

A Literature Review on Green Supply Chain Management (GSCM) Practices

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Abstract: The objective of the study is to extend available green supply chain management (GSCM) literature by identifying and developing a conceptual framework that examines the practices of green supply chain management (GSCM). The study is based on literature review and generates important outcomes on the various dimensions of GSCM practices that are commonly used under the umbrella of GSCM. Through a review of available literature, we identified 30 articles on GSCM practices which were published between 2004 and 2018. This paper adds to the literature by defining GSCM that consider six main practices, namely, eco-design, internal environmental management, green purchasing, cooperation with the customer, investment recovery and reverse logistics. Subsequently, a conceptual framework was developed based on the identified GSCM practices. For managers, it is important to consider these dimensions/practices of GSCM when implementing environmental management in supply chain operations. Moreover, the implications of the study will help the managers and policymakers to have more focus on these dimensions of GSCM practices. Such studies also help academicians and researchers to a better understanding of these dimensions GSCM practices.

Keywords: Green Supply Chain Management (GSCM), Literature Review, GSCM Practices, Conceptual framework

Paper type: Literature Review

I. Introduction:

In the present era of globalization, green supply chain management (GSCM) has been developed as the strategy that helps the organization in managing both backward and forward supply chain partner and minimize the environmental impact of intra-firm and inter-firm management activities (Zhu et al., 2008a; Green et al., 2012). In accordance, to supply chain expert's diverse stakeholders such as various suppliers, manufacturers and customers need to collaborate in the implementation of GSCM practices. Researchers have pointed out that activities of supply chain management (SCM) cannot be performed individually but can be done together in collaboration (Kim, 2006) to contribute to the efficient supply chain process.

To get a deeper understanding of Green Supply Chain Management, it is necessary to give more attention to the concept of green along with supply chain management. Supply chain members of upstream and downstream must collaborate with internal processes of the organization to act environmental consciously (Rao and Holt, 2005; Vachon and Klassen, 2006). Inter-functional cooperation within an organization and outside the organization with members of the supply chain such as suppliers and customers are required to

achieve desired sustainable performance through the adoption of green supply chain management practices (Zhu and Sarkis, 2004; Vachon and Klassen, 2006; Green et al., 2012).

The increased pace of industrialization and rapid growth has led to unwanted environmental outcomes, for instance, toxic pollutions, harmful gas emissions, chemical spills and solid waste pollution (Peng and Lin, 2008). Due to various effects of industrialization, the global environmental awareness has also grown and therefore green supply chain management (GSCM) has occurred as a strategy that considers environmental elements within the organization and along with backward and forward members of the supply chain (Walker and Jones, 2012; Zhu and Sarkis, 2004). Majority of the manufacturing organizations relocated their production facilities and manufacturing bases in developing Asian economies (Lai and Wong, 2012; Tang and Zhou, 2012) due to low-waged labor and cheap cost of material (Lai et al., 2013). The growing worldwide awareness has mounting pressure on manufacturing organizations not only on the developed nations but also on developing economies. As the manufacturing sector is expected to continue to grow at a similar pace, organizational practices should balance the economic growth along with protecting the environment (Lee, 2008; Zhu et al., 2008b).

Thus, manufacturing organizations in the developing economies have begun to realize the need for environment-friendly practices and green strategies by collaborating with suppliers and customers to reduce the ecological impacts of their products and operations (Zhu and Sarkis, 2004; Zhu and Geng 2013). The concept of green supply chain management in the area of the supply chain has got increased attention from academia, professionals, industry, regulatory agencies and customers in particular in the manufacturing sector (Golicic and Smith, 2013; Lai et al., 2013). Therefore, there is a requirement of study to identify the different practices of green supply chain management (GSCM) (Mitra and Datta, 2014; Lo, 2014).

II. Literature Review:

In recent years, attention to sustainable or green supply chain management has been increasing in the literature (Pagell and Wu, 2009). The widely used concept of sustainability suggested the efficient use of resources to satisfy the wants of the present generations without compromising on the need of the of future generations (Brundtland Commission, UN, 1996). Elkington, (1998) has also focused on the triple bottom line approach considering social, ecological and economic dimensions in sustainability.

