RANKING DIFFERENT ENABLERS/DRIVERS OF SUSTAINABLE SUPPLY CHAIN MANAGEMENT BY USING AHP IN INDIAN MANUFACTURING INDUSTRIES

Jayant Suresh Chaudhari
chaudharijay2000@gmail.com
Department of Mechanical Engineering
Lokmanya Tilak College of Engineering
Koparkhairne. Navi Mumba, University of Mumbai

Dr. Renu Wasu
renuwasu@gmail.com
Department of Applied Chemistry
Lokmanya Tilak College of Engineering
Koparkhairne. Navi Mumbai, University of Mumbai

Dr. Avinash Sarode
avinashsarode@gmail.com
Department of Mechanical Engineering
Lokmanya Tilak College of Engineering
Koparkhairne. Navi Mumbai, University of Mumbai

ABSTRACT

In a global economy characterized by environmental, social and economic factors, environmental sustainability is currently one of the main concerns of industry and the economic sector. A large number of periodicals and special volumes related to the sustainable supply chain have been published. This paper intends to identify the drivers for sustainable supply chain management (SSCM) implementation. Twenty-eight enablers were identified and categorized using an extensive literature survey to improve the effectiveness of SSCM implementation. The authors attempted to identify the drivers/enablers and constructed a framework, which analyzed the SSCM using the AHP.

Keywords: sustainable; supply chain; drivers/enabler; AHP

1. Introduction

For any country, economic development is supported by the growth of its manufacturing industries. Currently, manufacturing industries are experiencing tough competition. Each industry must strive to improve productivity in all of its spheres of activity in order to survive (Sarode & Khodke, 2011). Because of the environmental movement, the term sustainable development has evolved over the past 30 years. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Commission, 1987). Sustainability is considered an innovative approach, including changes in previous existing processes, new technology, improved methods of management, and new

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

production systems, which may bring changes in supply chain management (SCM). These possible areas of change include old policies, production activities, inventory of goods and product management, and dispatching (Jayaratne et al., 2011).

Currently, sustainability has become a global concern, and therefore, organizations are motivated to revisit their supply chain operations and consider their environmental and social impact (Capaldi, 2005). This has given rise to sustainability and SCM, green supply chain management (GSCM), as well as sustainable supply chain management (SSCM) (Ashby et al., 2012). The integration of sustainability into SCM began with a focus on merging "green" considerations with SCM practices. Therefore, SSCM is an extension of the GSCM concept. According to Carter and Rogers (2007), SSCM is the strategic, transparent integration and achievement of the social, environmental and economic objectives of an organization by the systematic coordination of key inter-organizational business processes to enhance each company's long-term economic performance and supply chain. Sustainability in supply chains needs to reduce the environmental, social and economic impact. Basically, enablers/drivers are defined in layman's terms as an entity that makes something possible or easy. Therefore, enablers for sustainable supply chains are processes that can drive a supply chain to be sustainable.

In this paper, we attempt to identify and rank the drivers/enablers for sustainable supply chains. In order to identify the enablers in SSCM, it is necessary to prepare a method that is capable of collecting the appropriate information. These enablers/drivers will be further incorporated into SSCM to facilitate decision-making. Therefore, the authors have identified 28 enablers to solve the above problem. The data was obtained from various manufacturing industries in India. Twenty enablers were categorized within the seven main criteria, which include regulation, society, market, environment, economic, corporate, organization. This paper ranks the enablers in the context of Indian manufacturing using the AHP with the goal of enhancing the supply chains.

The structure of this paper is as follows: the literature review is presented in section 2, while section 3 presents the solution methodology with the AHP framework. The ranking of the enablers/drivers are discussed in the results and discussion in section 4. Finally, section 5 summarizes the conclusion and future scope of research.

2. Literature review

This section reviews the literature on SSCM and identifies the enablers that are important to the execution of sustainable practices in Indian organizations. The literature review was used to identify gaps in the research.

Svensson (2007) presented an empirical study in order to illustrate the aspects of SCM through the expansion of existing theories, and introduced several new terms such as first, second, and n-order supply chains in order to enhance corporate efforts in SSCM. Faisal (2010) presented an approach to adapt sustainable practices in a supply chain by analyzing the dynamics between various enablers that help transform a supply chain into a truly sustainable entity. The ISM approach was used to present a hierarchy-based model. Wittstruck and Teuteberg (2010) contributed to the SSCM research by providing a model that explains which factors impact SSCM success and how SSCM should be

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

established to enable successful SSCM networks in electronic industries that provides benefits and successful results. Carter and Easton (2011) demonstrated that the environment is, of course, a key component of the triple bottom line and has been at the forefront of SSCM research on climate change. The SSCM field has evolved from independent social and environmental research to corporate social responsibility to the beginnings of a convergence of sustainability perspectives as the triple bottom line and the emergence of SSCM as a theoretical framework. Wolf (2011) concurred that the supply chain is a set of business entities that are directly involved in the upstream or downstream flow of products, services, and information from a source to a customer. This definition places the consumer at the end of the supply chain and reflects a linear production paradigm that assumes a constant input of natural resources. Diabat and Kannan (2011) developed a model of the drivers that affect the implementation of green supply chain management (GSCM) practices in organizations using an ISM methodology. Walker and Jones (2012) pointed out that there is a wide gap between what practitioners say and what they actually do about the sustainability of supply chains; often they only provide lip service to sustainable supply chain management. Chikanikova and Mont (2012) found that food retail sustainability in the supply chain could largely be explained as an approach to corporate risk management, and therefore, maintain a competitive position, i.e., compliance strategy and taxonomy development of drivers and barriers drawing on Hoffman's framework and analyzing their relative importance for the initiation of upstream, in-store and downstream sustainability initiatives. Zailani (2012) investigated the extent of implementation of sustainable supply chain management practices (environmental purchasing and sustainable packaging) and found that environmental purchasing has a positive effect on three categories of outcomes (economic, social and operational), whereas sustainable packaging has a positive effect on environmental, economic and social outcomes. Grzybowska (2012) identified the enablers of sustainability in supply chains and explored their mutual relationships. Sixteen enablers were identified, and top management and adequate adoption of reverse logistic practices (environmental performance) had the highest driving and dependence power. Gopalkrishnan et al. (2012) demonstrated that social and environmental initiatives can increase financial gains, thereby encouraging supply chains to take a positive approach to sustainability. Through a detailed literature review, Mathiyazhagan et al. (2013) identified pressures for GSCM implementation. Sixty-five pressures were identified and categorized into six major groups. Then, the most common acceptable pressures were identified and prioritized using the Analytical Hierarchy Process through a questionnaire survey from different industrial sectors.

