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Green Supply Chain Management and Customer Satisfaction: A Bibliometric Analysis

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Abstract

A bibliometric analysis was conducted of the literature on green supply chain management (GSCM) and customer satisfaction (CS). It was revealed through analysis that the field has grown significantly in recent years, with the most significant increase in publications in the last decade itself. Most influential works and authors in the GSCM and CS fields were identified through this study. Analysis revealed that a small number of scholars have produced a disproportionate number of influential works. However, as the field matures, an increasing number of authors are contributing to the research. The study also highlighted the growing interest in the formal modelling of GSCM with practical applications. This is an essential and growing era of research, as it can assist companies to improve their customer satisfaction and environmental performance. Data were retrieved from the Scopus database, and bibliometric analysis was conducted using VOSviewer and the Bibliometrix package in R to visualize co-authorship networks, keyword clusters, and citation patterns.

Keywords: Green Supply Chain Management, Customer Satisfaction, Supply Chain, Management and Consumer Behavior.

1 Introduction

Environmental sustainability has become a high-priority goal. It is the top objective of businesses across all sectors of the economy. Customers and other stakeholders, spurred by a greater awareness of our changing climate and the deterioration of our environment, are now investigating, with great interest, the environmental practices of the businesses they deal with. Indeed, businesses are under increasing pressure to carry out sustainable practices in all aspects of their processes, including, very importantly, the management of their supply chains.

The strategic approach is now quite popular as a means of addressing environmental concerns in supply chain operations, known as “green supply chain management,” associated with several programs aimed at reducing waste, energy-efficient transportation, “green” production, and environmentally sound procurement processes.

Researchers are increasingly examining the link between GSCM practices and customer satisfaction, exploring whether environmentally responsible operations enhance consumer trust, loyalty, and brand reputation. The thought that emerged to spur it was this: if businesses in the supply chain conduct themselves in an environmentally conscious way, will that make consumers more satisfied with those businesses? Consumers increasingly prefer to associate with ecologically responsible companies, perceiving such practices as aligned with their values. Moreover, are not “green” practices by those companies a good thing for the environment that should make consumers feel good, too?

In today's economy, where environmental issues are at the forefront, businesses that want to secure a competitive position must understand the relationship between GSCM and customer satisfaction. Recent research has shown that even the perception of sustainability in a company's operations can boost its brand image and engender customer loyalty in this environmentally conscious age. However, what GSCM does to (or for) customer happiness seems to be far from direct. Despite this growing attention, the literature on GSCM and customer satisfaction remains fragmented, lacking a systematic synthesis of research trends and thematic directions. This study addresses this gap through a bibliometric analysis of the GSCM–CS knowledge base. In light of this gap, the present study offers the bibliometric mapping of the GSCM–CS research landscape, identifying influential publications, thematic clusters, and future research trajectories.

2 Literature Review:

In the contemporary landscape of global business, there is an undeniable and growing emphasis on the adoption of environmentally sustainable practices, often encapsulated under the umbrella term "Green Concept." Most organizations nowadays are focused on making efficient use of resources while keeping in mind their impact on people's health, environment, and productivity (Waidyasekara & Sandamali, 2012).

The biggest challenge of the 21st century is dealing with environmental pollution (Cosimato & Troisi, 2015). With an increasing population, more waste is being generated, and we are running out of resources. In order to address these problems, the academic and business communities need to focus on protecting the environment (Wang et al., 2023). Businesses are under constant pressure to consider environmental issues across all steps of their supply chains (Yu et al., 2014). This makes green supply chain management the only solution. Managers and researchers have been adapting to GSCM (Srivastava, 2007). GSCM is the broader picture that talks about getting things done while being environmentally conscious about how things are made and delivered (Srivastava, 2007). GSCM practices enable companies to be environmentally responsible and leave a smaller impact on the world (Khan et al., 2016).

Managing the supply chain is a crucial part of managerial operations, which involves everything from procuring raw materials to delivering final goods. To get these tasks done most efficiently, most manufacturing companies are adopting GSCM practices. These practices include making required changes in processes to reduce pollution and waste, recycle and reuse materials, use natural resources efficiently, and cut down on emissions (Waidyasekara & Sandamali, 2012).

Customers, government bodies, and others who are interested are asking companies to do better in how they work, in terms of taking care of the environment, being responsible for society, and making money. This is about addressing the needs of today's society without giving up the capability to meet the needs of the future. Getting good results in three areas – making money, helping the environment, and benefiting society – all at the same time, is quite tricky for both businesses and the sustainability field (Dubey & Gunasekaran, 2014). Recent bibliometric studies such as (Mathur et al., 2024) on Green Human Resource Management and Environmental Performance further affirm the interdisciplinary expansion of green management practices, suggesting that HR functions too play a pivotal role in enhancing environmental outcomes—a dimension closely linked to supply chain sustainability and customer trust.

The need to lower the amount of carbon released by organizations is becoming more important, especially for organizations that are not focused on making a profit. These organizations are worried about issues like global warming and pollution. Taking care of the natural environment has become a goal for companies to address societal concerns and to look after the environment. It is a good idea for these organizations to promote sustainability throughout their entire supply chain network. These ways can help in achieving environmental sustainability (Masoumi et al., 2019).

