Green supply chain management: learning from Indian chemical sector

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Abstract: The purpose of this paper is to understand current and desired status of the environmental responsiveness of supply chains in India. The objective of this study is to explore the framework for GSCM implementation in Indian context. A self-administered questionnaire was developed containing three parts, i.e., GSCM drivers, GSCM practices and GSCM performance. The total sample size was 180 consisting of MSMEs in chemical business. The dimensions for GSCM drivers, practices and performance were explored and their interrelationships were analysed. It was found that GSMC drivers create significant impact on GSCM practices, which in turn creates significant impact on GSCM performance. Most relevant studies about framework for GSCM implementation has not addressed properly in Indian context. This new framework fills the gap of the absence of strategies for GSCM implementation in India.

Keywords: green supply chain management; GSCM drivers; GSCM practices; GSCM performance; environmental sustainability; supply chain management; India.

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1 Introduction

Sustainability is an emerging business that has shaped the competitive landscape and becoming drivers for innovation (Hazen et al., 2011). Today, companies have started recognising that environmental awareness can be a source of competitive advantage (Hu

and Hsu, 2010). Success in addressing environmental issues can provide new opportunities for new ways to add value to core business programs (Hansmann and Claudia, 2001). With the increased environmental concerns during the past decade, environmental pollution accompanying industrial development should be addressed together with supply chain management (Sheu et al., 2005). Greater importance of inter-organisational relationships has caused organisations to consider building competitive advantage by management of their supplier and customer partnerships and networks (Sarkis, 2012). Nikbakhsh (2009) mentioned that environmental sustainability practices in the supply chain are often referred to as green supply chain management (GSCM). van Hoek (1999) and Tundys (2018) argued that the most far-reaching approach of environmental management is to create value through GSCM. GSCM has gained momentum in recent years as a potential tool to counter the detrimental impacts of the supply chains (Shukla et al., 2009; Mujkić et al., 2018). Mollenkopf et al. (2010) claimed that GSCM is one of the most contemporary issues among supply chain trends. Gorane and Kant (2016) found GSCM as one of the most contemporary aspects related to supply chain in today's context. GSCM can be considered a relatively advanced management practice for organisations to improve their environmental performance (Zhu et al., 2010). GSCM integrates environmental concerns into supply chain management and has been increasingly accepted and practiced by forward-thinking organisations (Zhu and Sarkis, 2004). Jensen et al. (2013) explained that companies will experience an increasing pressure to reduce environmental impact from stakeholders throughout supply chain including customers/purchasers, governments and regulators, non-governmental organisations (NGOs), communities, shareholders, and even internally from company employees. GSCM as a form of environmental improvement is a strategic, operational and tactical initiative that many organisations are adopting to address environmental issues (Rao and Holt, 2005). A green supply chain focus requires working with suppliers and customers, analysis of internal operations and processes, environmental considerations in the product development process, and extended stewardship across products' life-cycles (Corbett and Klassen, 2006; Mollenkopf, 2006).

In India, industrial waste accounts for over 50% of total pollution caused in the country. In 2012, India's Environmental Performance Index (EPI) rank stood at a dismal 125 out of 132 countries ranked (Soda et al., 2015). EPI measures effectiveness of national environmental protection efforts, on the count of measurable outcomes such as emissions or deforestation rates rather than policy inputs, such as program budget expenditures, etc. India's poor rank indicates the miserable status of country's awareness of GSCM practices (Nimawat and Namdev, 2012). The status of pollution and wastage calls for adoption of GSCM measures on an immediate basis across the Indian industrial sector (Soda et al., 2015). Gorane and Kant (2016) also explored that GSCM practices have been moderately implemented in Indian organisations. Vijayvargy et al. (2017) found that GSCM practices are very low in Indian organisations.

In India, manufacturing sector which accounts for 16% of GDP is poised for growth and its share as percentage growth of GDP will go up to 25% by 2022, dominated by micro, small and medium enterprise (MSME) sector. MSMEs which accounted for 40% of industrial production, deployed limited pollution control technologies and were responsible for an estimated 70% of the total industrial pollution caused nationwide (OECD Report, 2006). Chemical sector is one of the major contributors in MSME in

India. The Indian chemical industry has been one of the driving forces for industrial growth and has contributed immensely to the social and economic development of the country. The MSME chemical manufacturers has grown phenomenally in the last three decades and manufactures wide range of organic chemical intermediates and finished products for varieties of sectors. Indian chemical manufacturers also have strong presence in export market. Often the Chemical Industry is found and perceived to be a significant contributor to the global environmental issues. The Indian government has classified chemical industry as one of the most polluting industry in country (Soda et al., 2015).

Table 1 Selected studies on interrelationship among GSCM drivers, practices and performance

Author	*Dimensions*	*Country*	*Industry*
Zhu et al. (2005)	Exploring and interrelationships among GSCM drivers, practices and performance	China	Manufacturing
Shukla et al. (2009)	Exploring and interrelationships among GSCM drivers, practices and performance	India	Automobile
Zhu et al. (2010)	Exploring and interrelationships among GSCM drivers, practices and performance	Japan	Manufacturing
Hu and Hsu (2010)	Critical factors for implementing GSCM	Taiwan	Electrical and electronics
Lee et al. (2012)	Exploring and interrelationships between GSCM practices and performance	Korea	SMEs in electronics
Perotti et al. (2012)	Exploring and interrelationships between GSCM practices and performance	Italy	3PLs
Green et al. (2012)	Exploring and interrelationships between GSCM practices and performance	USA	Manufacturing
Lo (2013)	Exploring and interrelationships between GSCM drivers and practices	Taiwan	Hi-Tech
Laosirihongthong et al. (2013)	Exploring and interrelationships between GSCM practices and performance	Thailand	Manufacturing
Drohomeretski et al. (2014)	Exploring and interrelationships between GSCM drivers and practices	Brazil	Automotive
Vanalle and Santos. (2014)	Exploring and interrelationships between GSCM practices and performance	Brazil	Automotive
Tachizawa et al. (2015)	Exploring and interrelationships among GSCM drivers, practices and performance	Spain	Multiple industries
Balasubramanian and Shukla (2017)	Exploring and interrelationships between GSCM drivers, practices and performance	UAE	Construction
Haq et al. (2017)	Exploring and interrelationships between GSCM drivers, practices	India	Plastic industry
Famiyeh et al. (2018)	Exploring and interrelationships between GSCM practices and performance	Ghana	Multiple industries
Petljak et al. (2018)	Exploring and interrelationships between GSCM practices and performance	Croatia	Food retailing

The chemical industry touches all facets of human lives and is an important source of world‘s energy and raw materials requirements. However, it has always been perceived as a contributor in degradation of environment across the globe and has been labelled as

dirty (handles non-renewable raw materials and generates hazardous wastes and emissions), dangerous (handles hazardous reagents and solvents) and demanding (multi-step material and energy intensive processes involving reworks and reprocessing), leading to excessive strain on environment, natural resources and human health. Indian chemical manufacturers face challenges in form of reducing energy intensity of their operations, minimising pollution, increasing the share of eco-friendly and recyclable products in their portfolio and diversifying their raw material base to include bio-feedstock.

Environmental pressures and globalisation have been driving Indian governments to include MSMEs in chemical sector for environmental improvement process of entire supply chains. The involvement of MSME suppliers is vitally important in achieving national or corporate environmental targets (Holt et al., 2001). Seen from a life-cycle perspective (Zhu and Sarkis, 2006), it is difficult to achieve the goal of GSCM without the deep involvement of supply chain partners. In other words, it is crucial to include MSME suppliers in the supply chain-wide environmental improvement process (Lee, 2008). In past, few authors have signified the importance of GSCM in MSME sector (Clark, 2000; Hemel and Cramer, 2002; Hitchens et al., 2003; Rao, 2007 and Lee, 2008). However, few authors have highlighted the challenges for MSMs in adoption of green practices, i.e., lack of technical know-how, lack of managerial competence, lack of government support, cost implications, unawareness of employees and customers, lack of organisational support, lack of information, lack of human and financial resources (Lee, 2008; Gorane and Kant, 2016). These challenges lead to create bottleneck problems in pursuing a goal of green supply chain.