Beske and Seuring (2014) identified five key categories that are highly important to SSCM as follows: orientation towards SCM and sustainability, continuity, collaboration, risk management, and proactivity. They also described distinctive practices that allow an organization to follow the goals formulated in the five key categories. Marshall et al. (2014) developed a multidimensional concept and measure of social and environmental SSCM practices based on a multi-stage procedure involving a literature review, expert Q-sort and pre-test process, pilot test and survey. Ali Diabat et al. (2014) found influential enablers for SSCM using Interpretive Structural Modelling (ISM) from thirteen recommended enablers in five Indian textile units located in southern India. These revealed that five enablers dominate the industry's practices including adoption of safety standards, adoption of green practices, community economic welfare, health and safety issues, and employment stability. Grimm et al. (2014) focused on the food industry and

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

helped overcome the complexities and unique challenges of sub-supplier management and identified 14 CSF's which were classified into focal firm, relationship, supply chain partner, and context-related CSFs. Through a literature review, Tay et al. (2014) identified the barriers and drivers of SSCM implementation and found that there are factors that have been documented to influence an organization in making a decision to implement SSCM. Luthra et al. (2014) analyzed six critical success factors to the implementation of GSCM to achieve sustainability, and four expected performance measures were extracted using factor analysis. Dubey and Gunasekaran (2015) attempted to develop a responsive sustainable supply chain network that can respond to a degree of uncertainty due to uncontrollable forces and developed a multi-objective MILP model to handle high uncertainties related to demand and supply. Stiller and Gold (2015) studied the neglected issue of how to include the social dimension of sustainability into SCM and developed some of the following categories through an analytical framework: reconceptualizing supply chain design, supply base continuity, decommodization, traditional supplier development, novel supplier development, transparency and traceability, and reward and incentive systems. Luthra and Haleem (2015) identified various hurdles in the implementation of SSCM in the Indian automotive industry. The ISM methodology was utilized to understand the contextual relationship among these identified hurdles, their interdependence, and the hierarchy levels to implement SSCM practices in the Indian automobile sector. Gopal and Thakkar (2016) analyzed twenty-five critical success factors (CSFs) based on organizational theory and modeled them to execute successful implementation of sustainable supply chain practices in the Indian automobile industry. Sarode and Kole (2016) found that environmental policy for GSCM, green design, initiation of top management support, involvement of suppliers and vendors in green practices, green manufacturing practices, reverse logistics, and recycling programs are the major subcritical factors according to the literature. Dubey et al. (2017) identified drivers for the adoption of SSCM, and proposed the use of TISM and a cross impact matrix-multiplication applied to classification (MICMAC) analysis to test a framework that extrapolates SSCM drivers and their relationships. Raut et al. (2017) tried to identify the numerous CSFs that are needed to implement SSCM practices, and attempted to explore the interdependence between them, which presented considerable challenges due to the complex nature of green practices, customers, suppliers, cost pressures and uncertainty of regulations. Mathiyazhagan et al. (2017) analyzed and prioritized the most important drivers for the implementation of GSCM in the Indian construction industry and 27 drivers were identified within seven categories. This paper tried to present a benchmarking framework for ranking the drivers for implementation of the GSCM.

From the above literature review, it is evident that the past research studies on the implementation of sustainable practices have been conducted in different countries and industries. Not many studies have covered the importance of SSCM implementation practices/issues in Indian manufacturing industries. Very few research studies have focused on the manufacturing industry, and fewer still have dealt with sustainable implementation practices. This shows that there is a research gap in the implementation of sustainable practices in the manufacturing sector. Table 1 lists the enablers/drivers derived from the literature.

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

Table 1
Enablers/drivers from literature

Drivers / Authors	Government Regulation	ISO 14001	NGO	Health & Safety	Competitiveness	Supplier Management	Adoption of Environmental Std.	Adoption of Green Practices	Green Design	Green Marketing	Green Packaging	Green Purchasing	Adoption of Safety std.	Initiation of Top management	Strategic Planning	Mutual Transparency	Collaborative with partners	Technology Management	Quality Management	Cost Performance	Rewards & incentives	Organization management	Organization capability effort	Employee involvement & training	Corporate Social Responsibility	Reverse Logistics	IT enablement	Logistics & transportation
Faisal (2010)	✓							✓						✓	✓	✓	✓						✓	✓				
Wolf (2011)			✓			✓								✓	✓							✓						
Gopalkrishnan et al. (2012)	✓			✓		✓								✓					✓	✓		✓		✓		✓		
Walker, Jones (2012)	✓		✓		✓		✓							✓	✓	✓			✓			✓		✓				
Wittstruck, Teuteberg (2012b)							✓					✓		✓	✓	✓											✓	
Buykozkan, Cifci (2013)						✓	✓				✓				✓	✓	✓	✓				✓		✓		✓	✓	
Beske, Seuring (2014)		✓			✓	✓	✓							✓		✓	✓	✓				✓			✓			
Chein, Sinh (2007)	✓								✓						✓							✓				✓		✓
Diabat et al. (2014), Mathiyazhgan, Kannan Devika	✓			✓				✓				✓	✓						✓	✓			✓					
Grim et al. (2014)						✓								✓			✓					✓						
Stiller & Gold (2014)						✓								✓		✓					✓		✓					
Chkanikova & Mont (2015)	✓		✓			✓									✓					✓								
Kuo-Chung Shang et al. (2015)						✓	✓	✓	✓		✓	✓		✓	✓							✓				✓		✓
Dubey (2015)							✓					✓				✓	✓					✓				✓		
Ferreira (2015)	✓						✓	✓	✓				✓	✓										✓		✓		
Jabbour (2015b)														✓		✓					✓	✓	✓	✓				
Luthra et al. (2015)	✓		✓		✓	✓		✓		✓		✓		✓	✓	✓		✓					✓	✓			✓	

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

ArefHervani, Joseph Sarkis (2005)						✓		✓		✓												✓	✓			✓		✓
Kole (2016)	✓		✓			✓	✓				✓			✓	✓						✓			✓		✓	✓	
Zailani, Jeyaraman (2012)								✓			✓	✓																
Diabat, Govindan (2010)	✓	✓							✓								✓		✓				✓			✓		
Svensson (2007)		✓					✓			✓		✓										✓			✓	✓		
Tay, Rahman, Aziz, Sidek (2014)	✓		✓		✓	✓	✓					✓		✓	✓	✓						✓		✓	✓			
Gopal, Thakkar (2016)	✓	✓			✓	✓										✓		✓				✓	✓		✓			
Pan jehfouladgar an (2014)						✓								✓	✓	✓	✓		✓	✓			✓	✓		✓	✓	
Marshall, McCarthy, McGrath (2014)															✓							✓			✓			
Dubey, Gunasekaran , Childe, Wamba (2016)									✓					✓	✓	✓	✓		✓				✓				✓	✓
Raut, Narkhede (2016)		✓	✓	✓	✓	✓			✓	✓		✓		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	

3. Methodology

The goal of this work is to investigate how SSCM practices influence the different dimensions of SSCM performance and the competitiveness of an organization based in India.

3.1 Overview of AHP

The Analytical Hierarchy Process (AHP) is a theory of general measurement used to derive relative scales from discrete and consistently matched comparisons. These comparisons are made using actual measurements or a baseline scale reflecting the relative strength of preferences and feelings. The AHP is particularly concerned about the inconsistency of discrepancy, its measurement, and the dependence of its structure within and among the elementary groups. It has found wider applications in multi-criteria decision-making, planning, resource allocation and conflict resolution. The AHP, in its general form, is a nonlinear framework for deductive and inductive reflection without the use of syllogism, and simultaneously accounts for several factors of synthesis or inference. T.L. Saaty developed the AHP at the Wharton School (Pennsylvania University, Philadelphia, Pennsylvania) between 1971-1975.