Regulatory organizations have been active more than ever before and have been regularly introducing new rules to make businesses environmentally responsible (Zhang et al., 2019). China has made it a significant part of its national strategy to be environmentally sustainable. MNCs like Apple, Motorola, Pepsi, and Walmart have also directed their Chinese manufacturers to create ISO 14001 environmental management systems and to make a public disclosure of their environmental audits (Muralidhar, 2012) because of this global pressure, the whole manufacturing community is taking GSCM practice's role serious in their operations (Villena & Dhanorkar, 2020).

The competitive nature of the market makes manufacturers more environmentally responsible, as it also benefits them economically (Albort-Morant et al., 2016). Pressure from governments, suppliers, and rivals has made businesses understand the importance of being environmentally responsible. Businesses are making a genuine effort to adapt accordingly to GSCM strategies and practices (Khan & Qianli, 2017).

Customer satisfaction (CS), a dominant concept in marketing, refers to the actions customers take after making a purchase, which are influenced by the quality of the product and the efficiency of the supply chain (Yu et al., 2013). Many manufacturers are now paying close attention to what customers want. Nowadays, customers are well-informed and are increasingly concerned about how products affect the environment. They push manufacturers to avoid actions that harm the environment and encourage protective measures. More customers are getting aware and demanding products that are environmentally friendly (Choi & Hwang, 2015).

In the world of business, supply chain management is all about working closely with suppliers, manufacturers, and customers to improve efficiency and speed. Customers play a crucial role in keeping a business going. That is why it is important to study how adopting green supply chain management (GSCM) practices can impact how well a business runs and how satisfied customers are.

Past studies show that manufacturing companies should consider being environmentally responsible. If they successfully use GSCM practices, they can reduce waste, save money, raise awareness about eco-friendly products, boost employee

morale, respond to public concerns, and overall do better in many ways, including the environment, the economy, and their operational efficiency (Le et al., 2022).

2.1 Research Gap

Although several studies have explored individual aspects of GSCM and CS, there remains a lack of systematic, data-driven synthesis connecting the two. Previous reviews are largely narrative and do not map publication trends, influential contributors, or thematic structures of this domain. Moreover, no bibliometric study has comprehensively examined how GSCM–CS research has evolved, the intellectual and collaborative networks driving it, or the emerging clusters shaping future inquiry. This study addresses these gaps by applying bibliometric techniques to provide a structured, quantitative overview of the field's evolution and research directions.

2.2 Synthesis of Prior Findings

The reviewed literature highlights that while GSCM practices positively influence customer satisfaction through improved environmental performance, cost efficiency, and brand trust, findings remain fragmented. Few studies directly quantify the impact of customer satisfaction, and results vary across industries and regions. There is consensus on the reputational value of GSCM, but disagreement persists on its measurable effect on long-term loyalty and retention. Siddiqui et al. (2019) empirically established that customer satisfaction directly and indirectly (via trust) drives loyalty, a finding that complements emerging GSCM research linking sustainability-driven satisfaction with long-term consumer retention. This inconsistency underscores the need for a structured bibliometric synthesis to map the intellectual structure, collaborative networks, and emerging themes in this domain.

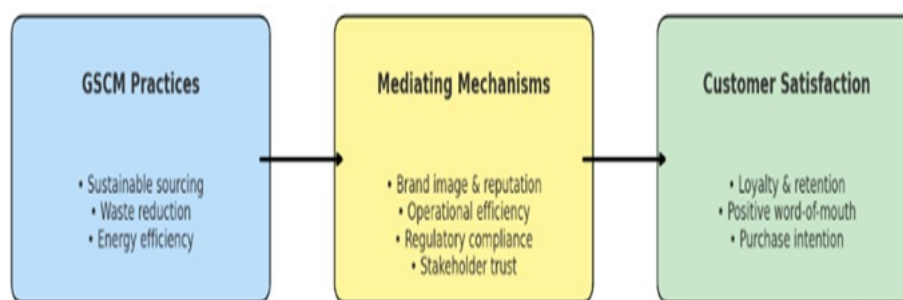


Figure 1: Conceptual Framework

Based on the reviewed literature, Figure1 presents the conceptual framework showing how GSCM practices influence customer satisfaction through mediating mechanisms such as operational efficiency, improved brand image, compliance, and stakeholder trust.

3 Research methodology and preliminary data statistics

Literature reviews map and assess the existing body of research to recognize gaps in knowledge and help in highlighting the borders of knowledge. They are typically conducted in an iterative cycle of defining appropriate search terms, exploring the literature, and analyzing the results (Tranfield, Denyer, & Smart, 2003; Saunders, Lewis, & Thornhill, 2009). Rowley and Slack (2004) have given an organized procedure for scanning resources and a mind map to constitute the literature review, building the bibliography, and writing the study. A parallel methodology was followed, using a five-step method for data collection and assessment of the field.

