets done", the success lies in identifying what specific initiatives to take and how to measure or monitor them. Such initiatives relate to green procurement, carbon foot print reduction, energy savings, resource savings, social and affirmative action initiatives and contribution to profit and cost savings. These steps can only be taken when there is an environmental collaboration among the supply chain partners, as suggested by Vachon and Klassen (2008). Simultaneous involvement and integration of suppliers, who can provide many enriching ideas, in the development of

[4] It stands for Global Reach Initiative.

Table 10 Patten matrix with component loadings

Codes	Attributes	Factors	
O7	Governance structure for sustainability	0.810	Favourable organizational environment
O2	Organizational culture for proactive adoption of SSCM	0.802	
O1	Top leadership commitment and support	0.709	
O6	Investment in technology and resources	0.652	
S2	Supplier selection strategy	0.626	
S1	Sustainability procurement policy	0.608	
O3	Organizational financial health	0.550	
O4	Employee training and preparation	0.410	
S4	Identified SP initiative	0.791	Sustainable procurement initiatives
PS3	Contribute to resource savings (water)	0.792	
PS5	Carbon foot print reduction	0.718	
PS2	Energy savings	0.703	
S3	Well-defined practice for sustainability tracking	0.575	
PS1	Contribute to profit and resource	0.510	
PS6	Compliance to environmental standard	0.808	Compliance to sustainability standards
O5	Safety and health focus OHSAS 18001	0.772	
PS4	Compliance to social accountability, etc.	0.745	
E1	Governments pressure	0.837	External environmental pressure
E3	Consumer concern	0.658	
E2	Market and social pressure	0.721	

SSCM sustainable supply chain management, *OHSAS* occupational health and safety assessment series, *SP* strategic procurement

sustainable SCM system will help speed up the entire process and reduce the environmental impact (Handfield et al. 1997; Carter and Carter 1998; Bowen et al. 2001; Vachon and Klassen 2006). Progressive organizations, even in India, have started monitoring these and many more such metrics and other organizations may benchmark with them and implement them in future.

Compliances to sustainability

The findings support that compliance to environmental standards, safety and health focus, and social accountability has an important role in successful implementation of SSCM. The third party certifications direct the organizations to operate in a focussed and disciplined way to meet the stringent sustainability considerations, and in the process, improve their performance. They also provide assurance to customers and help improve the brand perception. Bai and Sarkis (2010) opine that a more environment-friendly organization has a better brand image. In order to comply with various standards, an organization must develop and adopt an environmental management system so as to minimize impact across the supply chain (Darnall et al. 2008)

External environmental pressure

Institutional theory suggests that external forces motivate the firms to take strategic actions (Scott 2008). Supporting this, Hall (2001) also observed that the pressure from the external environment particularly from government regulation and legislation (Walton et al. 1998; Zhu et al. 2008) is the prime factor affecting the implementation of sustainable supply chain management. The Indian organizations are also under constant pressure from government, customers and other stakeholders to implement these best practices. As the days go by, government is making newer and more stringent compliance norms on sustainability and social compliances. Domestic customers in steel sector today, being in demand–supply gap scenario, may not be insisting so much for

Table 11 Relative importance index ranking

Code	Success attributes	W	RII	Ranking
PS6	Compliance to environmental standard	644	1.1103	1
O5	Safety and health focus OHSAS 18001	641	1.1052	2
O1	Top leadership commitment and support	633	1.0914	3
O7	Governance structure for sustainability	616	1.0621	4
S3	Well-defined practice for sustainability tracking	616	1.0621	5
PS1	Contribute to energy savings	613	1.0569	6
PS2	Contribute to profit and resource	612	1.0552	7
S4	Identified SP initiative	607	1.0466	8
PS3	Contribute to resource savings (water)	607	1.0466	9
S1	Sustainability procurement policy	600	1.0345	10
O2	Organizational culture for proactive adoption of SSCM	598	1.0310	11
S2	Supplier selection strategy	584	1.0069	12
PS5	Carbon foot print reduction	583	1.0052	13
PS4	Statutory compliance to human rights	582	1.0034	14
O6	Investment of technical and resources	574	0.9897	15
O4	Employee training and preparation	572	0.9862	16
O3	Organizational financial health	560	0.9655	17
E2	Market and social pressure	551	0.9500	18
E1	Governments pressure	491	0.8466	19
E3	Consumer concern	542	0.7476	20

W weight, *RII* relative information index

sustainability compliances, but the way market is moving towards over-supply, and the customer demands would be more vocal. The overseas buyers are already insisting on minimum compliances from their suppliers. The stakeholders have already started demanding reports on sustainability compliances in their board reviews.

