

# Green Supply Chain Practices and Green Supply Chain Performance

*A review of past literature and future research directions*

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**Abstract**—This paper explores past literature relating to Green Supply Chain Practices and Green Supply Chain Performance and identifies those papers that address these terms with a view of identify research work already done in these areas and also to identify future research directions from the identified papers. The papers have been identified year wise, journal title wise and topic wise along with the aim of these papers, the methodology used, conclusions drawn, limitations, sector and country context. This paper could serve as a good cross-check before taking on any new research work jointly addressing Green Supply Chain Practices and Green Supply Chain Performance. This way it could save a lot of time on the part of researchers and managers as it will serve as a ready reference for future research work that has potential.

**Index Terms**—Green Supply Chain Practices, Green Supply Chain Performance, review, past literature, future directions.

## I. INTRODUCTION

Global warming has been the priority issue for all the nations as it has a direct adverse impact on the planet Earth. Supply chains are also responsible for some of the non-environmentally friendly activities that they have. So it is of prime importance to know which Green Supply Chain Practices need to be used and also what Green Supply Chain Performance measures should be focused on. This paper focuses on identifying those papers that jointly address Green Supply Chain Practices and Green Supply Chain Performance. Further it enables one to identify papers and journals addressing a particular topic. Since this paper reviews the appropriate papers on Green Supply Chain Practices and Green Supply Chain Performance, it also throws light on the aim of the papers reviewed, the methodology used by these papers, the conclusion of these papers and also the future research directions. New researchers may use these future research directions to carry the work forward.

## II. METHODOLOGY USED TO ABSTRACT PAPERS FOR REVIEWING EXISTING LITERATURE

A suitable research library database was identified for reviewing literature on Green Supply Chain Practices and Green Supply Chain Performance. Based on the suitability of the database for the subject and based on the access to the research library database Science Direct was chosen as the research library database for abstracting relevant literature on Green Supply Chain Practices and Green Supply Chain Performance. Papers were searched jointly on the key words Green Supply Chain Practice and Green Supply Chain Performance for their occurrence in the title of the papers, abstract of the papers, keyword section of the papers and the body of the entire paper. In order to have a good quality of access to as many papers from peer-reviewed international journals, some filters were used. Firstly all papers were looked for in the listing. Then only journals were searched for. Books were dropped from the search process. Also topic wise listing was available. Accordingly all papers having a footprint on all available topics related to the keyword search were listed. The papers obtained by following this process had their footprints on one or more of the following sixteen topics namely Supply Chain; Green; Chain Management; China; Supply; Alternative; Carbon; Carbon Emission; Company; Contract; Government Intervention; Green Channel; Green Marketing; Indian; Producer; and Relationship Quality.

## III. REVIEW OF LITERATURE ON GREEN SUPPLY CHAIN PRACTICES AND GREEN SUPPLY CHAIN PERFORMANCE

In all eleven papers were obtained by applying the filters as discussed in the methodology section of this paper. The year wise distribution of the papers obtained is shown in Fig. 1.