A growing number of GSCM studies have dealt with the GSCM drivers, practices and performance (refer Table 1). Out of this, only few researchers have studied the complete interrelationships among GSCM drivers, practices and performance. However, these scholarly works have primarily focused on large-sized buying firms. Again, there is a lack of research on GSCM drivers, practices and performance in Indian context (Dubey et al., 2017). Vijayvargy et al. (2017) in their research found that GSCM practices are very low in MSME in India. So, it is important to study the GSCM drivers, practices and performance and their interrelationships in Indian context. This study focuses on GSCM drivers, practices and performance and interrelationships for MSMEs in chemical sector in India.

2 Literature review

2.1 GSCM

GSCM as an initiative that is mainly aimed to reduce environmental impacts of sourcing, production, and distribution activities along the supply chain has been gaining interest among researchers and practitioners (Famiyeh et al., 2018). GSCM has been referred differently in literature such as, sustainable supply network management (Cruz and Matsypura, 2009), corporate social responsibility network (Kovacs, 204), supply chain environmental management (Sharfman et al., 2009), green purchasing and procurement (Carter et al., 2000), environmental purchasing (Carter et al., 2000), green logistics

(Murphy and Poist, 2000) and sustainable supply chain (Linton et al., 2007). Green supply chain strategies refer to efforts to minimise the negative impact of firms and their supply chains on the natural environment (Mollenkopf et al., 2010). Table 2 summarises selected definitions of GSCM by different authors.

Table 2 Selected definitions of GSCM

Definitions	*References*
Environmental/GSCM consists of the purchasing function's involvement in activities that include reduction, recycling, reuse and the substitution of materials	Narasimhan and Carter (1998)
GSCM is defined as: green supply chain management (GSCM) = (green purchasing + green manufacturing/materials management + green distribution / marketing + reverse logistics)	Hervani et al. (2005)
GSCM covers all phases of the product's life cycle from design, production and distribution phases to the use of products by the end users and its disposal at the end of the product's life cycle	Zhu and Sarkis (2006)
GSCM is an integrating environment thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers, and end-of-life management of the product after its useful life	Srivastava (2007)
GSCM ranges from green purchasing (GP) to integrated life cycle management supply chains flowing from supplier, through to manufacturer, customer and closing the loop with reverse logistics	Zhu et al. (2008b)
Green supply chain management is all encompassing, strategic set of actions taken by collaborating partners and stakeholders of an ultimate supply chain to mitigate and/or eliminate the detrimental impacts of all business activities, spanning across the chain, on the environment and thereby ensuring the sustainability	Shukla et al. (2009)
GSCM (the integration of both environmental and SCM) is a proven way to reduce a company's impact on the environment while improving business performance	Torielli et al. (2011)

The conceptual literature supports the proposition that GSCM leads to competitive advantage (Rao and Holt, 2005). GSCM has emerged as an important new archetype for enterprises to achieve profit and market share objectives by lowering their environmental risks and impacts and while raising their ecological efficiency (Zhu et al., 2005). Hu and Hsu (2010) argued that GSCM has emerged as an important new approach for enterprises to achieve profit and market share objectives by reducing environmental risk and impact. GSCM approaches can prepare enterprises for superior longer-term performance through improved management of environmental risks and development of capabilities for continuous environmental improvement (Tundys, 2018). GSCM can also promote efficiency and synergy among business partners and their lead corporations, and helps to enhance environmental performance, minimise waste and achieve cost saving (Rao and Holt, 2005). They further mentioned that GSCM initiative creates synergy among business partners (Tundys and Rzeczyck, 2015) and this synergy is expected to enhance the corporate image, competitive advantage and marketing exposure. GSCM aims to maximise overall environmental profit by adopting a life cycle approach through product

design, material selection, manufacturing, and sales and recovery, and therefore helps the firm to realise its sustainable development and improvement (Shi et al., 2012). The increasing acceptance and the importance of GSCM have been considerably driven by increasing environmental concerns, such as environmental pollution resulting from production and consumption issues around the world (Sheu et al., 2005), diminishing raw material resources, overflowing waste sites, and increasing levels of pollution (Srivastava, 2007). Vijavargy et al. (2015) mentioned that adoption of GSCM leads to minimise waste and scrap, improved financial performance by recycling and reusability, customer retention, competitive advantage, customer attraction, responding to social pressure, improved productivity and efficiency, risk management, improving economic performance and market image. De-Souza et al. (2019) explained that sustainable supply chain can lead to minimising environmental impacts while maximising profit.

2.2 GSCM drivers

Firms are pressured by stakeholders to be more environmentally conscious and to integrate environmental management into their processes and corporate strategies (Mollenkopf et al., 2010). Investigation of pressures and drivers for adoption and improving environmental performance arises from a number of external and internal groups or 'stakeholders' (Zhu et al., 2005). Vanpoucke et al. (2016) explained the factors affecting GSCM in two categories, namely internal stakeholders and external stakeholders. Internal stakeholders are stakeholders with the most authority to determine the way firms operate. Typical examples include vision, values, policies, employees, top management and shareholders, External stakeholders include suppliers, customers, regulators, competitors and society. Each of these internal and external stakeholders influence the operations of a company and the environmental goals and programs developed.

DiMaggio and Powell (1983) presented an institutional theory that suggests that environmental alignment may be influenced by three pressures: normative, coercive and mimetic. All institutional pressures (normative, coercive and mimetic) have the capacity to influence an organisation's responsiveness to the adoption of new practices. The literature review shows that these constructs collectively drive organisations to adopt green supply chains initiatives (Corral, 2003; Zhu et al., 2005; Tsoulfas and Pappis, 2008; Sarkis et al., 2011; Singh et al., 2016; Dubey and Bag, 2013). This has been signified by Tate et al. (2010). Huang et al. (2015) explained that institutional theory suggests that suppliers are more likely for environmental practices if coercive, normative and mimetic institutional forces are in play. Similar approach has been followed by Tachizawa et al. (2015) to explore the drivers of GSCM. Earlier, Hsu et al. (2013) added fourth dimension cultural-cognitive. Normative pressures are typically exerted by internal or external stakeholders who have a vested interest in the organisation. Good environmental image and social acceptance are essential to maintain or gain market share. Second, conformity through coercive pressures occurs through influence exerted by those in power. Government agencies are examples of powerful groups that may influence the actions of an organisation (Rivera, 2004). Third, mimetic pressures occur when an organisation mimics the actions of successful competitors in the industry. Firms may force to follow competitors merely because of their success else they mimic or generate negative publicity. Fourth, socio-cultural dimension occurs when society starts pressurising organisational practices.

Table 3 Summary of GSCM drivers

Drivers	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*16*	*18*
Social pressure										×								
Customer pressure			×															
Organisational environment													×					
Channel pressure																		
Organisational culture	×										×				×			
Competitive pressure						×												
Legal/regulatory factors				×						×				×		×		
Top management support		×			×		×					×						×
Environmental reputation																		
Non-government organisations																		
Green motivation																		
Supplier cooperation										×							×	
Expected business gains								×	×									

Notes: 1: Bowen et al. (2001), 2: Chan et al. (2012), 3: Christmann and Taylor (2001), 4: Delmas (2002), 5: Despeisse et al. (2012), 6: Dubey et al. (2017), 7: Dues et al. (2013), 8: Eltayeb and Zailani (2009), 9: Eltayeb et al. (2011), 10: Esty and Winston (2006), 11: Fernández et al. (2003), 12: Green et al. (2012), 13: Hansen et al. (2004), 14: Holt and Ghobadian (2009), 15: Jabbour and Santos (2008), 16: Kumar et al. (2012), 17: Large and Gimenez Thomsen (2011), 18: Law and Gunasekaran (2012), 19: Lee (2008), 20: Lee et al. (2012), 21: Mollenkopf et al. (2010), 22: Muduli et al. (2013a, 2013b), 23: Al-Rafaie and Momani (2018), 24: Seuring and Müller (2008), 25: Shukla et al. (2009), 26: Singh et al. (2012), 27: Tachizawa et al. (2015), 28: Vachon and Klassen (2008), 29: van Hoof and Lyon (2013), 30: Vanpoucke et al. (2016), 31: Walker et al. (2008), 32: Wee and Quazi (2005), 33: Wiengarten et al. (2012) 34: Zhu et al. (2005), 35: Zhu et al. (2007) and 36: Zhu et al. (2008b).