Accordingly, Pagell and Wu, (2009) sustainable supply chains consider various aspects of sustainability; though, it has been recommended that surpassing in all aspects is a challenging task to accomplish. However, the focus on environmental protection can be incorporated by adding the concept of green in supply chain management. Even, the studies highlight the trade-offs between environmental practices (Srivastava, 2007) and economic competitiveness (Kleindorfer et al., 2005). Some studies have also favored that dimensions of sustainability that leads to the adoption of environmental practices and resulted in the

profitability of the organization (Porter and van der Linde, 1995). For businesses, the focus should not be whether to become fully sustainable but to implement the triple bottom line approach in order to calculate progress towards sustainability as the final aim (Pagell and Wu, 2009). This paper is focused on the different dimensions of green supply chain management (GSCM) practices within the organization and outside the organization along the forward and backward supply chain, which has the ability to reduce the environmental impact of intra-organizational and inter-organizational activities (Zhu and Sarkis, 2004; Rao and Holt, 2005; Green et al., 2012).

To improve environmental performance, organizations need to implement various green supply chain management (GSCM) practices such as eco-designing, green purchasing, internal environmental management, cooperation with customers, reverse logistics etc in collaboration with suppliers and customers (Zhu et al., 2008; Rao and Holt, 2005; Green et al., 2012). Handfield et al. (1997) advocated that environmental consciousness should be incorporated in the whole supply chain. The area of green supply chain management has covered from green purchasing to reverse logistics by integrating supply chains members such as suppliers, manufacturer, customer and finally “closing the loop” (Zhu and Sarkis, 2004; Zhu et al., 2008a). Organizations seeking to get the benefits from their green supply chain management practices must integrate with all the members of the supply chain (suppliers and customers). Similarly, Walton et al. (1998) opined that organizations will succeed in the end phase of the green or environmental management when they work as a team for achieving a common goal by including suppliers, customers, third-party logistics and rest of the members of the supply chain. Additionally, stated that green supply chain management requires cross-functional and cross-organizational integration.

We conducted a systematic literature review to identify and the various GSCM practices prevailing in the industry. The study considered all the papers published with different GSCM practices until the end of 2018. The search terms were kept sufficiently wide and used the combinations of keywords related to green supply chain management (GSCM) practices (e.g. green purchasing, internal environmental management, eco-design, cooperation with customers, investment recovery and reverse logistics) in well-known databases (e.g. Scopus, Emerald, Science Direct). The search included papers with search terms appearing in keywords, title and abstract of papers that were published in journals. Further, we examined the papers to meet the criteria of focusing on the GSCM practices overall not on individual practice.

Table 1: Literature Review of GSCM practices

S. No	Authors and Year	Methodology	GSCM Practices	Tools used	Country
1.	Zhu and Sarkis (2004)	Survey questionnaire to 186	Eco-design, Internal environmental management, External	Exploratory Factor Analysis (EFA), Regression Analysis	China

		manufacturing enterprises	GSCM practices, Investment recovery		
2.	Zhu, Sarkis and Geng (2005)	Survey questionnaire to 314 manufacturing enterprises	Internal environmental management, External GSCM practices, Investment recovery, Eco-design	Exploratory Factor Analysis (EFA), Mean	China
3.	Zhu, Sarkis and Lai (2007)	Survey questionnaire to 89 automotive enterprises	Eco-design, Green purchasing, Internal environmental management, customer cooperation, Investment recovery	Mean, Regression Analysis	China
4.	M. K. Chien and L. H. Shih (2007)	Survey questionnaire to 151 manufacturers in electrical and electronic industry	Green procurement, Green design Green manufacturing	Structural Equation Modelling (SEM)	Taiwan
5.	Zhu, Sarkis, Cordeiro and Lai (2008)	Survey questionnaire to 314 manufacturing firms	Management support, External GSCM practices, Investment recovery, Eco-design	Mean, Factor analysis, Hierarchical regression	China
6.	Shukla, Deshmukh and Kanda (2009)	Survey questionnaire from 30 auto manufacturers	Eco-design , Green purchasing, Internal management, customer cooperation, Investment recovery	Mean, Regression	India
7.	Zhu, Geng, Fujita and Hashimoto (2010)	Data collected from 9 large manufacturers through questionnaire	Eco-design, Green purchasing, Internal management, customer cooperation, Investment recovery	Mean	Japan
8.	Eltayeb, T. K., Zailani, S., and Ramayah, T. (2011)	Collected data from 569 ISO certified firms	Supplier environmental collaboration, customer environmental collaboration, Eco design, green purchasing, reverse logistics	Mean, Regression	Malaysia
9.	Shi, Koh, Baldwin and Cucchiella (2012)	Conceptual	Green purchasing, Design for environment, Green distribution	Literature Review	UK
10.	Chan, He, Chan and Wang (2012)	Based on responses from 194 foreign invested enterprises	Green purchase, customer cooperation and investment recovery	Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA)	China