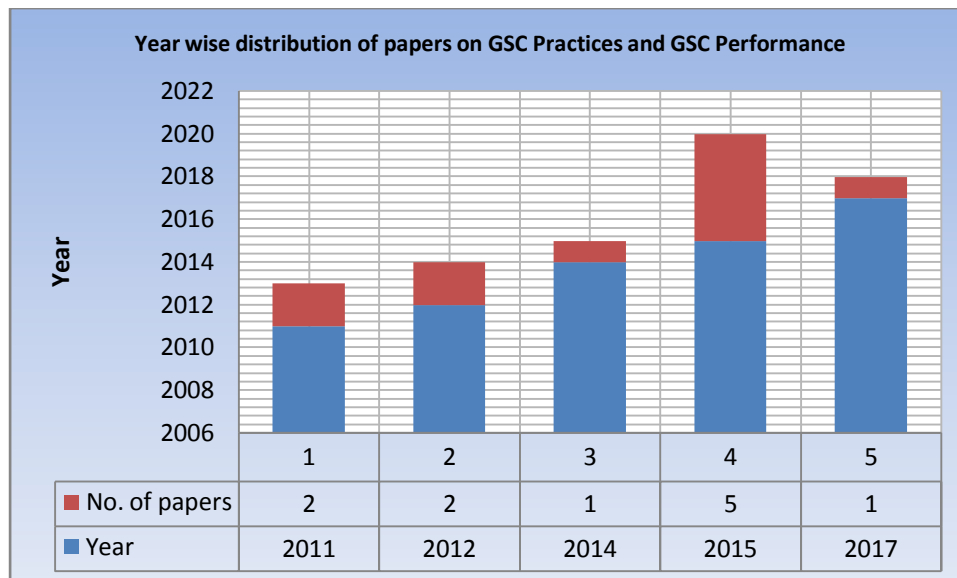


Figure 1. Year wise distribution of papers on GSC Practices and GSC Performance

From Fig. 1 it is evident that the eleven papers meeting the search criteria are spread over the five years namely 2011 (two papers published), 2012 (two papers published), 2014 (one paper published), 2015 (five papers published) and 2017 (one paper published so far this year). Fig. 1 shows that there is a rising trend in the number of papers published from 2011 (two papers) to 2015 (five papers). In 2017 one paper was available. This might be attributed to the fact that only a quarter of a year had elapsed when the keyword search was done. The papers available were spread over seven unique journals namely Transportation Research Part E: Logistics and Transportation Review; Industrial Marketing Management; Procedia - Social and Behavioral Sciences; Ecological Indicators; European Journal of Operational Research; International Journal of Production Economics; and Journal of Cleaner Production. Figure 2 shows the journal wise distribution of the papers that were available by doing the keyword search.