The AHP is a multi-criteria decision-making approach introduced by Saaty (1980) that consists of three main operations as follows: hierarchy construction, priority analysis, and consistency verification. The decision variables hierarchy is the subject of a pairwise AHP comparison. The pairwise comparisons are based on a nine-point scale that converts human preferences as equally, moderately, strongly, very strongly or extremely preferred.

3.1.1 Steps of the AHP methodology

1) To identify the enablers and structure the prioritization hierarchy model.
2) To prepare a questionnaire and gather data for the pairwise comparisons.
3) To determine the standardized weights in each category for each enabler and specific enablers.
4) To check the consistency of the judgments by calculating the consistency ratio (CR), and eventually revising the comparative matrices by asking experts if the consistency is too low in the judgments. If the CR is less than 0.1, the judgments will be consistent.
5) To synthesize and analyze the data using the AHP technique.

The acceptable CR range varies depending on the size of the matrix. The following guidelines are provided when making decisions based on the CR.

- When the CR value is equal to or less than the recommended value for a specific matrix size, the matrix evaluation is acceptable or has a good level of consistency in the comparative judgments represented in that matrix. This helps ensure the reliability of the decision-makers in determining the priorities of the criteria.
- If the CR is greater than the acceptable value, the judgments in that matrix are inconsistent and the evaluation process should be reviewed, reconsidered and improved.

3.2 Identification of the main and sub-drivers in SSCM

SSCM implementation has been attempted using several drivers that can enable a sustainable supply chain. Twenty-eight enablers/drivers were identified from the literature review and categorized into seven main categories as seen in Table 1 as follows:

1. Regulatory - These drivers are exercised in the form of standards, laws, procedures, and incentives of national or supranational (regional or international) regulatory institutions to promote sustainability practices.
2. Societal - These pressures help raise public awareness of various sustainability issues.
3. Market - Market drivers are responsible for the shape of the market which organizations consider a major concern.
4. Corporate - Integrating the principle of sustainability at a strategic level is the prerequisite for successfully achieving the sustainability goals of the organizations.
5. Environmental - This definition contains language that is related to the environmental dimension of sustainability, for example, product recycling and reuse, natural resource exploitation, water use, disposal of chemical wastes, product life-cycle impact, etc.

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

6. Economic - This definition includes language related to the economic dimension of sustainability. It may also include monetary savings in terms of reducing transportation costs, inventory management, logistics and freight, energy consumption, etc.
7. Organization – It has access to adequate resources and direct influence on the organization's motivation for sustainability.

Figure 1 is based on Table 1 and shows the number of studies that are focused on the enablers. This shows that the maximum number of studies considered the following enablers: initiation of top management, organization management, supplier management, strategic planning, and mutual transparency.

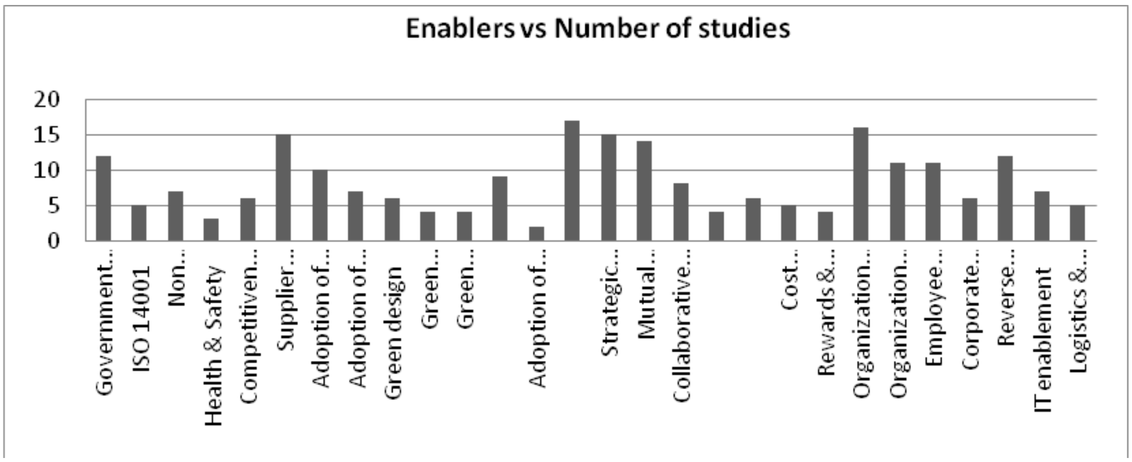

Figure 1 Enablers vs. number of studies

3.3 Framework for SSCM drivers

The AHP was used to prioritize the enablers for a sustainable supply chain. An AHP-based framework with four levels of hierarchy as shown in Figure 2 was developed. Level 1 of the hierarchy indicates the research objective, i.e., to analyze drivers/enablers for sustainability enhancement. Level 2 comprises a main driver/enabler category. In Level 3, the enablers/drivers are subcategorized. The last level of the hierarchy prioritizes the drivers/enablers.

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

Table 2
Abbreviation used in framework of SSCM

Drivers	**Abbreviation**	**Drivers**	**Abbreviation**
1.Regulation	**[REG]**	**5. Corporate**	**[COR]**
Government regulation	[REG 1]	Initiation of top management	[COR 1]
ISO 14000	[REG 2]	Strategic planning	[COR 2]
2. Society	**[SOC]**	Mutual transparency	[COR 3]
Non-government organization	[SOC 1]	Collaborative with partners	[COR 4]
Health & Safety	[SOC 2]	Technology management	[COR 5]
3. Market	**[MAR]**	Quality management	[COR 6]
Competitiveness	[MAR 1]	**6. Economic**	**[ECO]**
Supplier management	[MAR 2]	Cost performance	[ECO 1]
4. Environment	**[ENV]**	Rewards & incentives	[ECO 2]
Adoption of environment standard	[ENV1]	**7.Organization**	**[ORG]**
Adoption of green practices	[ENV 2]	Organization management	[ORG 1]
Green design	[ENV 3]	Organization capability effort	[ORG 2]
Green marketing	[ENV 4]	Employee training	[ORG 3]
Green packaging	[ENV 5]	Corporate social responsibility	[ORG 4]
Green purchasing	[ENV 6]	Reverse logistics	[ORG 5]
Adoption of safety standard	[ENV 7]	IT enablement	[ORG 6]
		Logistics & transportation	[ORG 7]