3.1 Defining the appropriate search terms

To identify relevant literature for this study, a structured search strategy was developed using Boolean logic, informed by prior research in green supply chain management (GSCM) and customer satisfaction.

The keywords were grouped into four thematic clusters:

- i. **Environmental terms:** "Green" OR "Sustainable" OR "Ecological"
- ii. **Supply chain terms:** "SCM" OR "Supply Chain" OR "Logistics"
- iii. **Customer perspective terms:** "Customer" OR "Client" OR "Consumer"
- iv. **Satisfaction terms:** "Satisfaction" OR "Happiness"

These groups were combined using the AND operator to construct the final search string: "Green" OR "Sustainable" OR "Ecological" AND "SCM" OR "Supply Chain" OR "Logistics"

AND "Customer" OR "Client" OR "Consumer" AND "Satisfaction" OR "Happiness".

When searched with the above-mentioned keywords in the Scopus database, it gave 564 articles, which were later subjected to further refinement criteria, which are:

- i. To align with the theme of this study, articles belonging to the following disciplines: 'Business Management and Accounting' and 'Social Sciences'.
- ii. The study selected was limited to Articles only; other scientific works, like conference papers, book chapters, research letters, and notes, etc., were excluded.
- iii. The study was limited to articles in the English language only.

After this refinement, 230 articles were taken for further analysis through Bibliometrix R and Vosviewer 4

3.2 Bibliometric Analysis

Bibliometric analysis studies use statistical and mathematical measures to determine patterns in the already available literature (Singh & Dhir, 2019). Bibliometric analysis helps in exploring and mapping existing literature in the domain. Reviewing the existing literature to understand the development of the research field is important. Hence, this study uses bibliometric analysis to highlight significant trends in terms of its theoretical, intellectual, and social structure.

To put it simply, bibliometric analysis is a helpful tool for understanding and tracking the growth of long-established areas of scientific knowledge. It takes a lot of scattered and unorganized data and makes sense of it carefully and systematically. Adequate bibliometric studies can lay down strong groundwork for moving a field forward in fresh and important directions. It gives researchers the ability to (1) get a quick overview, (2) spot areas where more knowledge is needed, (3) come up with new ideas to study, and (4) figure out where their work fits in this field. This Bibliometric study seeks to answer the following research questions.

RQ1: How has the literature on green supply chain management (GSCM) and Customer Satisfaction (CS) evolved, and what are the prevailing research subjects and conversations within it?

RQ2: Which countries are at the leading edge of contributing to academic GSCM and CS literature?

RQ3: Who are the most influential researchers, and which articles have had the most significant impact on GSCM and CS literature?

RQ4: What are the prevailing trends in the field of GSCM and CS literature?

3.3 Selection of Database and Tools

3.3.1 Choosing Scopus as your database for research on Green Supply Chain Management (GSCM) and customer satisfaction (CS) has several compelling justifications:

- i. *Comprehensive Coverage*: Among the biggest databases available for citations and abstracts for peer-reviewed literature is Scopus, offering a comprehensive coverage in fields including environmental sciences, management, and business (Schotten et al., 2017).
- ii. *High-Quality Sources*: Most of the high-impact journals are indexed by Scopus, so one can be sure that the research papers and articles found are of the highest caliber and have gone through the peer review process.
- iii. *Advanced Search Capabilities*: Scopus also provides a no. of advanced search features, such as the ability to filter results based on subject, date, author, and keyword searches, and document type.

3.3.2 Selection of Bibliometric Tool

For the application of statistical methods to the study of bibliographic data, this study uses bibliometric analysis. This is an early method that has been used since the 19th century, and it uses mathematical and statistical tools to study scientific literature. Most commonly, it is used by information science and libraries to improve library operations (Tella & Olabooye, 2014).

Over time, different software tools like BibExcel, Publish or Perish, CiteSpace (Lis et al., 2020), and Histcite (Garfield, 2004) have been used to do bibliometric studies. VOSviewer is the software used for visualizing the data (Sarkis et al., 2011).

On the other hand, there is a tool called Bibliometrix, which is open-source. In this study, a tool was developed using a programming language called R. This tool facilitates a thorough bibliometric study, including data analysis and visual representation (Ariaa & Cuccurullo, 2017). Usually, using other software can be complicated due to issues with access and training.

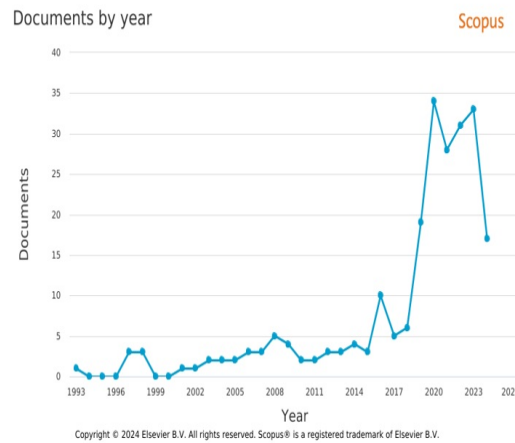
This means anyone can use it. It is designed to map out science in a detailed way. It is constantly being improved and can work well with other stats tools in R. Because of this, it has become popular in the world of studying bibliometrics. In this study, they used something called Biblioshiny, which is a web app that comes with the Bibliometrix package. It is easy to use, even if you are not a coder. It helps with mapping science and uses the main features from the Bibliometrix package to do this.