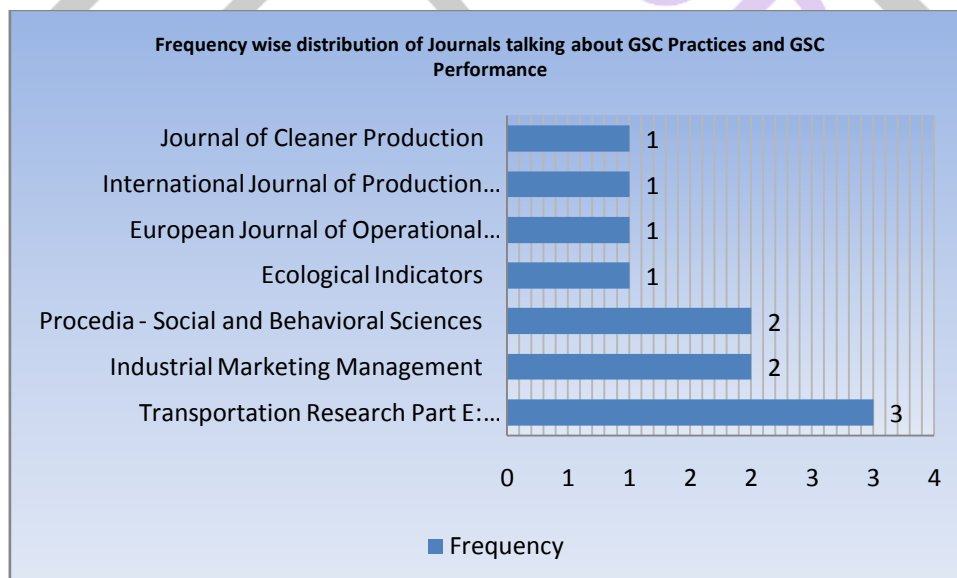
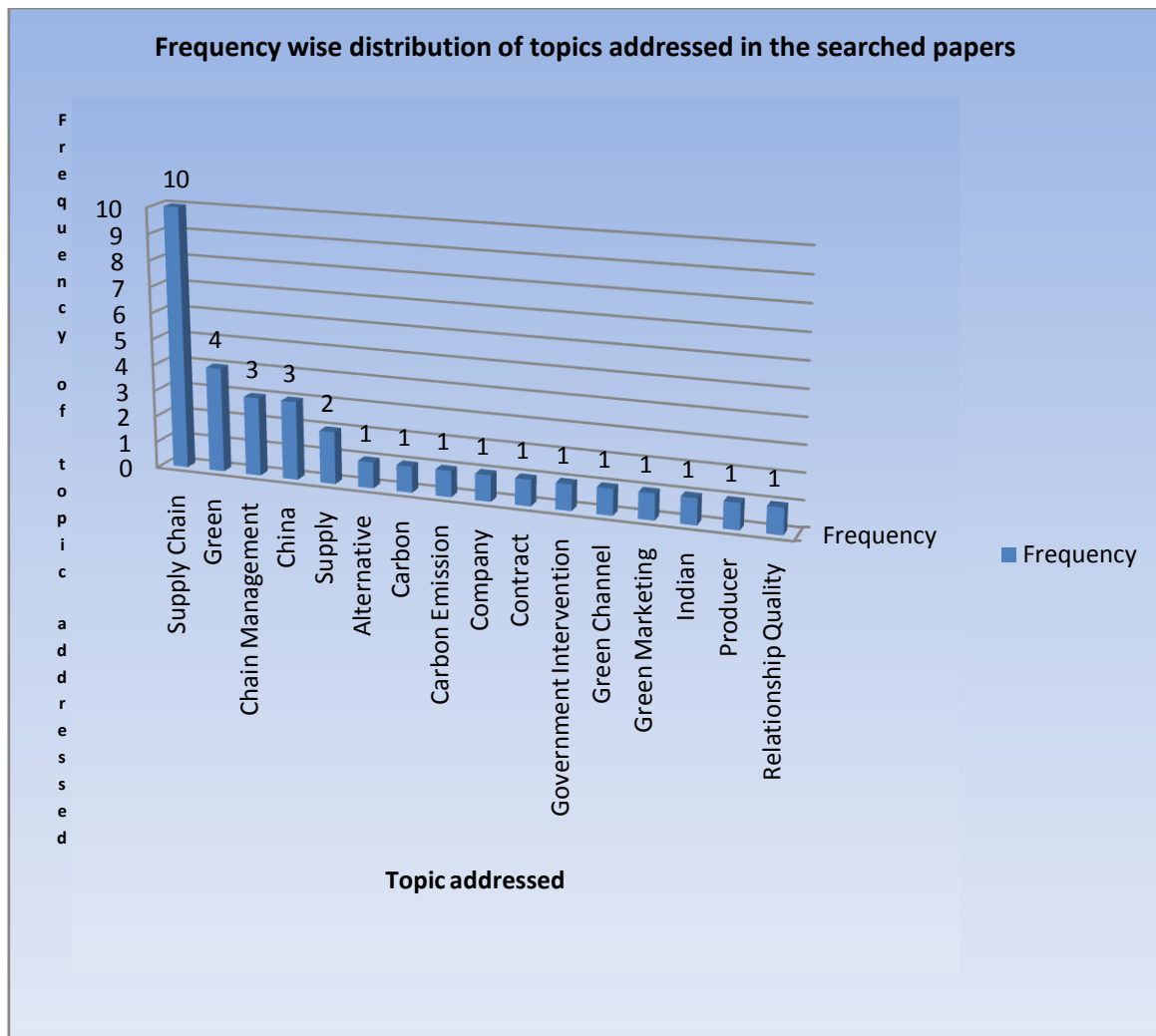


Figure 2. Frequency wise distribution of the journals talking about GSC Practices and GSC Performance

From Fig. 2 it is evident that there is a visible trend as regards the number of publications in the journals talking about Green Supply Chain Practices and Green Supply Chain Performance. The maximum number of papers talking about Green Supply Chain Practices and Green Supply Chain Performance appear in the journal Transportation Research Part E: Logistics and Transportation Review (three papers); followed by Industrial Marketing Management (two papers); followed by Procedia-Social and Behavioral Sciences (two papers); followed by Ecological Indicators (one paper); followed by European Journal of Operational Research (one paper); followed by International Journal of Production Economics (one paper); followed by Journal of Cleaner Production (one paper). The eleven papers obtained had their footprints on one or more of the following sixteen identified topics namely Supply Chain; Green; Chain Management; China; Supply; Alternative; Carbon; Carbon Emission; Company; Contract; Government Intervention; Green Channel; Green Marketing; Indian; Producer; and Relationship Quality. Figure 3 shows the frequency with which papers addressing these topics occurred in various papers obtained by a keyword search.