Table 3 Summary of GSCM drivers (continued)

Drivers	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*
Social pressure					×		×		×				×					
Customer pressure					×		×		×						×			×
Organisational environment							×											
Channel pressure	×	×							×									
Organisational culture																×		
Competitive pressure					×				×						×		×	
Legal/regulatory factors					×	×	×		×				×			×		
Top management support					×			×	×		×		×					
Environmental reputation			×															
Non-government organisations			×						×			×						
Green motivation				×										×				
Supplier cooperation										×			×					
Expected business gains																		

Notes: 1: Bowen et al. (2001), 2: Chan et al. (2012), 3: Christmann and Taylor (2001), 4: Delmas (2002), 5: Despeisse et al. (2012), 6: Dubey et al. (2017), 7: Dues et al. (2013), 8: Eltayeb and Zailani (2009), 9: Eltayeb et al. (2011), 10: Esty and Winston (2006), 11: Fernández et al. (2003), 12: Green et al. (2012), 13: Hansen et al. (2004), 14: Holt and Ghobadian (2009), 15: Jabbour and Santos (2008), 16: Kumar et al. (2012), 17: Large and Gimenez Thomsen (2011), 18: Law and Gunasekaran (2012), 19: Lee (2008), 20: Lee et al. (2012), 21: Mollenkopf et al. (2010), 22: Muduli et al. (2013a, 2013b), 23: Al-Rafaie and Momani (2018), 24: Seuring and Müller (2008), 25: Shukla et al. (2009), 26: Singh et al. (2012), 27: Tachizawa et al. (2015), 28: Vachon and Klassen (2008), 29: van Hoof and Lyon (2013), 30: Vanpoucke et al. (2016), 31: Walker et al. (2008), 32: Wee and Quazi (2005), 33: Wiengarten et al. (2012) 34: Zhu et al. (2005), 35: Zhu et al. (2007) and 36: Zhu et al. (2008b).

In past, several researchers have explored the drivers for adoption of GSCM. A large amount of literature is available signifying the various drivers of implementing GSCM (refer Table 3). Bowen et al. (2001) examined the relationship between supply management competencies and GSCM practices and identified internal drivers for implementing GSCM policies like corporate environmental proactivity, strategic purchasing and supply and supply management capabilities. Wee and Quazi (2005) obtained seven critical factors in their research into environmental management, namely, total involvement of employees, green products/process design, top management commitment, training, measurement, information management, and supplier management. Zhu et al. (2007) pointed out drivers and barriers for green practices namely regulations, elimination, or reduction of liabilities in products and services, customer demands, corporative image, internal cost reduction pressure, and technological offers from partners. Zhu and Sarkis (2007) studied the effects of institutional pressures in terms of internal and external factors on the performance of green supply chains. Lee (2008) acknowledged the main drivers for organisations to contribute to the GSCM implementation as government involvement, buyer influence, and GSCM willingness. Zhu et al. (2008b) examined the correlation of two major factors, organisational learning and management support, to the extent of acceptance of GSCM practices. Walker et al. (2008) identified the factors that drive or hinder organisations to implement GSCM. These include internal drivers such as: organisational factors, and external drivers such as society, customers, competitors, suppliers, society and regulatory. Diabat and Govindan (2011) analyse 11 drivers which affect GSCM implementation. These are ISO 14001 certification, environmental collaboration with suppliers, certification of suppliers' environmental management system, green design, reducing energy consumption, government regulation and legislation, integrating quality environmental management into planning and operation process, collaboration between product designers and suppliers to reduce and eliminate product environmental impacts, reverse logistics, reusing and recycling materials and packaging, and environmental collaboration with customers. Lo (2013) explored drivers of implementing GSCM namely, top management support, customer acceptance, government legislation, supplier cooperation and competitors' pressure. Dubey et al. (2015a, 2015b) identified drivers in terms of different enablers of GSCM. Singh et al. (2016) found the factors affecting successful implementation of green supply chain practices.

2.3 GSCM practices

The term GSCM practices are commonly used in the research literature to refer to a variety of activities performed by an organisation (refer Table 4) in order to minimise their impact on the natural environment (Sarkis et al., 2010). GSCM can be achieved through different types of green practices. The execution of green practices can influence the design, strategy, and operation of the supply chain (Sellitto, 2018). Testa and Iraldo (2010) mentioned that implementation of GSCM practices leads to gain operational efficiency and greater competitiveness. Sellitto et al. (2019) mentioned that GSCM practices include actions of focal company, suppliers, distributors, retailers, and customers. Zhu et al (2008b) and Sarkis et al. (2010) mentioned that GSCM practices include both intra-organisational and inter-organisational practices. The inclusion of intra-organisational and inter-organisational activities into GSCM practices has been

investigated by many authors (Perrotti et al., 2012). Lee et al. (2012) found that implementation of GSCM practices leads to improve inter-organisational relationships. Mollenkopf et al. (2010) earlier explained that taking intra and inter-organisational context of GSCM practices leads to create sustainable competitive advantage. Green et al. (2012) found that it is imperative to or organisation to implement GSCM practices in collaboration with supplier and customers to improve organisational performance. Zhu and Sarkis (2006), in their study, mentioned five underlying dimensions of GSCM practices – internal environmental management, green purchasing, cooperation with customers, investment recovery and eco-design. Internal environmental management includes top management commitment, support from mid-level managers, cross-functional co-operation, environmental compliance and auditing (Zhu et al., 2005). Holt et al. (2009) mentioned that internal environment consists of corporate environmental management practices. The most frequently cited predictor GSCM implementation is the proactivity of the firm's corporate environmental approach (Hervani et al., 2005). Bowen et al. (2001) mentioned that positive organisational approach towards green purchasing and selling leads to health GSCM practices. Green purchasing includes providing environmental friendly design specifications to suppliers; cooperation with suppliers, environmental audit for supplier' internal management and suppliers ISO certification. Tiwari et al. (2019) did a comprehensive review and found sustainable procurement as an important aspect of supply chain management. Cooperation with customers on GSCM practices involves activities among supply chain players such as a corporation with customers for eco-design, cleaner production, and demand for less energy consuming products during transportation (Famiyeh et al., 2018). Eco-design is defined as the development of products which are more durable, energy efficient; avoiding the use of toxic materials and those which can be easily disassembled for recycling (Gottberg et al., 2006). It provides opportunities to minimise waste and improve the efficiency of resource consumption through modifications to product size, serviceable life, recyclability and utilisation characteristics. The investment recovery aspects of the GSCM practices involve the extent to which organisations take steps to initiate the sales of excess inventories, scrap, used materials, and excess capital equipment (Zhu et al., 2008a).

Table 4 Summary of GSCM practices

Practices	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
Green supplies and audit			×	×						×	×			×
Green designing	×	×	×		×		×	×			×			
Green environment policy			×	×							×			

Notes: 1: Balasubramanian and Shukla (2017), 2: Green et al. (2012), 3: Hervani et al. (2005), 4: Holt and Ghoadian (2009), 5: Hsu et al. (2013), 6: Kirchoff et al. (2016), 7: Lo (2013), 8: Luthra et al. (2014), 9: Perotti et al. (2012), 10: Sarkis et al. (2010), 11: Tachizawa et al. (2015), 12: Zhu and Sarkis (2006) 13: Zhu et al. (2005) and 14: Zhu et al. (2010).