Similarly, Vos Viewer was also used to analyze and visualize the dataset and extract meaningful insights. A powerful software tool named Vos Viewer was used, which helped visualize bibliometric data through term maps and keyword co-occurrence networks.

4 Descriptive Analysis

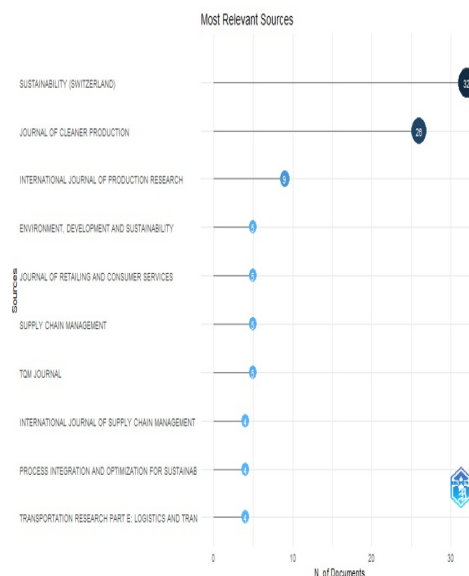
It discusses various dimensions through which data has been taken for analysis and unveils the primary findings from the bibliometric analysis:

4.1 Descriptive statistics:



Graph 1: Annual distribution of research within the field of GSCM and CS.

In order to understand the evolution of GSCM and CS literature (RQ1), historical progression was examined as in Graph 1. Research publications have been steady since 2001, with minimal activity before 2001. The early 2000s saw gradual growth in the number of publications, with a sudden increase in 2015–16, nearly three times from 3 to 10. This upward trend then continued increasing exponentially, reaching its peak in 2020 with 34 documents, indicating sustained interest.



Graph 2: The 10 most prominent journals within the GSCM and CS.

Graph 2 shows the top 10 journals in GSCM and CS, and their no. of articles. Leading among all journals with the most significant number of articles is Sustainability (Switzerland), with 32 articles. The second prominent journal is the Journal of Cleaner Production, with 26 documents, and the International Journal of Production Research comes in third with a total of 9 documents. Together, these three journals constitute approximately 29% of the total 230 articles in our sample. Other notable journals include Environment, Development and Sustainability (5), Journal of Retailing and Consumer Services (5), Supply Chain Management (5), International Journal of Supply Chain Management (4), Process Integration and Optimization for Sustainab (4), and Transportation Research Part E: Logistics and Tran (4). Together, the top 10 journals constitute above 43% of the total sample taken for analysis, representing a varied and interdisciplinary approach to GSCM and CS studies across environmental, economic, technological, and management disciplines.

Similarly, Table 1 above lists the top 15 research scholars who have contributed to GSCM and CS research in leading Scopus journals. Among these, Tirkolae and Zhang J have the highest no. of articles, with 4 articles each. Followed by the next 10 authors with 3 articles each, and later 3 with 2 articles each. The top 15 authors together constitute more than 19%

Table 1: The top contributors.

Research scholars with the highest research production		Top Academic institutions in terms of production		Country-specific production	
Authors	Articles	Institution	Articles	Country	Articles
TIRKOLAEI	4	ISLAMIC AZAD UNIVERSITY	10	India	42
ZHANG J	4	ISFAHAN UNIVERSITY OF TECHNOLOGY	9	China	36
CHOI D	3	UNIVERSITAS INDONESIA	9	United States	33
HEJAZI SR	3	YAZD UNIVERSITY	9	Iran	27
KHOSROSHAHI H	3	DALIAN MARITIME UNIVERSITY	8	UK	18
KUMAR V	3	JIANGSU UNIVERSITY	8	South Korea	14
LI Z	3	SUAN SUNANDHA RAJABHAT UNIVERSITY	8	Canada	11
SARKAR B	3	CHUNG-ANG UNIVERSITY	7	Turkey	11
VACHON S	3	MAZANDARAN UNIVERSITY OF SCIENCE AND TECHNOLOGY	7	Taiwan	9
WANG H	3	NANYANG TECHNOLOGICAL UNIVERSITY	7	Spain	8
XU Z	3	TIANJIN UNIVERSITY	7	Italy	8
ZHANG X	3	UNIVERSITY OF TEHRAN	7	Thailand	7
AGHDAM MM	2	LOVELY PROFESSIONAL UNIVERSITY	6	Malaysia	7
CHAND P	2	AUBURN UNIVERSITY	5	Poland	6
CHAUHAN R	2	CHONGQING JIAOTONG UNIVERSITY	5	BANGLADESH	5

of the articles in our sample. Leading academic institutions for GSCM and CS research are highlighted in Table 1. With ten papers, Islamic Azad University is first on the list. With nine articles each, Isfahan University of Technology, Yazd University, and the University of Indonesia follow. Several institutes with eight and seven publications are also included. Most of these universities are found in developed nations with strong research networks. Underdeveloped country institutions also contribute to the literature on sustainability research, although they might need help getting worldwide recognition.