*Figure 3. Frequency wise distribution of the topics addressed by the searched papers*

The sixteen topics addressed by the eleven searched papers in the descending order of their occurrence are as follows: Supply Chain (10 times); followed by Green (4 times); followed by Chain Management (3 times); followed by China (3 times); followed by Supply (2 times); followed by Alternative (1time); followed by Carbon (1 time); followed by Carbon Emission (1 time); followed by Company (1 time); followed by Contract (1 time); followed by Government Intervention (1 time); followed by Green Intervention (1 time); followed by Green Channel (1 time); followed by Green Marketing (1 time); followed by Indian (1 time); followed by Producer (1 time); followed by Relationship Quality (1 time). Figure 4 shows the number of times one or more key topic(s) was addressed by each of the seven journal titles.

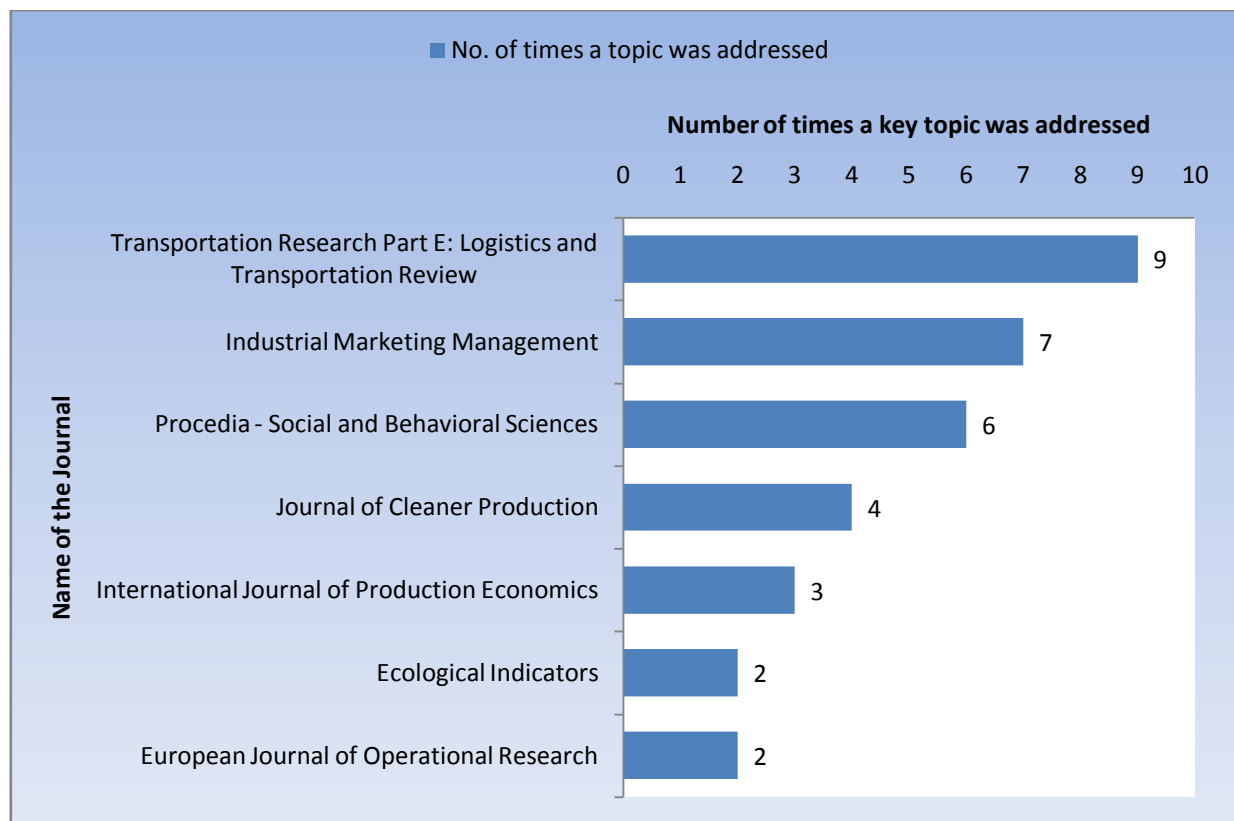


Figure 4. The number of times a key topic was addressed by each of the journal titles.