		operating in China through questionnaire			
11.	Green Jr, Zelbst, Meacham and Bhadauria (2012)	Data collected from 159 manufacturing managers through survey questionnaire	Eco-design, Green purchasing, Cooperation with customers and investment recovery	Structural Equation Modelling (SEM)	US
12.	Lee, Kim and Choi (2012)	Data collected through survey questionnaire from 229 SMEs in electronic industry	Eco-design, Internal environmental management, Green purchasing, customer cooperation	Structural Equation Modelling (SEM)	South Korea
13.	Zhu, Sarkis and Lai (2013)	Data collected from 396 manufacturers through survey questionnaire	Eco-design, Green purchasing, Internal management, customer cooperation, Investment recovery	Path Analysis through Structural Equation Modelling	China
14.	Laosirihongthong, Adebajo and Tan (2013)	Data collected from 190 ISO 14001 certified manufacturing firms	Eco-design practices, Green purchasing practices, Product related related practices, Reverse logistics practices, Legislation and regulations	Factor Analysis, Multivariate linear regression	Thailand
15.	Vanalle and Santos (2014)	Data from 20 automobile organizations	Eco-design, internal environmental management and cooperation with customers	Average score, Z-test	Brazil
16.	Ming-Kuei Chien (2014)	Data from 175 electrical and electronic related manufacturers	Green design, green manufacturing, green innovation, green purchasing and green services	Structural Equation Modelling (SEM)	Taiwan
17.	Yu, Chavez, Feng, Wiengarten	Collected data from 126 automotive manufacturers through survey	Internal GSCM, GSCM with customers and GSCM with suppliers	Structural Equation Modelling (SEM)	China
18.	Chin, Tat and Sulaiman (2015)	Conceptual	Green procurement, green manufacturing, green distribution and green logistics	Conceptual	Malaysia
19.	Choi and Hwang (2015)	Data from 230 manufacturers	Eco design and investment recovery	Hierarchical regression analysis	South Korea

20.	Govindan, Khodaverdi and Vafadarnik joo	Case study of an automobile manufacturer	Green design, green purchasing, customer environmental collaboration, ISO 14001 certification, carbon management, supplier environmental collaboration and internal management support, reverse logistics	Fuzzy DEMATEL	Iran
21.	Diab, Bourini and Rumman (2015)	Data collected from 6 firms in food industry	Internal environment management, green purchasing, eco-design and packaging, collaboration with customers, and warehousing and green building.	Simple and multiple linear regressions analysis	Jordan
22.	Krichoff, Tate and Mollenkopf (2016)	Data collected from 367 manufacturing firms	Green purchasing, Internal environment management, eco-design, collaboration with customers, green purchasing, investment recovery	Hierarchical regression analysis	US
23.	Schmidt, Foerstl, and Schaltenbrand (2016)	Data collected from 284 manufacturing firms	Green design, green purchasing, green manufacturing green internal management and green logistics	Structural Equation Modelling (SEM)	Europe
24.	Younis, Sundarakan i and Vel (2016)	Received response from 117 manufacturing firms	Eco-Design, Green Purchasing, Environmental Cooperation, Reverse Logistics	Multiple regressions analysis	UAE
25.	Gopal and Thakkar (2016)	103 responses were obtained from automobile manufacturers	Eco design practices, lean practices, continuous improvement, customer cooperation, risk management practices	Structural equation Modelling (SEM)	India
26.	Luthra, Garg and Haleem (2016)	123 responses from automobile organizations	Green purchasing, green design, green production, green management, green marketing, green logistics	Multiple regression analysis	India
27.	Geng, Mansouri and Aktas (2017)	Literature review and conceptual framework	Eco design, intra-organizational management, supplier integration, customer	Meta-analysis	Asian Emerging Economie s

			cooperation, reverse logistics		
28.	Huang, Huang, and Yang (2017)	Data collected from 380 manufacturers in electrical and electronic industries	Eco-design, internal environment management, green purchasing, collaboration with customers, green purchasing, reverse logistics	Structural equation Modelling (SEM)	Taiwan
29.	Balasubramanian, Shukla (2017)	Response from 455 construction industry professionals	Green purchasing, green design, green transportation, green manufacturing, end-of-life management	Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)	UAE
30.	Famiyeh, Kwarteng, Asante-Darko, and Dadzie (2018)	370 responses from various industrial sector	GSCM practices: Internal environmental management practices, green purchasing	Structural Equation Modelling (SEM)	Ghana