Table 1 also outlines the top 15 countries in GSCM and CS research. India leads with 42 articles (18%), followed by China (36, 16%) and the US (33, 14%). Iran and the UK contribute significantly, with 27 (12%) and 18 (8%) articles, respectively. Other nations, such as South Korea, Canada, Turkey, Taiwan, and Spain, collectively represent 23%. Italy, Thailand, Malaysia, Poland, and Bangladesh complete the top 15, comprising 14%. These results underline a global interest in GSCM research, highlighting the global nature of sustainability challenges and the importance of collaborative research.

4.2 Keywords and citations

Critical insights into the commonly discussed subjects and rising themes in GSCM and CS may be gained by analyzing the keyword occurrences in Table 2. Notably, “Customer satisfaction” (94 occurrences) and “sustainable development” (66 occurrences) take center stage, highlighting the emphasis on these overarching concepts. The study explores several aspects of sustainable development, such as ecological stability, resource security, and sustainability research. Equally important are “Supply chain management” (59 occurrences), “sustainability” (49 occurrences), and “supply chains” (42 occurrences), underlying keen interest in enhancing GSCM processes. Less often discussed yet important keywords include “Decision making” (28 Occurrences), concentrating on sustainable development decision-making procedures, and “Sales”, “Logistics”, and “Optimization” accounting for (27, 25, and 15) occurrences consecutively, stating optimizing the supply chain in a more efficient, green, and sustainable way.

Table 2 also highlights top-cited articles, led by Vachon and Klassen (2008) with 1275 citations for their work on moving toward environmental sustainability. Management should be more precise and concerned about improving environmental practices and integrating them into their supply chain. Linton et al. (2007), who followed, provided insights about the focus on environmental management and optimization of environmental factors, considering the entire supply chain during production. Ranked third with 453 citations, focusing on the effects of green practices on the performance of the supply chain (Azevedo et al., 2011), and garnered 448 citations for their work on pricing strategies in competitive dual-channel green supply chains (Li et al., 2016). Vachon (2007) received 367 citations for their work, implying that increased investment in pollution prevention technology is favorably correlated with environmental cooperation with suppliers, but that similar cooperation with customers has little effect on the application of pollution prevention technologies. These top-cited articles cover diverse GSCM and CS topics, from the influence of green practices among supply chains to how operational performance impacts customer satisfaction.

Table 2: Top 15 frequent keywords in the GSCM and CS research.

Top 15 frequent key-words		Most Cited articles	
Keywords	Occurrences	Document	Citations
Customer satisfaction	94	Vachon (2008)	1275
Sustainable development	66	Linton (2007)	1247
Supply chain management	59	Azevedo (2011)	453
Sustainability	49	Li (2016)	448
Supply chains	42	Vachon (2007)	367
Decision making	28	Horvath (2001)	346
Sales	27	Vachon (2006)	323
Logistics	25	Kainuma (2006)	323
Optimization	15	Lu (2007)	319
Manufacture	15	Lee (2012)	289
Environmental impact	14	Sun (2020)	253
Environmental management	13	Tirkolaee (2020a)	245
Competition	12	Campbell (1998)	188
Sustainable supply chains	10	Fuller (1993)	187
Integer programming	10	Seuring (2004)	168

5 Discussion of Results of Network Analysis

5.1 Keywords Co-occurrences Analysis

A bibliometric method known as keyword co-occurrences reveals knowledge links by creating clusters that provide light on a variety of study fields. We used density-based spatial clustering to create a network using VOSviewer. Maintaining a Keyword count, we set a threshold of 5 for keywords' appearance on the map, resulting in 63 keywords classified into six clusters (Fig.2). As can be seen from the keywords network in Fig. 2, each cluster includes ideas and keywords that are connected and give an overview of areas within sustainability and business. The cluster covers several topics, including green supply chain, customer satisfaction, environmental sustainability, and electronic commerce. Key themes and influences in sustainable business practices can be identified with the help of this network.

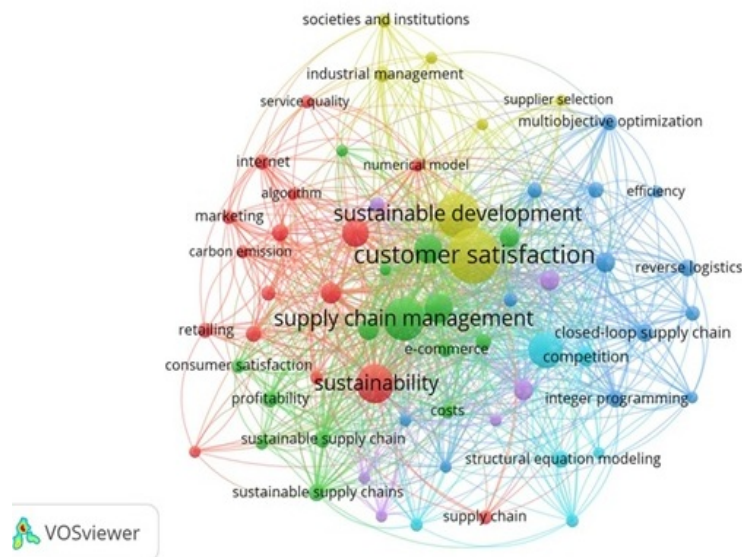


Figure 2: The network of keyword co-occurrences.