The descending order of the number of times one or more of these sixteen key topics were addressed by each of the journal titles is as follows: Transportation Research Part E: Logistics and Transportation Review (9 topics); followed by Industrial Marketing Management (7 topics); followed by Procedia-Social and Behavioral Sciences (6 topics); followed by Journal of Cleaner Production (4 topics); followed by International Journal of Production Economics (3 topics); followed by Ecological Indicators (2 topics); followed by European Journal of Operational Research (2 topics). This is illustrated in Figure 4. Table 1 shows a listing of the topics addressed by each of the journals in the descending order of the frequency by which they appeared in the respective journals.

Table 1. Topics addressed by the journals

Sr. No.	Title of the journal	Topic addressed	Frequency by which topic was addressed
1	Ecological Indicators	Green	1
		Supply Chain	1
2	European Journal of Operational Research	Green	1
		Supply Chain	1
3	Industrial Marketing Management	Contract	1
		Green	1
		Green Channel	1
		Green Marketing	1
		Producer	1
		Relationship Quality	1

Sr. No.	Title of the journal	Topic addressed	Frequency by which topic was addressed
		Supply Chain	1
4	International Journal of Production Economics	Company	1
		Supply	1
		Supply Chain	1
5	Journal of Cleaner Production	Carbon	1
		Carbon Emission	1
		Supply	1
		Supply Chain	1
6	Procedia-Social and Behavioral Sciences	Chain Management	2
		Supply Chain	2
		Alternative	1
		Indian	1
7	Transportation Research Part E: Logistics and Transportation Review	China	3
		Supply Chain	3
		Chain Management	1
		Government Intervention	1
		Green	1

Table 1 shows that journal named Ecological Indicators addressed the topic Green (1 time) and Supply Chain (1 time). The journal named European Journal of Operational Research addressed the topic Green (1 time) and Supply Chain (1 time). The journal named Industrial Marketing Management addressed the topics namely Contract (1 time), Green (1 time), Green Channel (1 time), Green marketing (1 time), Producer (1 time), Relationship Quality (1 time) and Supply Chain (1 time). The journal named International Journal of Production Economics addressed the topics namely Company (1 time), Supply (1 time) and Supply Chain (1 time). The journal named Journal of Cleaner Production addressed the topics namely Carbon (1 time), Carbon Emission (1 time), Supply (1 time) and Supply Chain (1 time). The journal named Procedia-Social and Behavioral Sciences addressed the topics namely Chain Management (2 times), Supply Chain (2 times) followed by Alternative (1 time) and Indian (1 time). The journal named Transportation Research Part E: Logistics and Transportation Review addressed the topics namely China (3 times) and Supply Chain (3 times) followed by Chain Management (1 time), Government Intervention (1 time) and Green (1 time). Likewise it was also of interest to know the journals on which a particular topic had its footprint. Accordingly Table 2 shows for each of the sixteen identified topics, the journals addressing these particular topics.

*Table 2. Journals addressing a particular topic for each of the sixteen identified topics*

Topic addressed	Name of Journal	Frequency	Cumulative Frequency
Supply Chain	Transportation Research Part E: Logistics and Transportation Review	3	10
	Procedia - Social and Behavioral Sciences	2	
	Ecological Indicators	1	
	European Journal of Operational Research	1	
	Industrial Marketing Management	1	
	International Journal of Production Economics	1	
	Journal of Cleaner Production	1	
Green	Ecological Indicators	1	4

	European Journal of Operational Research	1	
	Industrial Marketing Management	1	
	Transportation Research Part E: Logistics and Transportation Review	1	
Chain Management	Procedia - Social and Behavioral Sciences	2	3
	Transportation Research Part E: Logistics and Transportation Review	1	
China	Transportation Research Part E: Logistics and Transportation Review	3	3
Supply	International Journal of Production Economics	1	2
	Journal of Cleaner Production	1	
Alternative	Procedia - Social and Behavioral Sciences	1	1
Carbon	Journal of Cleaner Production	1	1
Carbon Emission	Journal of Cleaner Production	1	1
Company	International Journal of Production Economics	1	1
Contract	Industrial Marketing Management	1	1
Government Intervention	Transportation Research Part E: Logistics and Transportation Review	1	1
Green Channel	Industrial Marketing Management	1	1
Green Marketing	Industrial Marketing Management	1	1
Indian	Procedia - Social and Behavioral Sciences	1	1
Producer	Industrial Marketing Management	1	1
Relationship Quality	Industrial Marketing Management	1	1