Table 4 Summary of GSCM practices (continued)

Practices	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*
Planning and finance		×	×									×		
Environmental awareness			×	×										
Green processes	×		×				×	×			×			
Green purchasing	×	×	×		×	×	×	×						×
Internal environmental management		×	×	×		×							×	×
Cooperation with customers		×	×			×								×
Investment recovery		×	×			×							×	
Eco-design		×	×			×							×	
External environment			×			×							×	
Green information system		×	×											
Green distribution	×		×					×	×					
Green warehousing			×						×					
Reverse logistics			×						×					

Notes: 1: Balasubramanian and Shukla (2017), 2: Green et al. (2012), 3: Hervani et al. (2005), 4: Holt and Ghoadian (2009), 5: Hsu et al. (2013), 6: Kirchoff et al. (2016), 7: Lo (2013), 8: Luthra et al. (2014), 9: Perotti et al. (2012), 10: Sarkis et al. (2010), 11: Tachizawa et al. (2015), 12: Zhu and Sarkis (2006) 13: Zhu et al. (2005) and 14: Zhu et al. (2010).

2.4 GSCM performance

GSCM performance is an indicator of the degree to which sustainable practices are embedded within the company and across the SC (Roehrich et al., 2017). Traditionally, the focal point in definition of value has been the end customers in terms of framing value as a trade-off between customer benefit and cost (Jensen et al., 2013). Earlier, several researchers claimed that there are several dimensions to measure value for the firm (Amit and Zott, 2001). Recently, many authors have claimed environmental organisational performance as one of the important values for the firm (Hervani et al., 2005; Shukla et al., 2009; Zhu et al., 2010; Lee et al., 2012; Perotti et al., 2012; Shi et al., 2012; Green et al., 2012; Dubey et al., 2017; Roehrich et al., 2017; Famiyeh et al., 2018).

Björklund et al. (2012) mentioned the lack of knowledge to measure environmental performance in supply chain management. Cuthbertson and Piotrowicz (2008) descried that performance measurement approaches seldom include environmental aspects. Earlier, Hervani et al. (2005) argued that GSCM performance measurements have not been developed properly. Vachon and Klassen (2008) explained that the development of GSCM performance measurement tool is one of the most important issues in field of supply chain management. Perroti et al. (2012) found that there is a strong need to develop the measures of GSCM performance. Jensen et al. (2013) further explained the strong need to develop basic framework for analysing the potential development in value offerings when introducing green innovations in a supply chain. Several researchers have defined the value creation in context of GSCM (refer Table 5). In this context, Hervani et al. (2005) mentioned that there are difficulties within organisation and in inter-organisational environmental performance measurement. These difficulties further increase due to various measurement taxonomies like strategic, tactical, or operational; tangible versus intangible measures; variations in collection and reporting; an organisation's location along the supply chain or functional differentiation within organisations. Gunasekaran et al. (2004) highlighted several issues in designing performance measurement system: successful implementation requires organisation-wide coordination; to monitor performance each metric must take a supply chain perspective; each entity in the supply chain should be measured and improved with common goals; non-financial metrics are gaining more attention than financial ones; and additional and creative efforts are needed to design new measures.

Table 5 Summary of GSCM performance

Performance	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Financial/economic performance	×		×	×	×	×	×	×	×	×	×	×	×		×
Operational performance			×	×		×		×	×		×		×		×
Environmental performance	×			×			×		×		×		×		×
Market and product performance				×	×	×	×			×					
Competitive performance				×					×	×	×	×			×
Social performance	×	×								×	×	×		×	

Notes: 1: Dubey et al. (2017), 2: Eltayeb et al. (2011), 3: Famiyeh et al. (2018), 4: Green et al. (2012), 5: Hervani et al. (2005), 6: Kazancoglu et al. (2018), 7: Kirchoff et al. (2016), 8: Lee et al. (2012), 9: Perotti et al. (2012), 10: Roehrich et al. (2017), 11: Shi et al. (2012), 12: Shukla et al. (2009), 13: Vijayvargy et al. (2017), 14: Zailani et al. (2012) and 15: Zhu et al. (2010).

3 Objectives of the study

The objective of this study is to explore the dimensions of GSCM drivers, practices and performance in Indian context. This study also aims to determine the interrelationships

among GSCM drivers, practices and performance and finally to suggests the measures to improve GSCM practices in India.

4 Research methodology

4.1 Questionnaire development

A detailed questionnaire was developed for the empirical data collection based on the existing literature and similar studies done in other parts of the world. The instrument contained three different sections:

a Attributes related to pressures/drivers that prompt organisation to adopt GSCM practices were taken mainly from previous work of Tachizawa et al. (2015). Some additional dimensions were included based on other literature review.

b The four dimensions of GSCM practices namely internal environmental management, external environmental management, eco-design and investment recovery were taken from previous work of Zhu et al. (2005) and other two dimensions distribution and warehousing and reverse logistics were taken from previous work of Perotti et al. (2012).

c The three dimensions of GSCM performance namely financial performance, operational performance and environmental performance were taken from previous work of Zhu et al. (2010). Competitive performance dimension was taken from the earlier work of Green et al. (2012). Social performance dimension was taken from the previous work of Dubey et al. (2017). Market performance dimension was taken from the earlier work of Kazancoglu et al. (2018).

Final questionnaire development procedure involved two steps: one, statements or items taken from previous studies undertaken for GSCM drivers, practices and performance and two, semi-structured interview (Delphi method). In Delphi method, in the first phase, the questionnaire was administered to eight experts in the field of GSCM, two experts in the academic world and ten owners/managers of chemical MSMEs. Their views were taken as to whether a particular item is relevant to study GSCM in context of this study. Based on the response of these twenty respondents, items were selected for further study. Based on the responses of respondents, a questionnaire was prepared which constituted statements regarding GSCM drivers, practices and performance. This questionnaire was pre-tested on 15 chemical MSMEs.

The statements are rated on five-point likert scale. For the first section, comprising 30 items, a five-point likert scale is used (1 = not at all important, 2 = not important, 3 = not thinking about it, 4 = important and 5 = extremely important). Similarly, for the second section containing 30 items, a five-point likert scale is chosen consisting of responses ranging from 1 = not considering it, 2 = planning to consider, 3 = considering it currently, 4 = initiating implementation and 5 = implementing successfully. Section three has 30 items and answers were sought on likert scale (1 = not at all, 2 = little bit, 3 = to some degree, 4 = relatively significant and 5 = significant).

4.2 Data collection

The sample consist owner or senior manager/s responsible for GSCM in chemical MSMEs, who were contacted to filled the questionnaire. In total, researcher contacted 225 chemical MSMEs, out of which 180 completely filled questionnaire were received. The personal contact method was used to conduct the survey. The questionnaires were sent to respondents in advance of final personal interaction so that they could study it well that resulted into more accurate responses.

5 Data analysis

5.1 Factor analysis of GSCM drivers

Initially 30 items were subjected to factor analysis using principal axis factoring procedure. The obtained factor solution was subjected to varimax rotation. The eigenvalue was considered as 1 and the items which had factor loadings less than 0.40 on any factor were dropped. The same criterion was applied at all the subsequent factor analysis stages for dropping items. The factor analysis at first stage resulted in seven dimensions. The Cronbach alpha was calculated to measure reliability of proposed constructs. Another statistics was calculated for each item – the value of alpha if that item was removed (Hair et al., 2009).

Factor analysis output, at this stage, showed that both Kaiser-Meyer-Olkin measure of sampling adequacy had the value of 0.857 and Bartlett test of sphericity had the χ^2 value of 4,611.323, with 435 degrees of freedom (df) and significance value of 0.000, which proved the appropriateness of the correlation matrix for factor analysis. The seven dimensions consisting of final 24 items are social and customer reactions, internal and external environment, expected business benefits, vertical channel partners, organisational factors, competitive forces and regulatory factors, as shown in Table 7. The reliability of these seven factors was checked using Cronbach alpha measurement. As shown in Table 7, the Cronbach alpha values of all seven factors were above 0.6, which was sufficient to prove their reliability for further analysis.