5.2 Research clusters discussion

5.2.1 Cluster 1: Sustainable E-commerce and supply chain optimization.

Cluster 1, named "Sustainable E-commerce and supply chain management," gives us a comprehensive picture of relatively recent business practices, mainly focused on efficiency, sustainability, and technological integration. Cluster 1 gives us a comprehensive view of commerce, spanning production to consumption and highlighting various areas such as e-commerce, supply chain management, marketing, and manufacturing. The inclusion of terms like "carbon emission," "sustainability," and "sustainable supply chain management" signifies a focus on environmental accountability and ethical practices during the whole business process (Liao & Wang, 2019).

Also, keywords like "algorithm," "numerical model," and "optimization" tell us about today's real-world shift towards data-driven decision-making and analytical approaches to make the process smooth and efficient (Liao & Wang, 2019b).

Table 3: Clusters Selected Based on Keywords co-occurrences.

Cluster 1: Sustainable E-commerce and supply chain optimization.	Cluster 2: Integrated Sustainable Commerce and Supply Chain Dynamics	Cluster 3: Optimizing Closed-Loop Supply Chains for Environmental Sustainability and Customer Satisfaction	Cluster 4: Sustainable Industrial Management for Customer Satisfaction and Societal Impact	Cluster 5: Sustainable Environmental Management and Green Supply Chain Performance	Cluster 6: Competitive Supply Chain Management Strategies: Insights from Structural Equation Modelling
algorithm	commerce	benchmarking	cost-effectiveness	environmental management	Competition
carbon emission	consumer satisfaction	closed-loop supply chain	customer satisfaction	environmental performance	design/methodology/approach
china	Costs	cost reduction	industrial management	environmental protection	managers
consumption behavior	decision making	customers' satisfaction	product development	green supply chain management	structural equation modelling
electronic commerce	e-commerce	efficiency	societies and institutions	industrial performance	supply chain practices
internet	economics	environmental impact	supplier selection	stakeholder	supply chains
logistics	game theory	environmental sustainability	sustainable development		
manufacturing	green products	integer programming			
marketing	green supply chain	Multi-objective optimization			
numerical model	manufacture	reverse logistics			
optimization	profitability	sensitivity analysis			
retailing	sales	uncertainty			
service quality	supply chain management	uncertainty analysis			
supply chain	sustainable supply chain				
sustainability	sustainable supply chains				
sustainable supply chain management					

"China" denotes the signal to the global nature of business, telling us about the complex dynamics of global trade and manufacturing (Wang et al., 2023). At last, keywords like "service quality" and "consumption behavior" provide insights into the importance of customer-centric methods and help us understand the market dynamics for long-term success (Soh et al., 2015).

Theoretical contribution: This cluster contributes to optimization and digital supply chain literature by merging e-commerce operations with sustainability frameworks, particularly under the lens of systems and operations theory.

Practical implication: It highlights the growing relevance of sustainable last-mile delivery, reverse logistics, and AI-enabled supply chain efficiency in online commerce platforms — a key area for retail strategy transformation.

So, taking this as a whole cluster 1 sheds light on a multidisciplinary and forward-thinking perspective on commerce whose goal is to balance profitability with social and environmental efficiency in the present global economy. This cluster aligns with **Dynamic Capabilities Theory**, which explains how firms reconfigure and adapt their supply chain resources in response to sustainability demands and rapid technological changes in e-commerce.

5.2.2 Cluster 2: Integrated Sustainable Commerce and Supply Chain Dynamics

Cluster 2, titled "Integrated Sustainable Commerce and Supply Chain Dynamics," gives us a more understandable and integrated view of how sustainability, efficiency, and strategic decision-making across numerous commercial domains are interlinked. The core idea revolves around sustainability, which can be comprehended through keywords like "green products," "green supply chain," and "sustainable supply chain," emphasizing attaining environmental efficiency and promoting ethical practices throughout the supply chain (Khosroshahi et al., 2019). This cluster further discusses the growing landscape of businesses, as evidenced by keywords like "e-commerce" and "sales", highlighting the relevance of customer engagement strategies and digital platforms.

Likewise, economic considerations are central, as indicated by keywords such as "economics," "costs," "profitability," and "supply chain management," highlighting the importance of financial analysis and optimization in business decision-making. Concepts like "manufacture" and "decision-making" discuss the growing importance of both operational and

strategic considerations (Sahu et al., 2022). The presence of "game theory" further highlights the analytical approach to decision-making, considering competitive dynamics and strategic interactions (Fakheri et al., 2022).