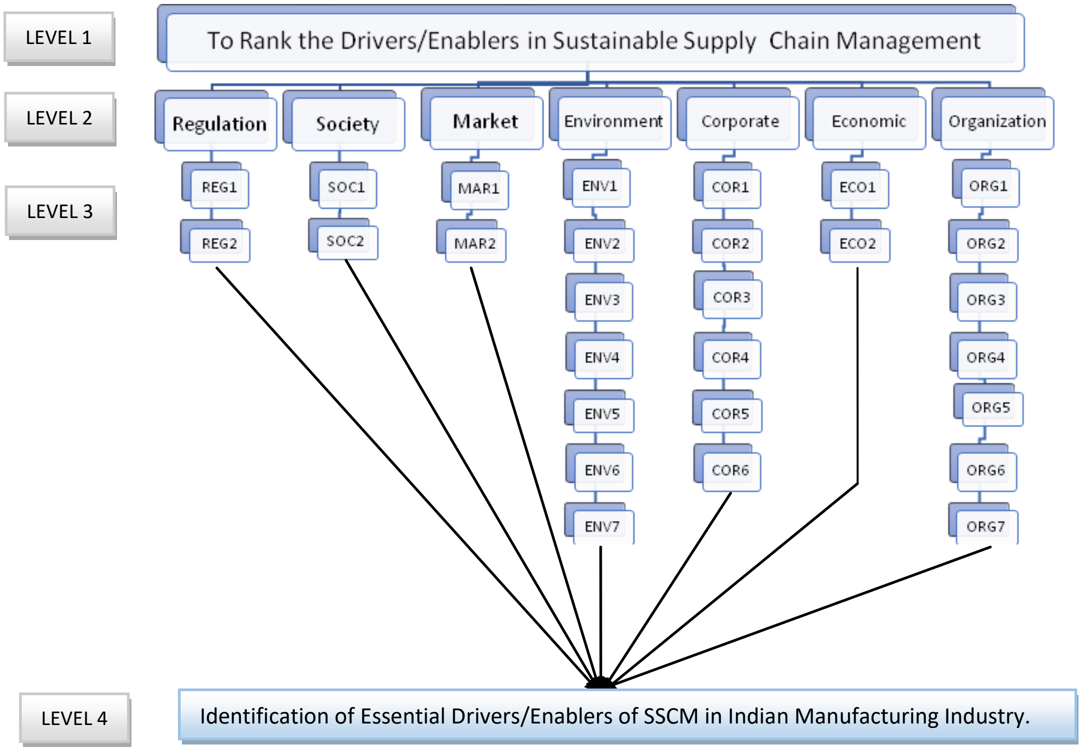

Figure 2 AHP framework for ranking the drivers in SSCM

3.4 Development of survey instrument

Based on the literature review, the list of drivers used in the SSCM was developed. In the pre-testing phase of the questionnaire, industry representatives were consulted about their views on drivers and sub drivers, which were selected for further study. Each sub driver in the questionnaire was most important to the main driver/enabler and was based on a five-point Likert scale. We performed two surveys; the first survey included an overview of all of the sub drivers, and the second survey consisted of pairwise comparisons among the main drivers with the AHP. Both of the questionnaires were divided into two sections; the first section collected organizational information, and the second section, which was the body of the survey was arranged in tabular format with multiple choice grid variables ranging from not important to very important, which represented the Likert scale and was used because it was easy for the respondent to understand. In the second survey of main drivers for pairwise comparison, Saaty's nine-point scale was used. This scale is used to assign relative weights to the pairwise comparisons between the main drivers.

3.5 Data collection

The data collection involved meeting manufacturing industries in India and sending them the questionnaire. Academicians and industry people with relevant subject matter expertise reviewed the questionnaire. We developed the pilot study using the first 15 responses, and subsequent follow-ups were done. Their responses were analyzed and incorporated into the questionnaire before it was executed. The data was collected using convenience sampling of 166 respondents who are top and middle level management

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

executives in industrial engineering, operations, and sustainable supply chain management. The questionnaires were designed to facilitate the data collection for the AHP and pairwise comparisons. The questionnaires were sent to relevant experts in 166 companies that were selected with the help of an Indian industry directory and through the internet. Of the total 166 questionnaires that were mailed out, 35 were returned by the end of four months, representing a response rate of 21.08%. To increase the response rate, a reminder was sent to each of the companies after two weeks and in some cases personal calls were also made. We received 12 additional responses after these reminders. Due to time constraints, we began our analysis with these 47 responses, which provided a response rate of 28.31% which was acceptable. A response rate of more than 20% is acceptable for data analysis (Malhotra & Grover, 1998).

3.6 Response from survey

We performed this survey based on Saaty's scale throughout manufacturing industries. We sent the questionnaire to the manufacturing industries and received responses from some of the targeted area. The pie chart in Figure 3 shows the number of years of experience that the respondents possessed. Thirty-two percent of the respondents had from 11-15 years of experience, 24% had from 16-20 years of experience, 23% had 6-10 years of experience, and 21% had less than 5 years.

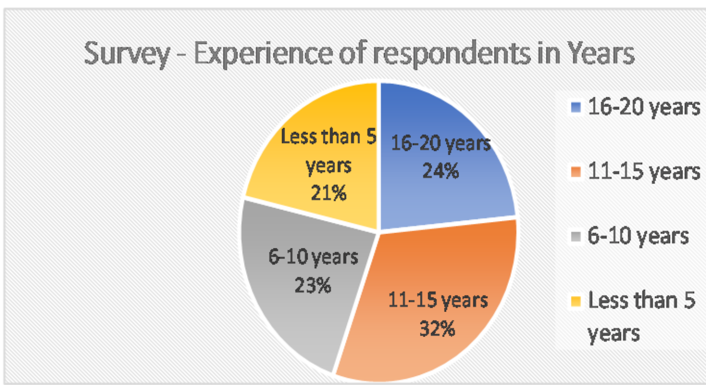

Figure 3 Aggregation of survey

4. Results and discussion

The collected data was processed using the AHP as described earlier. This section gives a stepwise processing of the data and discussion of the results.

4.1 Relative weights for SSCM drivers

The responses were collected by sending the questionnaire via Google survey and e-mail. The average values of the 47 responses were used to construct a matrix (7 x 7) for the pairwise comparisons as shown in Table 3.

Table 3
Pair wise comparison matrix for drivers

	REG	SC	MAR	ENV	COR	ECO	ORG
REG	1	1.53	2.21	3.67	2.78	2.92	3.86
SOC	0.65	1	1.96	2.65	3.10	2.87	2.89
MAR	0.45	0.51	1	1.97	2.04	2.62	2.78
ENV	0.27	0.37	0.5	1	2.04	2.88	2.15
COR	0.35	0.32	0.49	0.49	1	2.10	2.12
ECO	0.34	0.34	0.38	0.34	0.47	1	1.88
ORG	0.25	0.34	0.35	0.46	0.471	0.53	1
Column total	3.31	4.41	6.89	10.58	11.901	14.92	16.68

The relative importance of the row element with respect to the corresponding column element is indicated by each cell value in Table 4. If the row element dominates the column element, then the cell value is a decimal or otherwise. Likewise, the matrix's diagonal is unity, as a value compared to itself is 1. The values obtained in Table 4 were standardized by dividing each cell value by the total column in order to facilitate data handling. The standardized matrix is presented in Table 5.