Table 2 shows in the descending order the frequency of occurrence of a particular topic addressed by various journals to date and also the cumulative frequency of the occurrence of a particular topic. This would enable one to select a particular journal based on the key topic of focus and the frequency of occurrence of the key topic in that journal. Table 3 gives a listing of paper obtained by doing a joint keyword search on Green Supply Chain Practices and Green Supply Chain Performance along with the aim of the paper, methodology used, conclusion obtained and future directions for research. Also it gives the key topics focused by each of the papers. In this way one can select a future research direction based on the topic of interest.

*Table 3. Aim, methodology, conclusion, future research directions and key topics addressed by each paper.*

Reference no.	Aim of the paper	
[1]	The purpose of this paper is to improve the understanding of carbon footprint in the automobile supply chain with the help of a case study of Hyundai Motor Company (HMC)	<p><b>Methodology:</b> First, identification and measurement of direct and indirect carbon footprint is critical for mitigating supply chain risks. Second, setting the system boundary of measurement is another important issue to integrate the issue of carbon footprint into supply chain management. Third, developing a map of product carbon footprint facilitates identification and measurement of carbon emissions across the supply chain.</p> <p><b>Conclusion:</b> This paper helped to understand the carbon footprint in the automobile supply chain with the help of a case study of Hyundai Motor Company.</p> <p><b>Future directions:</b> Since climate change and carbon footprint present challenges to many industries, increasing our understanding of how to integrate carbon footprint in supply chain management is necessary, but has seen little research in the automobile industry. So it may now be applied in the automobile industry.</p> <p><b>Key topic(s) addressed:</b> Carbon, Carbon Emission, Supply, Supply Chain.</p>
[2]	The aim of this editorial is to highlight on the following topics: 1. GSCM strategic planning and operational models. 2. Green logistics network configurations and resource allocation strategies. 3. GSCM multilateral channel relationship management.	<p><b>Methodology:</b> Literature Review</p> <p><b>Conclusion:</b> This paper helped to identify the content in the special issue which was published along with its importance.</p> <p><b>Future research direction:</b> More investigation is required in the area of GSCM.</p>

	4. Driving and promotional incentives for sustainability of green supply chains. 5. GSCM practical cases, issues and solutions.	<b>Key topic(s) addressed:</b> Chain, Chain Management, Green, Supply Chain.
[3]	This editorial, reviews some key literatures relating to green marketing strategy, green supply chain management, and the role of technology in green management. This editorial then introduces the articles appearing in this special issue. This special issue aims at reflecting the most recent advances on green industrial marketing, green/sustainable supply chains and their interplay in green industrial branding, and to explore future research directions.	<b>Methodology:</b> Literature review <b>Conclusion:</b> This paper gave a good review of green marketing strategy, green supply chain management, and the role of technology in green management. <b>Future research direction:</b> The guest editors hope that the solicited papers can provide insights on the impacts of sustainable or green supply chains on marketing theory in industrial and business-to-business markets. <b>Key topic(s) addressed:</b> Green, Green Marketing, Supply Chain.
[4]	The purpose of our research is to : (i) review sustainable supply chain management research in the last decade and analyze it from different perspectives, (ii) propose a unified conceptual frame- work for sustainable supply chain management, (iii) highlight the importance of reliable supply chain performance measures and develop and propose a composite index metric, (iv) present a case study of sustainable supply chain performance indicators in a the energy sector, and highlight the gaps in the literature that need further investigation.	<b>Methodology:</b> Literature review; Case study <b>Conclusion:</b> Original framework for Sustainable Supply Chain Management was developed. <b>Future research directions:</b> Recognizing the importance of reliable performance measures for the mainte- nance of sustainable supply chain practices we have also included a case study describing the experience of a utility company in setting performance indicators. This case showed that there is a strong demand in industry for such indicators; and that more complex indicators are required. Based on these findings we also developed a framework for sustainable supply chain metrics. There is an increasing interest in studying sustainable supply chains. Below we outline a research agenda based on our findings in the literature and experience with the case study company. <b>Key topic(s) addressed:</b> Company, Supply, Supply Chain.
[5]	This study aims to understand how buyer–seller relationship, competitive environment and guanxi affect Chinese manufacturers’ decision to implement Green Supply Chain Collaboration (GSCC). Also this paper examine whether guanxi is able to mediate the buyer–seller relationship and GSCC implementation.	<b>Methodology:</b> Data collected from 222 Chinese manufacturing organizations was analyzed using the partial least squares method of structural equation modeling. <b>Conclusion:</b> The result shows that buyer–seller relationship influences Green Supply Chain Collaboration through asset specificity, volume uncertainty, transaction frequency and competitive environment. The results also showed support for the hypotheses that guanxi mediates the effect of asset specificity, volume uncertainty and environmental competition on GSCC. <b>Future research directions:</b> Future research work can collect data from other developing or Asian countries and conduct a cross-country comparison. <b>Key topic(s) addressed:</b> China, Supply Chain
[6]	This paper develops a quantitative evaluation model to measure the uncertainty of GSCM activities and applies an approach based on Višekriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method which is an extension of intuitionistic fuzzy environment aiming to solve the green multi-criteria decision making (GMCDM) problem.	<b>Methodology:</b> The triangular fuzzy numbers (TFNs) were used to handle imprecise numerical quantities. Then, a hierarchical multiple criteria decision making (MCDM) model was proposed based on fuzzy sets theory and VIKOR method to deal with the problem. The results show the alternative ranks of the four