Theoretical contribution: The cluster advances systems thinking and dynamic capability theories by emphasizing interconnectedness between sustainable business models and supply chain responsiveness.

Practical implication: It reflects the need for seamless integration of sustainability across procurement, production, and distribution functions — especially relevant for firms undergoing green transformation across departments.

Overall, this cluster underscores the need for businesses to navigate the complications of the current marketplace by harmonizing profitability with environmental and social responsibility, leveraging technology, economics, and strategic management principles to drive sustainable and competitive outcomes. The underlying theoretical lens for this cluster is **Systems Theory**, which emphasizes that achieving sustainability requires coordinated functioning across interconnected components of the supply chain.

5.2.3 Cluster 3: Optimizing Closed-Loop Supply Chains for Environmental Sustainability and Customer Satisfaction

Cluster 3 is mainly focused on the integration of supply chains for environmental sustainability, operational efficiency, and customer satisfaction. The central idea is the concept of a "Closed-Loop Supply Chain," focused on reducing the environmental impact by reducing, reusing, and recycling the products at the end of their life cycle (Zadeh et al., 2023). Important themes such as "environmental sustainability," "reverse logistics," and "cost reduction" discuss the relevance of sustainable practices and financial efficiency within supply chain operations (Lu et al., 2007).

Also, the focus is on "customer satisfaction," which signals an effort to meet consumer needs through ecologically responsible and efficient processes (Fan et al., 2021). The addition of advanced analytical techniques like "integer programming," "multi-objective optimization," and "sensitivity analysis" takes the whole supply chain optimization process into account, considering diverse objectives, constraints, and uncertainties (Gerdodbari et al., 2022).

Finally, the acknowledgment of "uncertainty" and the need for "uncertainty analysis" echoes an understanding of the volatile nature of supply chain operations and the necessity of risk management (Abdolazimi et al., 2020).

Theoretical contribution: This cluster reinforces the closed-loop supply chain (CLSC) framework by integrating environmental outcomes with customer-oriented metrics, connecting reverse logistics theory with consumer behaviour.

Practical implication: It encourages firms to balance ecological goals with satisfaction-driven policies such as product take-back programs and green packaging, especially in electronics and apparel sectors.

Overall, cluster 3 revolves around sustainable supply chain management, leveraging sustainability principles, operational excellence, and analytical practices to steer performance, resilience, and customer value in the current business environment. This cluster is supported by **Closed-Loop Supply Chain Theory** and **Stakeholder Theory**, as it involves managing reverse flows and aligning supply chain processes with stakeholder (especially customer) expectations for sustainability.

5.2.4 Cluster 4: Sustainable Industrial Management for Customer Satisfaction and Societal Impact

Cluster 4, named "Sustainable Industrial Management for Customer Satisfaction and Societal Impact," highlights current emerging trends and the inclination of business operations towards sustainability, customer satisfaction, and societal well-being. It reflects a genuine attempt by business organizations towards balancing economic success, environmental efficiency, and social accountability. Business nowadays is adapting to practices as sustainable development, supplier selection, and product development. The primary goal of businesses is to optimize their operations while satisfying the ever-evolving needs and expectations of the customers (Folkerts & Koehorst, 1997).

Furthermore, recognizing the importance of engaging with broader societal issues and institutions, this approach is focused on the implications of ethical business practices and stakeholder collaboration (Kornelius & Wamelink, 1998).

Theoretical contribution: This cluster broadens GSCM by incorporating elements of stakeholder theory and shared value, showing how sustainability can address both firm-level efficiency and societal well-being.

Practical implication: It suggests that industrial operations must evolve beyond compliance to contribute to broader societal goals (e.g., job creation, emissions control) while retaining customer satisfaction as a central performance metric. Ultimately, this cluster underscores the interconnection of economic, environmental, and social considerations in modern industrial management, highlighting the potential for businesses to create value for themselves and also for their customers and the communities they serve. The relevant theoretical foundations here are **Shared Value Theory** and the **Triple Bottom Line (TBL)** framework, both of which emphasize balancing economic performance with societal and environmental contributions.

5.2.5 Cluster 5: Sustainable Environmental Management and Green Supply Chain Performance

Cluster 5 particularly emphasizes sustainable environmental management and green supply chain performance, and how business organizations are incorporating environmental considerations into their business practices. "Sustainable Environmental Management" highlights the commitment towards reducing environmental impact by pollution prevention, waste reduction, and resource conservation. This includes integration of business activities and strategies towards environmental protection and enhancing overall environmental performance within industrial operations (Yao et al., 2020).

"Green Supply Chain Management" extends this effort to every step of the supply chain, focusing on the adoption of eco-friendly practices, such as sustainable sourcing, transportation optimization, and green packaging, to minimize the environmental footprint of products and services throughout their lifecycle.

Additionally, "Industrial Performance" highlights the larger perspective of operational efficiency and effectiveness within industrial settings, including environmental concerns into overall performance metrics (Raza & Woxenius, 2023). "Stakeholder" talks about various parties involved in environmental management efforts, including employees, communities, regulatory bodies, and advocacy groups. By taking into account the interests and concerns of stakeholders, businesses can foster teamwork and alignment towards sustainability goals (Raza & Woxenius, 2023).