Table 4
Normalized matrix for pairwise comparison of drivers

	REG	SOC	MAR	ENV	COR	ECO	ORG	Eigen/Priority vector
REG	0.302	0.346	0.32	0.346	0.233	0.195	0.231	0.281
SOC	0.196	0.226	0.44	0.250	0.26	0.192	0.173	0.248
MAR	0.135	0.115	0.145	0.186	0.171	0.175	0.166	0.156
ENV	0.081	0.083	0.072	0.094	0.171	0.193	0.128	0.117
COR	0.105	0.072	0.071	0.046	0.084	0.140	0.127	0.092
ECO	0.102	0.077	0.055	0.032	0.039	0.067	0.112	0.069
ORG	0.075	0.077	0.05	0.043	0.039	0.035	0.059	0.054
Column total	1	1	1	1	1	1	1	

Table 5
Calculation of λmax

	REG	**SOC**	**MAR**	**ENV**	**COR**	**ECO**	**ORG**	**Weighted Sum**	**Calculation of λmax**
	0.281	0.248	0.156	0.117	0.092	0.069	0.054		
REG	0.281	0.379	0.344	0.429	0.255	0.201	0.208	2.097	7.306
SOC	0.183	0.248	0.305	0.310	0.285	0.198	0.156	1.73	6.975
MAR	0.127	0.126	0.156	0.230	0.187	0.180	0.150	1.156	7.410
ENV	0.076	0.091	0.078	0.117	0.187	0.198	0.116	0.863	7.376
COR	0.099	0.079	0.076	0.057	0.092	0.144	0.114	0.661	7.184
ECO	0.096	0.084	0.059	0.039	0.043	0.069	0.101	0.491	7.115
ORG	0.07	0.084	0.054	0.053	0.043	0.036	0.054	0.394	7.296
							λmax		7.237

$$CI = \frac{\lambda max - n}{n-1}$$

CI = 0.0395

Consistency ratio(CR) = 0.029

The AHP's results are consolidated in Table 6, which shows the prioritization of the enablers in the sustainable supply chain. Manufacturing industries can focus on meaningful enablers to be more efficient in sustaining the market. The complete results of Table 6 with the global rank and local rank of the enablers/drivers are in Appendix 1. The top 15 results of these enablers are discussed below.

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

Table 6
Ranked drivers for SSCM in Indian manufacturing industries

Enablers	Priority weights for enablers	Global priority weights for enablers	Global Rank
Government regulation (REG 1)	0.826	0.232	1
Non-government organization (SOC 1)	0.741	0.183	2
Competitiveness (MAR 1)	0.848	0.132	3
Health & safety (SOC 2)	0.258	0.0639	4
ISO 14001 (REG 2)	0.173	0.0486	5
Adoption of environment standard (ENV 1)	0.355	0.0415	6
Initiation of top management (COR 1)	0.348	0.0301	7
Supplier management (MAR 2)	0.151	0.0235	8
Organization management (ORG 1)	0.409	0.022	9
Strategic planning (COR 2)	0.187	0.0172	10
Collaboration with partners (COR 4)	0.183	0.0168	11
Adoption of green practices (ENV 2)	0.143	0.0167	12
Mutual transparency (COR 3)	0.169	0.0164	13
Green design (ENV 3)	0.140	0..0163	14
Green marketing (ENV 4)	0.102	0.0119	15

4.2 Discussion

This section discusses the obtained results and presents some managerial implications of the research.

Regulation: Regulation drivers have a major impact on the sustainability approaches of organizations and may have the ability to dictate that organizations adopt certain sustainability practices. There are two enablers listed in this category. The regulation category (REG) received the highest priority weight (0.281). Government regulation (REG 1) ranked first in overall drivers (0.232) and ISO 14001 (REG 2) ranked fifth overall with 0.0486. These certifications are very important for companies as they enhance the company's image and show that their work or company is certified by the government.

Society: The society category (SOC) ranked second with a relative weight of 0.248. The society enablers help raise public awareness about various sustainability issues such as resource scarcity, environmental damage, human rights, social well-being, etc. In this category, there are two drivers listed. Non-governmental organizations (SOC 1) ranked

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

second overall (0.183), and health and safety (SOC 2) ranked fourth overall with a relative weight of (0.0639).

Market: The market category (MAR) ranked third overall with a priority weight of 0.156. The market category is responsible for the market shape, which is considered one of the main concerns of an organization. Competitiveness and supplier management are categorized within the market driver. Competitiveness (MAR 1) is ranked third (0.132) and supplier management (MAR 2) is ranked eighth (0.0235). Suppliers can provide valuable sustainable ideas and suggestions, but cooperation and integration in supply chains can more effectively support sustainability.

Environment: Environment was ranked fourth overall with a priority weight of 0.117. In the environment category, adoption of environment standards (ENV 1) obtained the highest rank and adoption of safety standards (ENV 7) received the lowest rank. Adoption of environment standards reduces the environmental impact of a company and improves operational efficiency and efficiency aspects (0.0415). Green practice adoption (ENV 2) had a relative weight of (0.0167), and green design (ENV 3) ranked 14th with a relative weight of 0.0163. Ecological design saves material and costs, reduces emissions, accidents, consumption of energy and waste. Green marketing (ENV 4) ranked 15th overall (0.0119). The use of plastic, as we all know, is harmful to the environment, which increases the need for green packaging (0.0094). Green purchasing (ENV 6) is a process that involves material reduction, reuse and recycling, with a relative weight of 0.0081.

Corporate: Integrating the principle of sustainability at a strategic level is the prerequisite for successfully achieving industrial sustainability goals. The relative weight of the corporate category (COR) is 0.092. Within this category, the initiation of top management (COR 1) is the most important and the least important is technology management (COR 6). Top management's commitment includes management's effort and financial support for sustainability implementation (0.0328) and ranked seventh. Strategic planning (COR 2) is an integral part of any organization and an important step in successfully implementing supply chain management (0.0172). In the supply chain, mutual transparency (COR 3) shapes the sourcing, procurement, logistics, partnerships and customer practices of industries or companies every day (0.0164). In the overall ranking, collaboration with partners (COR 4) ranked 11th (0.0168). Management of technology (COR 5) has a relative weight of 0.0053. In the context of supply chains, quality management (COR 6) is defined as a performance enhancement approach that is based on systems that leverage opportunities created by upstream and downstream connections with suppliers and customers (0.0057).

Economic: In the economic category, the cost performance driver (ECO 1) is more important than rewards and incentives (ECO 2). Sustainable practices include material reduction, reuse, and recycling, which in turn reduce the cost of purchasing materials, component manufacturing, production time, energy consumption, waste treatment, waste discharge and logistics (0.0044). Incentives, rewards, tax rebates, or soft loans will encourage companies to implement practices that are sustainable (0.0024).

Organization: In the organization category, there were seven sub categories of drivers. Organization management obtained the highest rank, and transportation ranked the lowest. There is a great need for organizational commitment (ORG 1) from top managers

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

and support from mid-level managers and other staff (0.022). Organizational capacity assessment (ORG 2) is necessary in order to implement green practices and evaluate the maintenance of sustainability in the organization (0.0108). In employee involvement and training (ORG 3), the awareness of senior members of management about the benefits of sustainability will help them make environmentally friendly decisions (0.0042). CSR (ORG 4) is an integral part of the process of wealth creation, although it does not provide the company with an immediate financial benefit. If properly managed, it will enhance business competitiveness and maximize returns (0.0054). Reverse logistics (ORG 5) addresses the reuse of the products related operations (0.0055) and includes refurbishing and remanufacturing activities. Process management enabled by IT (ORG 6) will be useful in strategic planning by giving access to information in real time (0.0036). Logistics and transportation (ORG 7) aims to organize forward distribution of transportation, warehousing, packaging and inventory management from the manufacturer to the consumer. Environmental considerations opened up recycling and disposal markets and led to an entirely new reverse logistics subsector (0.002). Table 6 shows the drivers as they are ranked by the AHP analysis.