Table 6 Summary of factor analysis for GSCM drivers

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Factor 7*	*Communality*
V8	0.877							0.861
V11	0.861							0.854
V6	0.848							0.837
V12	0.847							0.843
V14	0.824							0.828
V1	0.804					–0.434		0.790
V4	0.802							0.829
V10	0.750							0.637
V15	0.692							0.811

Table 6 Summary of factor analysis for GSCM drivers (continued)

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Factor 7*	*Communality*
V19	0.827							0.827
V5		0.846						0.790
V2		0.841						0.790
V3		0.835						0.811
V7		0.649						0.763
V17			0.863		–0.421			0.822
V16			0.809					0.750
V18			0.781					0.718
V30				0.811				0.839
V20				0.650				0.824
V24				0.646				0.812
V28					0.866			0.801
V27					0.812			0.748
V26					0.627			0.611
V29					0.601			0.605
V22						0.807		0.686
V25						0.766		0.659
V23						0.679		0.654
V21						0.573		0.526
V9							0.705	0.723
V13							0.665	0.579
Eigenvalue	11.117	3.197	2.309	1.903	1.658	1.293	1.120	
Variance explained	37.057	10.656	7.695	6.343	5.628	4.309	3.734	

Table 7 Summary of Cronbach's alpha test of reliability for GSCM drivers

Factor no.	*Factor name*	*Variables*	*Cronbach's alpha value*
Factor 1	Social and customer pressure (SCP)	V8, V11, V6, V12, V14, V1, V4, V10, V15, V19	0.959
Factor 2	Top management support (TMS)	V5, V2, V3, V7	0.889
Factor 3	Expected business benefits (EBB)	V17, V16, V18	0.848
Factor 4	Investors' pressure (IP)	V30, V20, V24	0.915
Factor 5	Organisational factors (OF)	V28, V27, V26, V29	0.784
Factor 6	Competitive pressure (CP)	V22, V25, V23, V21	0.717
Factor 7	Regulatory pressure (RP)	V9, V13	(Only two items)

The results of factor analysis shows seven GSCM drivers namely, social and customer pressure, top management support, expected business benefits, stakeholders' pressure,

organisational factors, competitive pressure and regulatory pressure. The descriptive statistics of GSCM drivers are given in Appendix 1. The mean of 2.85 for social and customer pressure indicates that the awareness for GSCM is still low in India, but increasing gradually. The organisation takes social pressure in terms of opportunity or risk associated with social image and corporate social responsibility (Walker et al., 2008). The increasing awareness among customers and market also forces organisations to follow GSCM practices (Wiengarten et al., 2012). Top management support is essential to implement GSCM practices (Law and Gunasekaran, 2012). The top management should believe GSCM practices as a part of corporates social responsibility and organisational value. The lack of top management support results into lack of organisational motivation to include green practices as a part of company strategy (Singh et al., 2012). The mean of 3.76 indicates high importance of top management support in India. Again, Indian chemical MSMEs have high degree of centralisation where the powers are in hand of the owner/s of respective MSME. So, the top management support plays pivotal role to drive GSCM practices. The benefits of implementing GSCM practices motivate organisations to follow it. These benefits could be in form of adaptability to market, greater long-term profitability, adhering to government norms and competitive advantage. The mean of 3.83 indicates that Indian chemical MSMEs are motivated to follow GSCM practices if they foresee its benefits. The pressure from various investors has been increasing to following GSCM practices. The firm investors also see opportunity for better value for their investment if the firm implements GSCM practices. The better synergy among firm's network members motivates organisations to follow GSCM practices. The mean of 3.09 indicates moderate importance of investors to drive GSCM practices. Organisational culture plays important role for implementation of GSCM practices (Gorane and Kant, 2016). Organisational capabilities are required to implement GSCM practices effectively. The support from employees of organisation can be of great help to follow green practices. No-a-days firms have started including green initiatives in its policy and financial planning. The mean of 3.85 shows that organisation capabilities plays vital role in following GSCM practices. Due to increasing awareness of green practices, many organisations have started to implement GSCM practices up to certain extent. It works as a pressure or motivation for other organisations to follow GSCM practices (Dubey et al., 2017). Again, many Indian firms are into export business. The global norms with respect to green practices make it essential for Indian firms to follow it. The mean of 3.81 indicates significance of competitive pressure to implement GSCM practices. Regulative pressures are in the form of central government rules and regulations, which make mandatory requirements to be fulfilled for environment protection and are obligatory. Similarly, regional (state government and local governing bodies like municipal corporations and pollution control boards) governments also have area specific rules, which are obligatory for companies to follow (Shukla et al., 2009). The mean of 3.89 indicates the vital role of regulatory pressure that mandates the Indian firms to follows GSCM practices.

5.2 Factor analysis of GSCM practices

Stage 1 Initially 30 items were subjected to factor analysis using principal axis factoring procedure. The obtained factor solution was subjected to varimax rotation. The eigenvalue was considered as 1 and the items which had factor loadings less than 0.40 on any factor were dropped. The same criterion was

applied at all the subsequent factor analysis stages for dropping items. The factor analysis at first stage resulted in seven dimensions. The Cronbach alpha was calculated to measure reliability of proposed constructs. Another statistics was calculated for each item – the value of alpha if that item was removed. Using this statistics, the items, which improved alpha if they were dropped, were dropped and the alpha was calculated for the dimension again. Three items were dropped based on these measures. The same criterion was applied at the subsequent Cronbach alpha stages for dropping items (Hair et al., 2009).

Stage 2 In this stage the remaining 27 items from the first stage were subjected to factor analysis, Cronbach alpha and value of alpha for each item if that item is removed. At this stage, the criterion resulted in the dropping of three more items from total 24 items. All three items were removed due to low value of alpha for each of those items. The remaining 24 factors were taken to the next stage.

Stage 3 Again at this stage, the factor loading and the value of Cronbach alpha and alpha if item is dropped were calculated for remaining 24 factors obtained from stage 2. At the end of two-stage factor analysis, Cronbach alpha and alpha if one item is dropped, the factors for GSCM practices were explored. Factor analysis output, at this stage, showed that both Kaiser-Meyer-Olkin measure of sampling adequacy had the value of 0.848 and Bartlett test of sphericity had the χ^2 value of 3,962.144, with 276 degrees of freedom (df) and significance value of 0.000, which proved the appropriateness of the correlation matrix for factor analysis. The six dimensions consisting of final 24 items are green supplies and audit, green designing, green environment policy, planning and finance, environmental awareness and green processes, as shown in Table 9. The reliability of these six factors was checked using Cronbach alpha measurement. As shown in Table 9, the Cronbach alpha values of all six factors were above 0.6, which was sufficient to prove their reliability for further analysis.