Relative importance index

This section scans the relative importance index (RII) for 20 critical success factors. RII is calculated to get the ranks of the attributes in terms of their criticality as perceived by the respondents. It was performed on overall sample to identify the most critical success factors (Pradhan et al. 2016; Iyer and Jha 2005). The RII indicates the following factors to be the most critical in the implementation of SSCM:

- Compliance to environmental standards;
- Safety and health focus
- Top leadership commitment and support;
- Governance structure for sustainability; and
- Well-defined practices for sustainability tracking.

Table 11 provides the relative importance index for 20 critical success factors, based on the survey data.

Contribution and implication

This study contributed to SSCM literature through the exploration of SSCM practices. Critical success factors of sustainable supply chain management and their interrelationships with organizational sustainability performance in the Indian steel sector were examined in detail using quantitative data. A validated questionnaire was used to gather quantitative data. The results from the study support a sizable number of causal linkages among these four constructs. The results were in line with expectations to a large extent.

The findings of this study contribute to the theory and past research by suggesting that implementation of SSCM practices can improve the organization's economic, environmental and social performances. By adopting SSCM practices, an organization puts additional focus to reduce carbon foot print, air emissions, wastages, energy usages and material consumption. This, however, is not the unanimous finding from previous researches. The traditional view remains contrary, maintaining that sustainability initiatives lead to negative returns by increasing operational costs and burdens (Walley and Whitehead 1994). However, positive relationship has been found between SSCM strategies and organizational performance (Heese et al. 2005; Martin 2005).

Conclusion

This study focused on the identification of critical success factors for sustainable supply chain management in the context of Indian steel sector. A theoretical framework for SSCM along the four dimensions was recognized, an empirical study to validate the theoretical framework was conducted, and a list of CSFs for implementing SSCM in order of priority was summarized. The results of this empirical research can be summarized as follows:

- Organizational factors emerged as having a higher order of significance compared to external factors and they influence the SSCM practices which lead to improved sustainability performance.
- Among the organizational factors, top leadership commitment and support has a significant contribution in creating favourable organizational environment.
- The compliances to environmental standards (ISO 14001) and safety standards (OHSAS 18001) create a condition to facilitate SSCM practices in the organization.
- The external factors do not play a very significant role in influencing sustainability practices in the organization. However, market and customer sensitivity is very dynamic, and hence, organization cannot afford to neglect them.

Limitations and future research directions

Being one of the few initial studies of its kind for Indian steel sector on factors impacting the organizational sustainability practices and performance, we consciously did not extend the scope to the extended supply chain and customers, which should be taken up in some future study. A follow-up study is planned on the interdependence of various critical success factors and developing their relationships through structural equation modelling. The study is exploratory and further study on type, size and whether catering to domestic customers and in export market could throw additional factors. In the absence of proper secondary data, a comparative performance of organizations on sustainable supply chain practices could not be undertaken and work on developing sustainability index for Indian organizations can be undertaken in future.

Appendix 1: Summary of SSCM literature

See Table 12.

Table 12 Summary of literature review

Study	1	2	3	4	5	6
Carter and Jennings (2002)			X	X		X
Sarkis (2003)			X		X	
Li et al. (2006)				X		X
Jawahir et al. (2007)			X		X	
Linton et al. (2007)					X	X
Srivastava (2007)		X		X		
Hacking and Guthrie (2008)	X		X	X		
Seuring and Muller (2008)		X	X			X
Gold et al. (2010)	X			X	X	X
Mollenkopf et al. (2010)				X	X	X
Neves and Leal (2010)			X	X	X	
Sundarakani et al. (2010a)	X		X		X	X
Sundarakani et al. (2010b)			X	X	X	
Zhu et al. (2010)				X	X	
Carter and Easton (2011)	X	X	X			X
Sarkis et al. (2011)		X			X	X
Chan et al. (2012)				X	X	X
Čuček et al. (2012)		X		X	X	
Mayyas et al. (2012)	X	X			X	X
Mori and Christodoulou (2012)	X			X		
Roca and Searcy (2012)	X			X	X	
Zailani et al. (2012a)				X	X	
Zailani et al. (2012b)	X			X	X	
Ahi and Searcy (2013)	X	X				
Brindley and Oxborrow (2014)				X		X
Gaussin et al. (2013)		X		X	X	
Hasan (2013)			X		X	X
Herva and Roca (2013)		X		X		