Due to strict government and environmental regulations and the demands of environmental accountability, environmental issues have become an intrinsic part of strategic planning in organizations (Walton et al., 1998). A sustainable supply chain may help organizations gain a competitive advantage and secure the loyalty of all of the stakeholders in the coming years, including shareholders and investors (Gladwin, 1992). The top management of a firm and the decision-makers must know the importance of the various sustainable CSFs and the tools and techniques needed to implement them. The CSFs for sustainability have considerable challenges because of the complex nature of green practices, customer, supplier, cost pressures and regulation uncertainty. In fact, implementing sustainability practices is considered a thankless task that increases the overall cost of a product (Hsu et al., 2008). In general, developing countries implement sustainability practices that are enforced by legislation, and in developed countries, sustainability is used as a tool to reach out to socially and environmentally conscious customers and build a positive brand image (De Brito et al., 2008).

Luthra (2015) and Mathiyazhagan (2017) ranked a few enablers/drivers, while in this paper, we ranked the top fifteen enablers/drivers that will help Indian manufacturing industries/companies select the appropriate driver to improve their supply chain in the context of sustainable supply chain management.

5. Conclusion

A comprehensive literature review was conducted to identify various enablers/drivers that help implement SSCM practices. Based on the literature review, 28 drivers were identified and divided into seven categories These categories included regulation, society, market, environment, corporate, economic and organization. Government law/regulation, NGO, green design, green marketing, etc. were also identified as drivers. This study found that not all enablers/drivers have the same influence on the adoption of SSCM, and focused on enablers/drivers for SSCM from an Indian perspective. The results of this research successfully rank the AHP-based enablers/driver's priorities. This has provided a comprehensive industry solution for enabler identification and given a benchmark for the implementation of industrial SSCM. All of the pairwise comparisons made in the

AHP were based on the experts' opinions. The categorization of the drivers is not the final verdict on the subject, as many other relevant drivers could be identified and categorized depending on the goals and perspectives of future studies.

In addition, this study included only 28 enablers; hence, more enablers need to be considered in future studies using statistical methods for validation. The Analytic Network Process (ANP) and Interpretive Ranking Process (IRP) may be considered for further studies to determine the ranking of the main drivers and sub-drivers. In future studies, the fuzzy AHP, which is able to give experts the freedom to express their judgments through natural language, may be considered.

REFERENCES

Ahi P. & Searcy, C. (2013). A comparative literature analysis of definitions for green and sustainable supply chain management. *Journal of Cleaner Production*, *52*, 329-341. doi: https://doi.org/10.1016/j.jclepro.2013.02.018

Ahi, P. & Searcy, C. (2015). An analysis of metrics used to measure performance in green and sustainable supply chains. *Journal of Cleaner Production*, *86(1),* 360-371. doi: 10.1016/j.jclepro.2014.08.005

Ahmed N. (2003). Environmental concerns, efforts and impact: an empirical study. *Mid-American Journal of Business*, *18(1),* 61-69.

Ashby, A., Leat, M. & Smith M.H., (2012). Making connections: a review of supply chain management and sustainability literature. *Supply Chain Management: an International Journal*, *17(5),* 497-516. doi: https://doi.org/10.1108/13598541211258573

Beske, P., Land, A. & Seuring, S. (2014). Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. *International Journal of Production Economics*, *152*, 131-143. doi: https://doi.org/10.1016/j.ijpe.2013.12.026

Beske, P. & Seuring, S. (2014). Putting sustainability into supply chain management. *Supply Chain Management International Journal*, *19(3),* 322-331. doi: https://doi.org/10.1108/scm-12-2013-0432

Brandenburg, M., Govindan, K., Sarkis, J. & Seuring, S. (2014). Quantitative models for sustainable supply chain management: development and directions. *European Journal of Operation Research*, *233*, 299-312. doi: https://doi.org/10.1016/j.ejor.2013.09.032

Brundtland Commission, Our Common Future, Oxford University Press: Oxford, 1987.
Business for social responsibility (2007). Perspectives on information management in sustainable supply chains. http://www.bsr.org/reports/BSR_Info-Management-Supply-Chains.pdf

Capaldi, N. (2005). Corporate social responsibility and the bottom line. *International Journal of Social Economics*, *32(5),* 408-423. doi: https://doi.org/10.1108/03068290510591263

Carter, C. R. & Easton, P. L. (2011). Sustainable supply chain management: Evolution and future directions. *International Journal of Physical Distribution & Logistics Management*, *41(1),* 46-62. doi: https://doi.org/10.1108/09600030810882816

Carter, C. & Rogers, D. (2007). A framework of sustainable supply chain management: moving toward new theory. *International Journal of Physical Distribution and Logistics Management*, *38(5),* 360 – 387. doi: https://doi.org/10.1108/09600030810882816

Chaabane, A., Ramudhin, A. & Paquet, M. (2012). Design of sustainable supply chains under the emission trading scheme. *International Journal of Production Economics*, *135(1),* 37-49. doi: https://doi.org/10.1016/j.ijpe.2010.10.025

Chaudhari, J.S. & Sarode, A. D. (2018). Identification of drivers in sustainable supply chain management: A review. *International Journal of Research in Science & Engineering*, *4(2),* ISSN: 2394-8299.

Chkanikova, O. & Mont, O. (2015). Corporate supply chain responsibility: drivers and barriers for sustainable food retailing. *Corporate Social Responsibility Environment Management*, *22(2),* 65-82. doi: https://doi.org/10.1002/csr.1316

Clift, R. (2003*). Metrics for supply chain sustainability*. Springer-Verlag.

Corbett, C. J. & Kleindorfer, P.R. (2003). Environmental management and operations management: Introduction to the third special issue. *Production and Operations Management*, *12(3),* 287–289. doi: https://doi.org/10.1111/j.1937-5956.2003.tb00203.x

Daly, H. & Cobb, J. (1989). *For the common good: Redirecting the economy toward community, the environment and a sustainable future*. Boston: Beacon Press.