Table 8 Summary of factor analysis of GSCM practices

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Communality*
V16	0.930						0.902
V15	0.915						0.862
V18	0.913						0.896
V22	0.913						0.890
V21	0.902						0.861
V10	0.876						0.841
V4	0.865						0.876
V3	0.797						0.766
V5		0.786					0.741
V1		0.759					0.667
V7		0.727					0.721

Table 8 Summary of factor analysis of GSCM practices (continued)

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Communality*
V9		0.706					0.683
V13			0.878				0.816
V11			0.768				0.720
V12			0.721				0.816
V14			0.680				0.796
V27				0.861			0.849
V29				0.783			0.759
V25				0.612			0.600
V24				0.524			0.481
V8					0.700		0.792
V6					0.674		0.834
V19						0.891	0.848
V20						0.759	0.790
Eigenvalue	9.187	3.666	1.945	1.639	1.274	1.097	
Variance explained (%)	38.280	15.277	8.106	6.829	5.310	4.572	

Table 9 Summary of Cronbach's alpha test of reliability for GSCM practices

Factor no.	*Factor name*	*Variables*	*Reliability*
Factor 1	Internal environment management (IEM)	V16, V15, V18, V22, V21, V10, V4, V3	0.971
Factor 2	External environment management (EEM)	V5, V1, V7, V9	0.819
Factor 3	Distribution and warehousing (DW)	V13, V11, V12, V14	0.849
Factor 4	Eco-design (ED)	V27, V29	(Only two items)
Factor 5	Investment recovery (IR)	V8,V6	(Only two items)
Factor 6	Reverse logistics (RL)	V19, V20	(Only two items)

The result of factor analysis shows six factors of GSCM practices namely, internal environment management, external environment management, distribution and warehousing, eco-design, investment recovery and reverse logistics. The descriptive statistics of GSCM practices are given in Appendix 2. The internal environmental management is essential to effectively implement GSCM practices (Zhu et al., 2008b). The commitment from senior managers is necessary for creating positive environment for GSCM practices. The support from mid-level managers is required for successful implementation of GSCM practices. Total quality management requires decisions based on data and continuous improvement through appropriate performance measurement. For successful implementation of GSCM practices, proper designing of environmental management system is required in terms of environmental compliance and auditing as well as environmental performance measurement system (Hervani et al., 2005). The mean of 3.06 indicates moderately efficient and effective internal environmental

management system for chemical MSMEs in India. External GSCM practices include proper communication and synergy among channel partners (Sarkis et al., 2010). Proper coordination with suppliers in terms of design specification including green aspects is required. Environmental audit for suppliers' ensures better synergy with them and leads to better implementation of GSCM practices. Green marketing plays significant role for effective implementation of GSCM practices (Rao and Holt, 2005). Designing of green products in co-ordination with customers leads to better GSCM practices. The mean of 3.91 indicates that external environmental management is gaining importance. The firms believe that support from suppliers and customers play pivotal role in implementing GSCM practices. Distribution and warehousing is considered as outbound function of GSCM practices (Rao and Holt, 2005). Distribution system includes designing effective logistics system, selection of appropriate mode and route of transport and developing appropriate infrastructure for distribution (Perotti et al., 2009). Good warehousing consists of designing proper layout, using appropriate material handling equipments and use of alternative source of energy. Distribution and warehousing has a mean of 3.95, which is highest among all GSCM practices dimensions. In India, the logistics sector contributes to 14% to GDP (Sahay and Mohan, 2006). It is essential for the firm to focus on optimising its logistics, distribution and warehousing system to minimise the cost and detrimental effect on environment. Eco-design is one of the most important aspects for successful implementation of GSCM practices. Firms should design their manufacturing system and products in such a manner that leads to reduce material as well as energy consumption. In India, government has started providing incentives in form of subsidy to use eco-friendly inputs and materials that minimise deterrent effect on environment. The importance of eco-design (3.04) investment recovery (mean of 2.99) is still low in India. Reverse logistics is defined here in terms of reuse of materials as well as recycling for the same (Hazen et al., 2011). The mean of 3.92 indicates chemical MSMEs in India have started practicing reuse or recycle it material thereby improving environmental practices. Reverse logistics practice leads to reduce cost as well as improve environmental practices of the firm. In India, many chemical MSMEs face the problem of how to dispose of the waste from their production process; and the way they address this concern is varied and fragmented. Lack of stringent waste management legislation lead to unregulated and ad hoc dispersal. However, more environmentally engaged chemical MSMEs are adopting on-site waste management treatment facilities and waste exchange networks. To address the problem of industrial waste management, many government agencies and NGOs are trying to promote the concept of industrial ecology for corporations, where a 'closed loop' approach (Jensen et al., 2012) utilises all waste through the recycling and reuse of energy and materials.

5.3 Factor analysis of GSCM performance

Stage 1 Initially 30 items were subjected to factor analysis using principal axis factoring procedure. The obtained factor solution was subjected to varimax rotation. The eigenvalue was considered as 1 and the items which had factor loadings less than 0.40 on any factor were dropped. The same criterion was applied at all the subsequent factor analysis stages for dropping items. The factor analysis at first stage resulted in seven dimensions. The Cronbach alpha was calculated to measure reliability of proposed constructs. Another statistics

was calculated for each item – the value of alpha if that item was removed. Using this statistics, the items, which improved alpha if they were dropped, were dropped and the alpha was calculated for the dimension again. Two items were dropped based on these measures. The same criterion was applied at the subsequent Cronbach alpha stages for dropping items (Hair et al., 2009).

Stage 2 At this stage, the factor loading and the value of Cronbach alpha and alpha if item is dropped were calculated for remaining 28 factors obtained from stage 1. At the end of first stage factor analysis, Cronbach alpha and alpha if one item is dropped, the factors for GSCM performance were explored. Factor analysis output, at this stage, showed that both Kaiser-Meyer-Olkin measure of sampling adequacy had the value of 0.878 and Bartlett test of sphericity had the χ^2 value of 5,007.202, with 378 degrees of freedom (df) and significance value of 0.000, which proved the appropriateness of the correlation matrix for factor analysis. The six dimensions consisting of final 28 items are financial performance, operational performance, environmental performance, competitive performance, market performance and social performance, as shown in Table 11. The reliability of these seven factors was checked using Cronbach alpha measurement. As shown in Table 11, the Cronbach alpha values of all seven factors were above 0.6, which was sufficient to prove their reliability for further analysis.

Table 10 Summary of factor analysis

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Communality*
V21	0.869						0.879
V17	0.869						0.847
V27	0.843						0.846
V20	0.838						0.841
V30	0.838						0.807
V16	0.782						0.829
V15	0.689	0.520					0.759
V5		0.875					0.879
V12		0.837					0.890
V4		0.837					0.830
V9		0.810					0.872
V6		0.786					0.867
V13		0.780					0.857
V14		0.707					0.865
V10			0.872				0.814
V8			0.808				0.740
V7			0.585				0.609
V11			0.575				0.599
V1			0.570				0.562
V3			0.556				0.553
V24				0.892			0.864

Table 10 Summary of factor analysis (continued)

Variables	*Factor 1*	*Factor 2*	*Factor 3*	*Factor 4*	*Factor 5*	*Factor 6*	*Communality*
V22				0.589			0.670
V25				0.568	0.505		0.728
V26				0.554	0.501		0.735
V29					0.889		0.844
V28					0.724		0.722
V18						0.842	0.849
V19						0.806	0.819
Eigenvalue	11.071	4.350	3.325	1.370	1.258	1.055	
Variance explained	39.540	15.534	11.970	4.894	4.494	3.767	

Table 11 Summary of Cronbach's alpha test of reliability

Factor	*Factor name*	*Variables*	*Reliability*
Factor 1	Financial performance (FP)	V21, V17, V27, V20, V30, V16, V15	0.958
Factor 2	Operational performance (OP)	V5, V12, V4, V9, V6, V13	0.968
Factor 3	Environmental performance (EP)	V10, V8, V7, V11, V1, V3	0.814
Factor 4	Competitive performance (CP)	V24, V22, V25,V26	0.811
Factor 5	Market performance (MP)	V29, V28	(Only two items)
Factor 6	Social performance (SP)	V18, V19	(Only two items)

The result of factor analysis shows six factors of GSCM performance namely, financial performance, operational performance, environmental performance, market performance, competitive performance and social performance. The descriptive statistics of GSCM performance are given in Appendix 3. Financial performance is related to the firm's ability to reduce costs associated with purchased materials, energy consumption, waste treatment, waste discharge, and fines for environmental accidents (Hervani et al., 2005). The mean of 3.97 for financial performance indicates that Indian firms have better financial performance after implementation of GSCM practices. Operational performance relates to the firm's capabilities to more efficiently produce and deliver products to customers by improving the product line and quality, decreasing inventory levels, improving operational flexibility and increasing capacity utilisation (Perotti et al., 2012). The mean of 3.677 for operational performance means that firms are experiencing better operational performance after implementation of GSCM practices. Environmental performance relates the ability of firm to reduce air emissions, effluent waste and solid wastes, the ability to decrease consumption of hazardous and toxic materials and reduction in environmental accidents (Zhu et al., 2010). The mean of 4.03 for environmental performance means that firms are experiencing high environmental performance after implementation of GSCM practices. Competitive performance relates to improve the competitive strength of the firm, improve stakeholder and customer

satisfaction and increase the customer loyalty (Green et al., 2012). The mean of 3.95 for competitive performance means that implementation of GSCM practices leads to improve competitive performance. Market performance relates to firm's better branding and increase in market share (Roehrich et al., 2017). The mean of 3.93 for market performance means that implementation of GSCM practices leads to develop markets for firms. Social performance relates to better image of the firm in society and gaining carbon credit and other benefits to the firm (Dubey et al., 2017). The mean of 4.03 for social performance means that implementation of GSCM practices leads to improve social image of firms in India.