Table 12 continued

Study	1	2	3	4	5	6
Seuring (2013)		X			X	
Brandenburg et al. (2014)		X		X		
Govindan et al. (2014)		X		X	X	X
Grimm et al. (2014)				X		X
Kuei et al. (2015)			X	X		
Luthra et al. (2015a)		X		X		
Huo et al. (2016)		X	X		X	X
Hussain et al. (2016)		X	X	X		X
Mani et al. (2016)		X		X	X	
Garg (2017)	X	X		X		
Qi et al. (2017)		X	X		X	

SSCM sustainable supply chain management; 1 is triple bottom line; 2 is literature review; 3 is framework design; 4 is sustainability indicators; 5 is manufacturing industry; and 6 is service industry

Table 14 Discriminant validity

EP	OIE	SSCMP	OSP	
EP	0.645			
OIE	0.200*	0.506		
SSCMP	0.310*	0.504*	0.509	
OSP	0.210*	0.470*	0.504*	0.565

Diagonal elements in the correlation matrix of constructs are the AVE values, and off diagonal are the squared inter-construct correlations. For discriminate validity to be present, the diagonal elements should be greater than the off diagonal

AVE average variance extracted, *EP* external pressure, *OIE* organizational internal environment, *SSCMP* sustainable supply chain management practices, *OSP* organizational sustainability performance

*The linkage is statistically significant at 1% probability level of significance

Appendix 2: Reliability, validity and non-response bias

See Tables 13, 14 and 15.

Table 13 Reliability statistics

Critical success	Factor	SL	CA	AVE	CR	Rho-A
EP	E1	0.664	0.733	0.645	0.843	0.796
	E2	0.864				
	E3	0.864				
OIE	O1	0.802	0.829	0.506	0.874	0.829
	O2	0.766				
	O3	0.666				
	O4	0.646				
	O5	0.416				
	O6	0.829				
	O7	0.770				
SSCM	S1	0.766	0.798	0.509	0.857	0.825
	S2	0.787				
	S3	0.771				
	S4	0.678				
OSP	PS1	0.693	0.742	0.565	0.838	0.744
	PS2	0.804				
	PS3	0.846				
	PS4	0.440				
	PS5	0.791				
	PS6	0.629				

Rho-A is used to check the co-linearity between constructs

SL standard loading, *CA* Cronbach alpha, *AVE* average variance extracted, *CR* composite reliability, EP is eternal pressures; *OIE* organizational internal environment, *SSCM* sustainable supply chain management practices, *OSP* organizational sustainability performance

Table 15 *t* test for non-response bias

Variable	*t* statistic for 80 responses (early)	*t* statistic for 45 responses (later)	*t* statistic for 145 responses (total)
E1	35.28	23.99	41.30
E2	39.49	32.77	51.16
E3	37.46	34.02	49.71
O1	58.12	49.24	75.60
O2	46.29	43.71	63.61
O3	40.97	38.51	54.92
O4	40.12	41.11	56.01
O5	51.09	40.30	64.75
O6	38.43	34.53	51.01
O7	43.10	50.57	63.63
S1	51.37	40.18	64.76
S2	39.94	43.71	58.23
S3	52.03	54.10	73.87
S4	45.03	46.76	62.56
PS1	55.63	54.10	76.47
PS2	59.78	52.27	79.13
PS3	56.02	50.73	75.30
PS4	43.64	29.14	50.33
PS5	45.57	43.91	62.31
PS6	57.75	48.96	75.76

t test results indicate no significant difference at $p < 5\%$

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