After a thorough review of the literature, the distribution of papers from 2004 to 2018 showed six common practices that are considered as the main component of green supply chain management (GSCM). The papers published on the topic of green supply chain management (GSCM) practices included six (6) main practices of GSCM irrespective of the type of organization. These are green purchasing, eco-design, internal environmental management, cooperation with customers, investment recover and reverse logistics. Consequently, the present study identified and defined GSCM practices from the literature (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008; Rao and Holt, 2005; Green et al., 2012, Geng et al., 2017). Although we define GSCM practices irrespective of industry and country, many of the green supply chain management practices that were investigated are wider in scope and covering various aspects of environmental consciousness (Zhu et al., 2007).

III. Dimensions of Green Supply Chain Management (GSCM) practices:

Green supply chain management (GSCM) practices are critical for the sustainable development of an organization and are defined as the integration of environmental aspects in the supply chain activities of the organization (Zhu et al., 2012). There are various dimensions of GSCM, but this study examines six GSCM practices that have been commonly discussed in the previous studies, namely,

i. **Eco-design (ED)** is a process of designing a product by incorporating environmental criteria in the development of product and considering its impact throughout its life cycle. (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008; Zailani et al., 2012a; Lin et al., 2013; Wong et al., 2014; Geng, et al 2017);

ii. **Green purchasing (GP)** comprises of collaboration between the organization and its suppliers for the development of a green product. Integration for environmental purposes includes trust between supplier and organization, information sharing, collaborative partnerships (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008; Rao and Holt, 2005; Chiou, et al., 2011; Laosirihongthong et al., 2013; Geng, et al 2017);

iii. **Internal environment management (IEM)** refers to the practices within the organization that leads to adoption of green practices along the whole supply of the organization such as management commitment for GSCM, environmental compliance, cross-functional cooperation for environmental improvements (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008; Yang et al., 2010; Huang et al., 2012; Geng, et al 2017);

iv. **Investment recovery (IR)** refers to the outcome of investment made by the company in adopting green practices along its supply chain. Changing the supply chain from traditional to green involves the investment of organization and any investment made by the organization expect a positive return. (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2013; Green et al., 2012; Choi and Hwang, 2015; Krichhoff, Tate and Mollenkopf, 2016);

v. **Customer cooperation (CC)** includes sharing information with the customer on environmental issues and getting information related to customer's demand for the environment-friendly product. Sharing information with customers aims to improve coordination and enable joint planning for environment-friendly product and processes (Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008; Wong et al., 2011; Yu et al., 2014; Geng, et al 2017);

vi. **Reverse logistics (RL)** is a concept of closing the loop by taking care of the product after its end life. Reverse logistics focuses on three "Re's" that is recycling, reusing and reducing the use of raw materials in production process and after end life (Zhu et al., 2005; Chan et al., 2012; Lai et al., 2013; Abdullah and Yaakub, 2014; Huang et al., 2015, Geng, et al 2017).

Table I showed that literature acknowledged different dimensions of green supply chain management (GSCM) practices on the basis of various types of activities in the supply chain. However, a large number of papers considered the GSCM practices that are widely used by the researchers such as eco-design, green purchasing, internal environmental management, cooperation with customers, investment recovery and reverse logistics. Accordingly, we used the classification for the industry as well and found that most of the studies are in the area of manufacturing such as automobile, chemical, electrical and electronics, etc. For instance, Huang and Yang (2014) and Huang et al., (2015) concentrated on reverse logistics while Yang et

al., (2010) focused on internal environmental practices. From this perspective, the studies by Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008 are most widely followed on the adoption of GSCM practices and used by many other researchers as a guideline to investigate on GSCM practices. In order to have a clearer understanding of the green supply chain management practices, we considered GSCM practices into six dimensions:

Table 2: Green Supply Chain Management (GSCM) Practices and their studies

S.no	GSCM Practices	References
1.	Eco Design	Eltayeb et al., 2011; Geng et al 2017; Green et al., 2012; Hsu et al., 2013; Krichoff, Tate and Mollenkopf, 2016; Laosirihongthong et al., 2013; Lo and Shiah, 2016; Wu et al., 2012; Younis et al., 2016; Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013;
2.	Internal Environmental Management	Geng et al 2017; Green et al., 2012; Krichoff, Tate and Mollenkopf, 2016; Lo and Shiah, 2016; Yang et al., 2013; Younis et al., 2016; Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013;
3.	Green Purchasing	Eltayeb et al., 2011; Geng et al 2017; Green et al., 2012; Hsu et al., 2013; Krichoff, Tate and Mollenkopf, 2016; Laosirihongthong et al., 2013; Lo and Shiah, 2016; Wu et al., 2012; Yang et al., 2013; Younis et al., 2016; Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013;
4.	Cooperation with customers	Eltayeb et al., 2011; Geng et al 2017; Green et al., 2012; Krichoff, Tate and Mollenkopf, 2016; Wu et al., 2012; Yang et al., 2013; Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013;
5.	Investment Recovery	Choi and Hwang, 2015; Green et al., 2012; Krichoff, Tate and Mollenkopf, 2016; Zhu and Sarkis, 2004; Zhu et al., 2005, 2007, 2008, 2010, 2013;

6.	Reverse logistics	Eltayeb et al., 2011; Geng et al., 2017; Hsu et al., 2013; Huang and Yang, 2014; Huang et al., 2015, 2016; Lo and Shiah, 2016; Laosirihongthong et al., 2013; Wu et al., 2012; Ye et al., 2013; Younis et al., 2016;
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IV. Conceptual Framework:

In this section, a conceptual framework is proposed in order to explore the various practices of green supply chain management. This is a first step to provide an overview and understanding of green supply chain management (GSCM) practices. Identification of main activities of supply chain will guide in adopting GSCM along the whole supply chain. Fig I shows the green supply chain management practices that focuses not only on the internal supply chain activities of the organization but also on the external activities of the supply chain such as eco-designing with suppliers, cooperation with customer, reverse logistics, etc. The GSCM activities that directly link the organization with suppliers are eco-designing, green purchasing and reverse logistics. On the other hand, organizations link with customers to satisfy their environmental requirement along with meeting the products expectation in various ways such as cooperation with customer for design of the product, fulfilling environmental demands of green products, taking back product after its end life through reverse logistics. The theoretical framework was developed on the basis of empirical evidence from the literature and Fig. I gives an overview of the conceptualized framework.

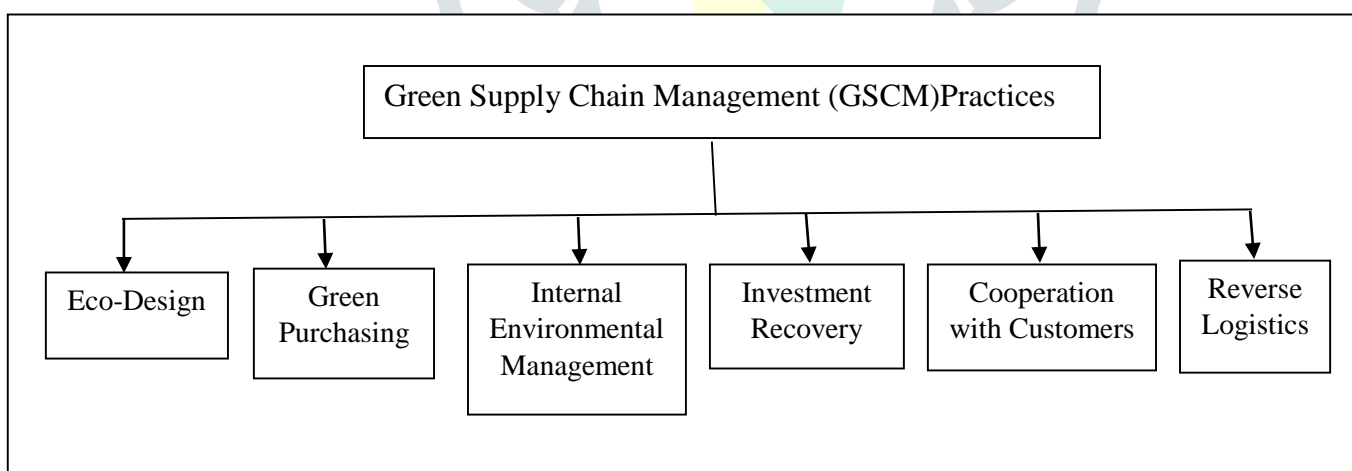


Fig 1 Practices of Green Supply Chain Management

V. Conclusion:

Our study extends the literature by describing various dimensions of green supply chain management (GSCM) practices. The six main dimensions of GSCM (i.e., eco-design, green purchasing, internal environmental management, cooperation with the customer, investment recovery and reverse logistics) were