5.4 Regression analysis

It is interesting to investigate the inter-relationships among the pressures/drivers, practices and performance of GSCM. It can be visualised that pressures/drivers should prompt the organisation to adopt the GSCM practices and there should be a positive relationship between the two. Similarly, once implemented, the practices should result in performance of GSCM. These interrelationships are checked using two sets of multiple regressions. The standardised β is used as regression coefficient as a direct comparison between coefficients as to their relative explanatory power of the dependent variable. The coefficient of determination adjusted R^2 is used to measure the strength of association between independent variables and dependent variable. F test is considered to measure the validity of regression model.

In the first set, seven GSCM drivers are taken as independent variables and each of six GSCM practices is considered as dependent variable and thus six regression models are built. The results of regression analysis are shown in Table 12.

Table 12 Regression of GSCM drivers on GSCM practices (standard estimates)

Drivers/practices	*IEM*	*EEM*	*DW*	*ED*	*IR*	*RL*
SCP	0.394*	0.246*	0.044	0.029	0.012	0.181*
TMS	0.411*	0.294*	0.220*	0.330*	0.276*	0.133*
EBB	–0.001	–0.090	0.091	0.141*	–0.006	–0.016
IP	–0.027	0.006	–0.021	–0.114	–0.089	0.059
OF	0.113*	–0.030	0.159*	0.185*	–0.038	0.112*
CF	–0.83	0.116*	–0.019	–0.013	–0.063	0.120*
RF	0.112*	0.119*	0.195*	0.128*	0.244*	0.187*
Adjusted R^2	0.245	0.352	0.138	0.259	0.101	0.228
F	9.346*	14.969*	5.106*	9.977*	4.098*	8.760*

Note: *means significant at 0.05 level of significance.

The results of regression analysis shows that top management support and regulatory factors are the most important drivers that prompt organisations to follow GSCM practices. These two drivers create significant impact on all GSCM practices mentioned in Table 12. Social and customer pressures create significant impact on internal environmental management, external environmental management and reverse logistics. Expected business benefits do not create significant impact on GSCM practices except eco-design. Investors' pressure does not create significant impact on GSCM practices.

Organisational factors create significant impact on internal environmental management, distribution and warehousing, eco-design and reverse logistics. Competitive factors create significant impact on external environmental management and reverse logistics. The F value is significant in all regression models, which proves that validity of all regression models.

In the second set, six GSCM practices are taken as independent variable and each of six GSCM performances is considered as dependent variable and thus six regression models are built. The results of regression analysis are shown in Table 13.

Table 13 Regression of GSCM practices on GSCM performance (standard estimates)

Practices/performance	*FP*	*OP*	*EP*	*CP*	*MP*	*SP*
IEM	0.233*	0.380*	0.152*	0.157*	0.116*	0.139*
EEM	–0.001	0.048	0.301*	0.214*	0.160*	0.115*
DW	0.074	0.188*	0.076	0.118*	0.142*	–0.095
ED	0.125*	0.145*	0.184*	–0.027	–0.089	0.062
IR	0.136*	–0.006	–0.009	0.046	–0.015	–0.023
RL	0.110*	0.104*	0.118*	0.010	–0.026	0.107*
R^2	0.331	0.283	0.300	0.140	0.081	0.059
F	14.526*	10.653*	13.883*	5.865*	3.643*	2.866*

Note: *means significant at 0.05 level of significance.

The results of regression analysis show that internal environmental management creates significant impact on all GSCM performance factors. External environmental management creates significant impact on environmental performance, competitive performance, market performance and social performance. Distribution and warehousing creates significant impact on operational performance, competitive performance and market performance. Eco-design creates significant impact on financial performance, operational performance and environmental performance. Investment recovery does not create significant impact on GSCM performance factors except financial performance. Reverse logistics creates significant impact on financial performance, operational performance, environmental performance and social performance. The F value is significant in all regression models, which proves that validity of all regression models.

Through this analysis it can be inferred that the awareness regarding GSCM practices are still low in India, which bring opportunity for firms to build competitive advantage through proper implementation and marketing of green initiatives among society and customers. Top management commitment towards green measures and government actions toward green practices are key factors for the implementation of GSCM and if implemented it can positively impact the performance of the organisation. The policy planners need to setup guidelines and action plan for strict implementation various regulations framed by the central and state governments. The top managements of various organisations are concerned about the deteriorating environmental conditions but lack motivation and confidence to implement any such measures. The senior managers of the organisations have to devise strategies for an integrated and coordinated effort to implement GSCM practices. This study follows the close loop supply chain approach (Jensen et al., 2012), where GSCM practices not only not only includes internal aspects of green practices, but also extends to external environment, synergy among channel

partners and reverse logistics. The internal environmental management of green practices plays critical role for GSCM performance. The organisation should devise robust environmental policy and norms for proper implementation of green practices in integrated manner throughout organisation. As per resource dependency theory (Zhu and Sarkis, 2004), the synergy among channel partners leads to solid implementation of GSCM. The literature in the field of GSCM generally focuses on financial performance, operational performance and environmental performance where it is evident that GSCM performance measure also includes competitive performance, market performance and social performance.

6 Conclusions and implications

This study reveals the current status and identifies the gap between current and desired status of the environmental responsiveness of supply chains in India. The GSCM is in its early stages of implementation in India. GSCM is a relatively less explored domain of SCM, which needs urgent attention of researchers in the present scenario. The social responsibility aspect of supply chain management has not been addressed properly by organisations in India, which might lead to major challenges in future towards environmental sustainability. The adoption of GSCM in chemical MSMEs in India is low but there is a growing concern among owners and managers to upgrade their systems and practices to meet stiff challenges and expectations of various stakeholders. A mindset of reactive conformance to laid-down regulations will lead only to avoidance of the legal action but to remain competitive and get an edge over competitors, organisations have to gear up to adopt environmentally conscious supply chains as an order winner. This study brings systematic view of GSCM drivers, practices and performance and their interrelationships.

This research can be a guideline to chemical MSMEs chemical companies' owners and managers for using this framework to adopt GSCM practices in India and other countries. This framework can be extended to MSMEs other than chemical manufacturing as well as large enterprises in India and other countries. This research brings numerous implications. Government needs to play key role to implement and promote the GSCM practices among chemical MSMEs. Government of India agencies (Ministry of environment and Forest, Central Pollution Control Board, Department of Chemicals and Petrochemicals) must work with state governments to ensure more rigorous and transparent enforcement of pollution and environment related regulations in chemical units. The chemical MSME units can be given the non-fiscal incentives in the form of 'Responsible Care Certification' to encourage companies through star rating and fast track clearance for future expansions that can motivate non-compliant companies towards better environmental compliance. Firms can use life cycle assessment tool to provide information on the environmental effects of various products and processes that help to take corrective measures towards sustainable practices. Seminars/workshops on GSCM best practices in the chemical industries should be organised to bring awareness about benefits of GSCM practices. The chemical companies need to upgrade their technologies and process to adhere to GSCM standards. The environmental audit procedure needs to be strengthen to better implement GSCM practices.