		<p>evaluated companies which was based on their performance in GSCM initiatives.</p> <p><b>Conclusion:</b> The results also indicated that the main criteria of the research ranked as follows respectively: eco-design, green production, green purchasing, green recycling, green transportation and green warehousing. Finally, a comparative analysis of results by fuzzy VIKOR is presented.</p> <p><b>Future research directions:</b> It would be more helpful to consider other alternative methodological approaches to test the proposed framework. In this case MCDM methods can be applied to assess the GSCM of firms. Results obtained from these methods could be compared with the results from this work which is another line for further research work.</p> <p><b>Key topic(s) addressed:</b> Alternative, Green, Supply Chain.</p>
[7]	<p>This study aims to understand how buyer–seller relationship, competitive environment and guanxi affect Chinese manufacturers’ decision to implement Green Supply Chain Collaboration (GSCC). Also this paper examine whether guanxi is able to mediate the buyer–seller relationship and GSCC implementation.</p>	<p><b>Methodology:</b> Data collected from 222 Chinese manufacturing organizations were analyzed using the partial least squares method of structural equation modeling.</p> <p><b>Conclusion:</b> The result shows that buyer–seller relationship influences Green Supply Chain Collaboration through asset specificity, volume uncertainty, transaction frequency and competitive environment. The results also showed support for the hypotheses that guanxi mediates the effect of asset specificity, volume uncertainty and environmental competition on GSCC.</p> <p><b>Future research directions:</b> Future research work can collect data from other developing or Asian countries and conduct a cross country comparison.</p> <p><b>Key topic(s) addressed:</b> China, Supply Chain.</p>
[8]	<p>In this research work, seven green criteria and three alternatives have been identified based on literature review and discussion with the field experts taken from Indian automobile industries located at Delhi region.</p>	<p><b>Methodology:</b> On the basis of considered criteria and alternatives, a hierarchy type performance model has been developed and analyzed using Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) approach to select the best alternative in order to improve the performance of GSCM system.</p> <p><b>Conclusion:</b> The findings suggested that alternative ‘web-based technologies’ is more desirable among considered alternatives and insert a significant role in enhancing the green supply chain performance of an industry.</p> <p><b>Future research directions:</b> Alternative web based technologies comes out as a best alternative and will play a very important role in improving the performance of GSCM system of an organization.</p> <p><b>Key topic(s) addressed:</b> Chain Management, Supply Chain.</p>
[9]	<p>In present research, an effort has been made to identify and evaluate hurdles in implementing SSCM in Indian automobile sector.</p>	<p><b>Methodology:</b> Literature review approach and experts’ inputs have been used to identify hurdles in implementing SSCM. Interpretive Structural Modeling (ISM) methodology has been utilized to understand the contextual relationships among these identified hurdles, their interdependence and hierarchy levels to implement</p>