identified from the available literature. The study investigated various dimensions of corporate environmental sustainability through GSCM that prevalent in the industries. Our study also extends GSCM research by developing a conceptual framework of GSCM practices. GSCM has gained increased attention in the literature as an important environmental initiative to safeguard the environment (Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013; Green et al., 2012).

Though, the existing green supply chain management research is characterized by evolving definitions and dimensions. Some studies have also combined the various practices of upstream and downstream activities in one construct while others have focused on each dimension of GSCM individually such as eco-design, green purchasing, internal environmental management, cooperation with customer, investment recovery and reverse logistics (Zhu et al., 2005, 2007, 2008, 2010, 2012, 2013; Zailani et al., 2012; Geng, et al 2017). Some studies have looked from the perspective of internal GSCM practices and external GSCM practices in particular environmental collaboration with customers and suppliers. This collaborative approach may overlook some important research contributions (Vachon and Klassen, 2008). Therefore, this study provides an integrated framework, which incorporates various practices of GSCM simultaneously.

Review of literature of this study focuses on the different dimensions of GSCM practices that are prevailing in the researches and industry. Through a literature review, six GSCM practices (i.e., eco-design, internal environmental management, green purchasing, cooperation with customer, investment recovery and reverse logistics) were identified that are commonly focused in previous studies. Afterward, we framed a conceptual framework of moving from SCM to GSCM by focusing the various practices. Moving from SCM to GSCM involved all the activities of the supply chain along with environmental initiatives to make its supply chain operations more sustainable. Due to a globalized economy, the adoption of GSCM practices will play a bigger role not only in decreasing ecological impact but also in improving the organization's performance. The Study has also highlighted that the adoption of these GSCM practices as a strategy to decrease environmental impact help in gaining a better environmental reputation for the organization.

VI. Implications:

The study has implications for the researchers, academicians, and practitioners working on green and sustainable practices. Deterioration of environment and natural resources has led practitioners and researchers to move from SCM to GSCM. Moving from SCM to GSCM requires a relationship between all the members of the supply chain (suppliers, manufacturer, customers, etc.). This research has implications for managers that adoption of environmental initiatives in the supply chain not only achieve better performance but also reduce waste, save energy, pollution, and emissions. Different practices of GSCM helps in the effective and efficient utilization of an organization's operations such as the reduction in scrap rate, on time delivery,

maintenance of inventory levels, and improved capacity utilization as well. In addition, policymakers have an active role in forming legislation and environmental standards to encourage organizations to adopt GSCM practices with proper guidelines (Zhu et al., 2012). Hence, policymakers can use the “carrot and stick” approach to encourage organizations to adopt GSCM practices (Zailani et al., 2012a). Due to the requirement of environmental standards that impact businesses globally, organizations have initiated to change their focus to balance economic growth and protect the environment. Researches in the area of environment, green or sustainable encourage organizations to consider adoption of GSCM practices to improve environmental situation and have better resource utilization. Organizations need to set an example of their success stories on the implementation of GSCM practices, which can create interest in other firms to go for the green supply chain management. Adoption of GSCM can bring both better organizational performances along with fulfilling their moral obligation to safeguard the environment.

VII. Limitations:

This paper is descriptive in nature and has focused on the different practices of green supply chain management (GSCM) which are common in different industries. The study has identified six GSCM practices that are commonly followed by various business. In terms of the limitation of the study, the study is a review of literature that is available on GSCM practices and doesn't take any data on these GSCM practices from managers. Empirical evidence on the implementation of GSCM practices is needed in this domain to have a better understanding of the current level of adoption of GSCM in the industry in particular and in the country in general. Although organizations beat their competitors through low cost and better service, but they are also encountering demand for environmental protection from various stakeholders. We also recommend that further research be directed toward finding the level of adoption of GSCM practices empirically. Furthermore, the study does not consider the impact of GSCM practices on organizational performance. Future research could identify the relation between GSCM practices and different dimensions of organizational performance.

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