De Brito, M.P., Carbone, V. & Blanquart, C.M. (2008). Towards a sustainable fashion retail supply chain in Europe: organisation and performance. *International Journal of Production & Economics*, *114(2)*, 534–53. doi: https://doi.org/10.1016/j.ijpe.2007.06.012

Dehghanian, F. & Mansour, S. (2009). Designing sustainable recovery network of end-of-life products using genetic algorithm. *Resources, Conservation and Recycling, 53(10),* 559-570. doi: https://doi.org/10.1016/j.resconrec.2009.04.007

Diabat, A. & Govindan, K. (2011). An analysis of the drivers affecting the implementation of green supply chain management. *Resources, Conservation and Recycling*, *55*, 659-667. doi: https://doi.org/10.1016/j.resconrec.2010.12.002

Diabat, A., Kannan, D. & Mathiyazhagan, K. (2014). Analysis of enablers for implementation of sustainable supply chain management - a textile case. *Journal of Cleaner Production, 83*, 391-403. doi: https://doi.org/10.1016/j.jclepro.2014.06.081

Dubey, R., Gunasekaran, A. & Childe, S.J. (2015). The design of a responsive sustainable supply chain network under uncertainty. *International Journal of Advance Manufacturing Technology*, *80(1),* 427-445. doi: https://doi.org/10.1007/s00170-015-6967-8

Dubey, R., Gunasekaran, A., Papadopolus, T., Childe, S., Shibin, K. T. & Wamba, S. (2017). Sustainable supply chain management: framework and further directions. *Journal of Cleaner Production*, *142*, 1119-1130. doi: https://doi.org/10.1016/j.jclepro.2016.03.117

Elkington, J. (1997). Cannibals with forks: The triple bottom line of 21st century business. *Environmental Quality Management*, *2*, 37-51. doi: https://doi.org/10.1002/tqem.3310080106

Faisal, M.N. (2010). Sustainable supply chains: a study of interaction among the enablers. *Business Process Management Journal*, *16(3),* 508-529. doi: https://doi.org/10.1108/14637151011049476

Ferreira, M.A., Jabbour, C.J.C. & de Sousa Jabbour, A.B.L. (2015). Maturity levels of material cycles and waste management in a context of green supply chain management: an innovative framework and its application to Brazilian cases. *Journal of Material Cycles Waste Management*, *19,* 516-525. doi: https://doi.org/10.1007/s10163-015-0416-5

Gladwin, T. (1992). The meaning of greening: a plea for organizational theory. In Fischer K, Schott J. (Eds), Environmental strategies for industry. *Washington, DC: Island Press*.

Gopal, P.R.C. & Thakkar, J. (2016). Sustainable supply chain practices: an empirical investigation on Indian automobile industry. *Production Planning Control Management Operation*, *27(1),* 49-64.

Gopalakrishnan, K., Yusuf, Y.Y., Musa, A., Abubakar, T. & Ambursa, H.M. (2012). Sustainable supply chain management: a case study of British Aerospace (BAe) systems. *International Journal of Production Economics*, *140(1),* 193-203. doi: https://doi.org/10.1080/09537287.2015.1060368

Grimm, J.H., Hofstetter, J.S. & Sarkis, J. (2014). Critical factors for sub-supplier management: a sustainable food supply chains perspective. *International Journal of Production Economics*, *152*, 159-173. doi: https://doi.org/10.1016/j.ijpe.2013.12.011

Grover R., Grover, R., Rao, B. & Kejriwal, K. (2016). Supplier selection using sustainable criteria in sustainable supply chain management. *International Journal of Economics and Management Engineering*, *10(5),* 1775-1779.

Grzybowska, K. (2012). *Environment issues in supply chain management*. Springer-Verlag. Doi: 10.1007/978-3-642-23562-7_2

Hamidzera P. & Bahiroie, N. (2014). Role of critical success factors in sustainable supply chain management. *International Journal of Applied Research on Industrial Engineering*, *1(5/6)*, 320-328.

Hertwich, E. G. & Peters, G.P. (2009). Carbon footprint of nations: A global, trade-linked analysis. *Environment Science Technology*, *43(16),* 6414–6420. doi: https://doi.org/10.1021/es803496a

Hervani A. & Helms M. (2005). Performance measurement for green supply chain management. *Benchmarking: an International Journal*, *12(4),* 330-353. doi: https://doi.org/10.1108/14635770510609015

Hsu, C.W. & Hu, A.H. (2008). Green supply chain management in the electronic industry. *International Journal of Environment, Science and Technology*, *5(2),* 205–16.

Jayaratne, P., Styger, L. & Perera, N. (2011). Sustainable supply chain management: using the Sri Lankan tea industry as a pilot study. *25th Annual Australia New Zealand Academy of Management Conference*, *1*, 1-22.

Jinturkar, A., Deshmukh, S., Sarode, A., Sunapwar, V. & Khodke, P. (2014). Fuzzy-AHP approach to improve effectiveness of supply chain. In Kahraman, Öztayşi (Eds), *Supply Chain Management Under Fuzziness* (35-59). Springer. doi: https://doi.org/10.1007/978-3-642-53939-8_3

Kothari, C.R. (2004). *Research methodology: Methods and techniques*. Delhi: New Age International Publication.

Laroche M., Bergeronand, J., & Forleo, G.B. (2001). Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, *18(6),* 503-520. doi: https://doi.org/10.1108/eum0000000006155

Linton, J., Klassen, R. & Jayaram, V. (2007). Sustainable supply chains: An introduction. *Journal of Operations Management*, 25(6), 1075-1082. doi: https://doi.org/10.1016/j.jom.2007.01.012

Luthra, S. & Haleem A. (2015). Hurdles in implementing sustainable supply chain management: An analysis of Indian automobile sector. *Procedia – Social and Behavioral Sciences*, *189*, 175-183. doi: https://doi.org/10.1016/j.sbspro.2015.03.212

Luthra, S., Garg, D. & Haleem, A. (2014). Critical success factors of green supply chain management for achieving sustainability in Indian automobile industry. *Production Planning Control*, *26(5),* 339 -362.

Malhotra, M.K. & Grover, V. (1998). An assessment of survey research in POM: from constructs to theory, *Journal of Operations Management*, *16(4),* 407–425. doi: https://doi.org/10.1016/s0272-6963(98)00021-7

Markley, J. M & Davis, L. (2007). Exploring future competitive advantage through sustainable supply chains. *International Journal of Physical Distribution and Logistics Management*, *37(9),* 763-774. doi: https://doi.org/10.1108/09600030710840859

Marshall, D., McCarthy, L., Heavey, C. & McGrath, P. (2015). Environmental and social supply chain management sustainability practices: construct development and measurement. *Production Planning Control*, *26(8),* 673-690. doi: https://doi.org/10.1080/09537287.2014.963726

Mathiyazhagan, K., Dattta, U., Bhadauria, R., Singla, A. & Krishnamoorthi, S. (2017). Identification and prioritization of motivational factors for the green supply chain management adoption: case from Indian construction industries. *Operation Research Society of India*, *55(1),* 202-219. doi: https://doi.org/10.1007/s12597-017-0316-7

Mathiyazhagan, K., Govindan, K. & Haq, A. (2014). Pressure analysis for green supply chain management implementation in Indian industries using analytic hierarchy process.

International Journal of Production Research, *52(1)*, 188-202. doi: https://doi.org/10.1080/00207543.2013.831190

Muduli, K., & Barve, A. (2011). Role of green issues of mining supply chain on sustainable development. *International Journal of Innovation, Management and Technology, 2(6),* 484.

Rakesh, R., Narkhede, B. & Gardas, B. (2016). To identify the critical success factor of sustainable supply chain management practices in the context of oil and gas industries: ISM approach. *Renewable and Sustainable Energy Reviews*, *68*, 33-47. doi: https://doi.org/10.1016/j.rser.2016.09.067

Saaty, R. *Decision making in complex environments, The Analytic Network Process (ANP) for dependence and feedback*. SuperDecisions.