		<p>SSCM practices in Indian automobile sector. MICMAC analysis has also been used to categorize identified hurdles according to their importance.</p> <p><b>Conclusion:</b> 'Political Instability' has been reported as most hurdle in implementing SSCM. Unawareness among society about social practices has been found as the most dependent hurdle of the present study.</p> <p><b>Future research directions:</b> In future work, the derived ISM based hierarchical model may be tested using Structural equation modeling (SEM). Graph theoretic approach may be used to quantification of identified hurdles. Fuzzy ISM may be used as a future work, which can be an improvement over binary ISM.</p> <p><b>Key topic(s) addressed:</b> Chain Management, Indian, Supply Chain.</p>
[10]	<p>This work presents an analytical model to investigate the effect of government intervention on green channel performance in a producer-retailer green channel dyad <i>via</i> the mediating effects of channel power shifts and relationship quality improvement.</p>	<p><b>Methodology:</b> The proposed model is tested empirically using questionnaire survey data obtained from retailers of the producer-retailer green channels of consumer electronic products in Taiwan.</p> <p><b>Conclusion:</b> Analytical results indicate that government intervention has positive effect on green channel performance when the producer adopts joint action measures. The producer can utilize joint action as a non-coercive influential strategy to alleviate a target member's countervailing power and bargaining power and to improve channel relationship quality, thereby enhancing green channel performance under government intervention to adopt extended producer responsibility.</p> <p><b>Future research directions:</b> Since the proposed model has been tested empirically, it can be implemented as a regular practice.</p> <p><b>Key topic(s) addressed:</b> Government Intervention, Producer, Relationship Quality.</p>
[11]	<p>This paper investigates the green product design issues in supply chains under competition. The research questions address how supply chains' decisions on the "greenness" of products are affected by factors such as supply chain structures (centralized and decentralized), the green product types (development-intensive product or marginal-cost intensive product), and the types of competition (price competition and greenness competition).</p>	<p><b>Methodology:</b> With a game-theoretic approach, the model starts with a simple supply chain with one manufacturer and one retailer. Then the model is expanded to include a horizontal retailer competition case and six cases of competing supply chains.</p> <p><b>Conclusion:</b> Results indicate that, 1. The distortion from a non-coordinated supply chain (the double marginalization effect) has counter-intuitive impact on the degree of product "greenness"; 2. supply chain price competition at the retailer level may positively influence the equilibrium greenness while the product greenness competition reduces the equilibrium greenness, and the joint impact from price and greenness competition on equilibrium greenness depends on the relative strength of the two types of competition.</p> <p><b>Future research directions:</b> This paper shows how green product design can be used in other supply chains under competition.</p> <p><b>Key topic(s) addressed:</b> Green, Supply Chain.</p>

#### IV. CONCLUSION AND FUTURE RESEARCH DIRECTIONS

This paper helps to identify past research and also future research directions with a keyword search jointly done on the terms Green Supply Chain Practices and Green Supply Chain Performance. Also this paper allows one to select a future research direction based on the topic of interest and methodology used. Also this paper throws light on the topics predominantly addressed in the various related journals pertaining to Green Supply Chain Practices and Green Supply Chain Performance. The paper gives a listing of papers that have published papers relating to Green Supply Chain Practices and Green Supply Chain Performance. This paper also indicates the topics focused on by each of the obtained papers. Apart from this it is possible to know which journals and which papers focus on a particular topic. This paper is expected to help know the current state of research and also help new researchers in selecting a future research direction to carry the work forward.

#### V. ACKNOWLEDGMENT

I acknowledge my heartfelt thanks to the anonymous reviewers. Also would like to thank Dr. Abdul Razak Honnutagi, Director-Anjuman-I-Islam's Kalsekar Technical Campus, New Panvel. I devote this paper to my parents Mr. Indravadan Chimanlal Gandhi and Mrs. Sarmista Gandhi and my wife Yasmin Gandhi for encouraging and motivating me constantly to do my research work. My children Mohd. Hasan Gandhi and Binish Gandhi have also been supportive to me though I was busy with my research work. Special thanks to my guide from NITIE, Mumbai, Dr. Sanjay Sharma for inculcating in me the habit of writing original work.

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