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Appendix 1

Descriptive statistics of GSCM drivers

No.	*Drivers/statements*	*Mean*	*SD*
F1	*Social and customer pressure*	*2.85*	*1.15*
V8	Our organisation has to pay attention towards sustainable environment due to social awareness	2.90	1.37
V11	Financial assistance provided by international/national/local organisation has motivated our company to follow green practices	2.90	1.25
V6	Increasing business opportunities after implementation of green practices motivates our organisation to follow the same	2.81	1.35
V12	Major customers of our company will not give us business unless we follow green practices	2.90	1.27
V14	Following green practices helps our organisation in avoiding customer complaints	2.87	1.38
V1	The pressure from market is forcing/motivating our organisation to practice green logistic	2.54	1.37
V4	Following green practices helps our organisation to improve our social image	2.64	1.33
V10	Social awareness regarding corporate social responsibility leads to implementation of green practices	3.23	1.31
V15	Pressure from NGOs forces our company to follow green practices	2.83	1.34
V19	Following green practice reduced public's perceived risks associated with the organisation	2.89	1.370

Descriptive statistics of GSCM drivers (continued)

No.	*Drivers/statements*	*Mean*	*SD*
F2	*Top management support*	*3.76*	*0.58*
V5	Top management is committed towards implementation of green practices in our organisation	3.78	0.70
V2	Following green practices is part of our company strategy	3.74	0.68
V3	Top management firmly believes that protecting environment is part of corporate social responsibility	3.65	0.69
V7	Top management of our organisation value the green initiative	3.87	0.67
F3	*Expected business benefits*	*3.80*	*0.62*
V17	Implementing green practices leads to quick adaptability to market conditions	3.71	0.68
V16	Our organisation believes that the benefits of following green practices will outweigh its costs in long run	3.83	0.72
V18	Through adopting green initiatives, our organisation will comply with government environmental legislations	3.87	0.72
F4	*Investors' pressure*	*3.09*	*1.19*
V30	Pressure from stakeholder (investor) motivates the company to follow green practices	3.16	1.34
V20	Network of our associates motivates/forces our company to follow green practices	3.06	1.27
V24	Adopting green practices improves channel relations and synergy	3.04	1.24
F5	*Organisational factors*	*3.85*	*0.59*
V28	Cooperation from employees helps the organisation to follow green practices	3.84	0.73
V27	Our organisation has financial resources to implement green practices	3.91	0.77
V26	Environmental protection is policy (value) of our organisation	3.84	0.80
V29	Our company has technical capabilities to implement green practices	3.82	0.74
F6	*Competitive pressure*	*3.81*	*0.63*
V22	Our customers prefer the organisation that follows green practices	3.87	0.72
V25	Global business of our organisation forces to adopt green practice	3.80	0.85
V23	Following green practices results in to competitive advantage for our organisation	3.66	1.11
V21	Big players in the industry follow green practices that motivate/force us to follow green practices	3.91	0.70
F7	*Regulatory factors*	*3.89*	*0.54*
V9	Initiatives of government with respect to environmental regulations and legislations lead to implementation of green practices in our organisation	3.94	0.68
V13	Following green practices helps our organisation to comply with pollution control regulations	3.83	0.69

Appendix 2

Descriptive statistics of GSCM practices

No.	*Drivers/statements*	*Mean*	*SD*
F1	*Internal environmental management*	*3.06*	*1.22*
V16	Commitment of GSCM from senior managers	3.07	1.35
V15	Support for GSCM from mid-level managers	3.07	1.34
V18	Cross-functional cooperation for environmental improvements	3.08	1.42
V22	Total quality environmental management	3.06	1.41
V21	Environmental compliance and auditing programs	3.01	1.37
V10	ISO 14001 certification	3.11	1.26
V4	Environmental management systems exist	3.19	1.25
V3	Environmental performance measurement and monitoring	2.90	1.27
F2	*External environmental management*	*3.91*	*0.51*
V5	Providing design specification to suppliers that include environmental requirements for purchased item	3.89	0.62
V1	Environmental audit for suppliers' internal management	3.85	0.57
V7	Cooperation with customers for eco-design	4.00	0.65
V9	Cooperation with customers for cleaner production	3.89	0.68
F3	*Distribution and warehousing*	*3.95*	*0.63*
V13	Designing effective logistics system (transportation mode, vehicle, route planning) for higher environmental efficiency	3.90	0.72
V11	Environment friendly facility location	3.95	0.70
V12	Use of alternative energy sources in warehouse	3.99	0.80
V14	Use of energy-efficient material handling equipment in warehouse	3.97	0.80
F4	*Eco-design*	*3.04*	*0.98*
V27	Design of products for reduced consumption of materials/energy	3.05	1.10
V29	Design of products for reuse, recycle, recovery of materials, component parts	3.03	0.99
F5	*Investment recovery*	*2.99*	*0.67*
V8	Investment recovery (sale) of excess inventories/materials	3.02	0.71
V6	Sale of scrap and used materials	2.97	0.73
F6	*Reverse logistics*	*3.92*	*0.66*
V19	Materials recycle whenever possible	3.88	0.71
V20	Materials reuse whenever possible	3.95	0.77

Appendix 3

Descriptive statistics of GSCM performance

No.	*Drivers/statements*	*Mean*	*SD*
F1	*Financial performance*	*3.97*	*1.24*
V21	Implementation of green practices decreases the scrap rate	3.9	1.36
V17	Implementation green practices results in reduction in marketing cost	3.90	1.40
V27	Implementation green practices reduces tax burden	3.03	1.37
V20	Implementation green practices leads to decrease the cost of waste management	3.01	1.40
V30	Implementation green practices results in to lower purchase costs	3.99	1.30
V16	Implementation green practices results in to lower energy consumption	3.01	1.47
V15	Implementation green practices results in to decrease in fine for environmental accidents	3.91	1.39
F2	*Operational performance*	*3.68*	*1.34*
V5	Implementation of green practices leads to improve delivery time	3.57	1.43
V12	Implementation green practices leads to increase the product line and quality	3.69	1.44
V4	Implementation of green practices leads to improve operational efficiency	3.51	1.52
V9	Implementation of green practices leads to decrease inventory levels	3.74	1.47
V6	Implementation of green practices leads to improve operational flexibility	3.77	1.52
V13	Implementation green practices results in improving capacity utilisation	3.79	1.34
F3	*Environmental performance*	*4.03*	*0.51*
V10	Implementation of green practices improve environmental compliance	4.02	0.79
V8	Implementation of green practices save energy	4.11	0.78
V7	Implementation of green practices leads to reduction of air emission	4.09	0.68
V11	Implementation of green practices decrease consumption for hazardous/ harmful/toxic materials	4.04	0.71
V1	Implementation of green practices leads to reduction in solid waste/waste water	3.96	0.58
V3	Implementation of green practices leads to decrease in environmental accidents	3.97	0.63
F4	*Competitive performance*	*3.95*	*0.61*
V24	Implementation green practices improve stakeholders' satisfaction	3.98	0.76
V22	Implementation green practices leads to better customer satisfaction than competitors	3.95	0.76
V25	Implementation green practices increase customer loyalty	3.96	0.77
V26	Implementation green practices improve competitive strength of the company	3.91	0.74

Descriptive statistics of GSCM performance (continued)

No.	*Drivers/statements*	*Mean*	*SD*
F5	*Market performance*	*3.93*	*0.67*
V28	Implementation green practices helps in creating better branding	3.93	0.73
V29	Implementation green practices leads to improve market share	3.92	0.77
F6	*Social performance*	*4.03*	*0.66*
V18	Implementation green practices improves social image of company	4.06	0.77
V19	Implementation of green practices helps and organisation to gain carbon credits and other such benefits for emitting less carbon in atmosphere	4.01	0.74