Seuring, S. & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, *16(15),* 1699-710.

Saaty T. L. & Ozdemir, M.S. (2003). Why the magic number seven plus or minus two. *Mathematical and Computer Modelling*, *38*, 233-244. doi: https://doi.org/10.1016/j.jclepro.2008.04.020

Saaty T. L. (1980). *The Analytic Hierarchy Process*. New York: McGraw-Hill.

Sarode A. D. & Khodke P. M. (2011). A framework for performance measurement of supply chain management. *International Journal of Advanced Engineering Technology*, *2(4),* 182-190.

Sarode A.D., Sunnapwar, V. K. & Khodke, P. M., (2008). A literature review for identification of performance measures for establishing a framework for performance measurement in supply chains. *International Journal of Applied Management and Technology*, *6(3),* 241-273.

Sarode, A.D., Adarsh, T.G. & Khodke, P.M. (2010). Development and validation of performance measures for vendor selection in Indian manufacturing industries. *Supply Chain Management Journal*, *2(26),* 31-34.

Sarode, A.D. & Kole, S. (2016). A literature overview on green supply chain management and critical factor. *International Journal of Advanced Engineering and Innovative Technology*, *3(1),* 1-5.

Sarode, A.D., Sunnapwar, V.K. & Khodke, P.M., (2010). Improving effectiveness of supply chain by selecting an appropriate supplier: an Analytic Hierarchy Process Approach. *International Journal Advance Manufacturing Systems*, *9(2)*, 129-144. doi: https://doi.org/10.1142/s0219686710001855

Shen, L., Muduli, K. & Barve, A. (2015). Developing a sustainable development framework in the context of mining industries: AHP approach. *Resource Policy*, *46*, 15-26. doi: https://doi.org/10.1016/j.resourpol.2013.10.006

Sodhi, M. & Tang, C. (2017). Corporate social sustainability in supply chains: a thematic analysis of the literature. *International Journal Production Research*. doi: 10.1080/00207543.2017.1388934

Srivastava (1995). The role of corporations in achieving ecological sustainability. *Academy of Management Review*, *20(4)*, 936-60.

Stiller, S. & Gold, S. (2014). Socially sustainable supply chain management practices in the Indian seed sector: a case study. *Supply Chain Forum International Journal*, *15(1)*, 52-67. doi: https://doi.org/10.1080/16258312.2014.11517333

Svensson, G. (2007). Aspects of sustainable supply chain management (SSCM): conceptual framework and empirical example. *Supply Chain Management International Journal*, *12(4)*, 262-266. doi: https://doi.org/10.1108/13598540710759781

Tay, M.Y., Rahman, A.A., Aziz, Y.A. & Sidek, S. (2015). A review on drivers and barriers towards sustainable supply chain practices. *International Journal of Social Science and Humanity*, *5(10)*, 892-897. doi: https://doi.org/10.7763/ijssh.2015.v5.575

Teuteberg, F. & Wittstruck, D. (2010). A systematic review of sustainable supply chain management research: What is there and what is missing? *MKWI 2010 – Corporate environment and sustainable management*, 1001-1015.

Walker, H. & Jones, N. (2012). Sustainable supply chain management across the UK private sector. *Supply Chain Management International Journal*, *17(1)*, 15-28. doi: https://doi.org/10.1108/13598541211212177

Walton, S.V., Handfield, R.B. & Melnyk, S.T. (1998). The green supply chain: integrating suppliers into environmental management process. *International Journal of Purchasing and Materials Management*, *34(1)*, 2-11. doi: https://doi.org/10.1111/j.1745-493X.1998.tb00042.x

Wittstruck, D. & Teuteberg, F. (2012). Understanding the success factors of sustainable supply chain management: empirical evidence from the electrics and electronics industry. *Corporate Social Responsibility Environment Management*, *19(3)*, 141-158. doi: https://doi.org/10.1002/csr.261

Wolf, J. (2011). Sustainable supply chain management integration: a qualitative analysis of the German manufacturing industry. *Journal of Business Ethics*, *102(2)*, 221-235. doi: https://doi.org/10.1007/s10551-011-0806-0

Zahir, S. (1999). Clusters in group: Decision making in the vector space formulation of the Analytic Hierarchy Process. *European Journal of Operational Research*, *112*, 620–634. doi: https://doi.org/10.1016/s0377-2217(98)00021-6

Zailani, S., Jeyaraman, K., Vengadasan, G. & Premkumar, R. (2012). Sustainable supply chain management (SSCM) in Malaysia: a survey. *International Journal of Production Economics*, *140(1)*, 330-340.

Appendix 1
Ranked drivers of SSCM in Indian manufacturing industries

Enabler Category	Priority weights for Enabler Category	Enablers	Priority weights for enablers	Global priority weights for enablers	Local Rank	Global Rank
Regulation (REG)	0.281	Government regulation (REG 1)	0.826	0.232	1	1
		ISO 14001 (REG 2)	0.173	0.0486	2	5
Society (SOC)	0.248	Non-government organization (SOC 1)	0.741	0.183	1	2
		Health & safety (SOC 2)	0.258	0.0639	2	4
Market (MAR)	0.156	Competitiveness (MAR 1)	0.848	0.132	1	3
		Supplier management (MAR 2)	0.151	0.0235	2	8
Environment (ENV)	0.117	Adoption of environment standard (ENV 1)	0.355	0.0415	1	6
		Adoption of green practices (ENV 2)	0.143	0.0167	2	12
		Green design (ENV 3)	0.140	0..0163	3	14
		Green marketing (ENV 4)	0.102	0.0119	4	15
		Green packaging (ENV 5)	0.081	0.0094	5	17
		Green purchasing (ENV 6)	0.070	0.0081	6	18
		Adoption of safety standard (ENV 7)	0.041	0.0047	7	23
Corporate (COR)	0.092	Initiation of top management (COR 1)	0.348	0.0301	1	7
		Strategic planning (COR 2)	0.187	0.0172	2	10
		Mutual transparency (COR 3)	0.169	0.0164	4	13
		Collaboration with partners (COR 4)	0.183	0.0168	3	11
		Technology management (COR 5)	0.058	0.0053	6	22
		Quality management (COR 6)	0.062	0.0057	5	19
Economic (ECO)	0.069	Cost performance (ECO 1)	0.064	0.0044	1	24
		Rewards and incentives (ECO 2)	0.035	0.0024	2	27
Organization (ORG)	0.054	Organization management (ORG 1)	0.409	0.022	1	9
		Organization capabilities effort (ORG 2)	0.200	0.0108	2	16
		Employee training (ORG 3)	0.079	0.0042	5	25
		Corporate social responsibility (ORG 4)	0.100	0.0054	4	21
		Reverse logistics (ORG 5)	0.103	0.0055	3	20
		IT enablement (ORG 6)	0.067	0.0036	6	26
		Logistics and transportation (ORG 7)	0.038	0.002	7	28

ISSN 1936-6744
https://doi.org/10.13033/ijahp.v12i2.711

Details of the calculations in Table 6 are given in Appendix 1. From the 47 responses, we calculated the geometric mean and eigen values for each of these drivers. Because the consistency indices were in the acceptable range, they did not need to be revised.