Theoretical contribution: Anchored in the triple bottom line and environmental management theory, this cluster ties environmental indicators directly to supply chain performance outcomes. **Practical implication:** It reinforces the need for performance-linked sustainability metrics (e.g., carbon benchmarking, eco-efficiency) and reveals the gap in integrating these into corporate scorecards and customer satisfaction indices.

Overall, this cluster underlines the critical role of environmental management and sustainability in performance improvements across industrial operations and supply chains while checking stakeholders' engagement and responsibility. This cluster reflects the principles of the **Resource-Based View (RBV)**, where green practices and environmental capabilities are considered strategic assets that enhance overall supply chain performance.

subsubsection Cluster 6: Competitive Supply Chain Management Strategies: Insights from Structural Equation Modelling

Cluster 6 discusses the competitive nature of supply chain management, providing insights into the inclusion of methodologies such as structural equation modeling (SEM). "Competitive Supply Chain Management" is about gaining a competitive edge over your competitors through strategic and effective practices. This involves improving supply chain practices to enhance efficiency, reduce costs, and improve overall performance. The presence of "Competition" talks about the competitive landscape within which supply chains function, focusing on the importance of strategic decision-making and differentiation to succeed in today's markets (Divsalar et al., 2022).

"Managers" signifies the role of management in managing effective supply chain strategies and implementing structural changes (Y. Wang & Zhu, 2020). "Supply Chains" and "Supply Chain Practices" discuss all the operations carried out from the procurement of raw material to the delivery of final goods, including various functions such as procurement, production, logistics, and distribution.

Theoretical contribution: This cluster advances empirical testing in GSCM through SEM-based modeling, enabling causal analysis of sustainability drivers on competitive performance and satisfaction outcomes.

Practical implication: It provides firms with evidence-backed models to assess which sustainability initiatives (e.g., eco-design, green sourcing) generate measurable competitive advantage and customer loyalty — aiding decision-makers in strategic planning.

Finally, "Structural Equation Modeling" is about a quantitative method that gives us relationships between different variables within the supply chain context, providing valuable insights into the factors influencing supply chain performance and competitiveness (Shin & Thai, 2016). Overall, this cluster offers a multidimensional perspective on competitive supply chain management, using advanced analytical techniques to inform strategic decision-making and enhance organizational success in today's competitive business environment. The theoretical grounding for this cluster comes from **Contingency Theory**, which posits that GSCM strategies must be context-specific; **Structural Equation Modeling (SEM)** is frequently employed here to test such context-dependent relationships.

5.3 Addressing the Research Questions

The results of this bibliometric analysis offer direct insights into the four research questions posed at the outset of this study:

The insights generated from this bibliometric analysis respond directly to the four research questions formulated at the outset of the study:

- i. **RQ1: How has the literature on green supply chain management (GSCM) and customer satisfaction (CS) evolved, and what are the prevailing research subjects and conversations within it?**

The trend analysis reveals a sharp rise in publications post-2015, reflecting increased scholarly and industry interest in the intersection of GSCM and CS. Keyword co-occurrence and cluster analysis revealed six dominant themes, ranging from sustainable e-commerce and closed-loop supply chains to CSR, performance, and strategic integration. These clusters highlight a transition from operational efficiency-focused studies to more customer-centric and value-driven approaches in recent years.

- i. **RQ2: Which countries are at the leading edge of contributing to academic GSCM and CS literature?**

The country-wise publication analysis shows that China, India, and the United States lead in research output, with strong international collaboration networks. This indicates the global relevance of GSCM and CS, particularly in emerging economies where supply chain transformation is rapidly advancing.

- i. **RQ3: Who are the most influential researchers, and which articles have had the most significant impact on GSCM and CS literature?**

Author productivity and citation analysis revealed a small but influential group of scholars contributing significantly to the field. Co-authorship networks further illustrated key collaborations that have shaped the academic conversation. Highly cited articles often explore the integration of green practices with performance measurement, consumer behaviour, or structural modelling—suggesting these are central anchors in the literature.

i. RQ4: What are the prevailing trends in the field of GSCM and CS literature?

Beyond the volume of research, thematic analysis uncovered a growing trend toward empirical modelling (e.g., structural equation modelling), customer-oriented outcomes, and digital sustainability solutions. The increasing attention to ethical dimensions, integration strategies, and performance impact suggests a maturing and diversifying research landscape. Gaps remain in areas such as longitudinal studies, digital integration, and the validation of green practices in developing country contexts.

6 Conclusion and limitations

A bibliometric analysis of the literature on green supply chain management and customer satisfaction was conducted. Analysis revealed that the field has grown significantly in recent years, with most papers published in the past decade. The study also helped in identifying many influential works and authors in the field. The analysis found that a few scholars have produced a disproportionate number of influential works.

This study provides valuable implications for both scholars and practitioners. For researchers, the identified clusters reveal emerging areas such as digital sustainability, closed-loop supply chains, and customer-centric green strategies, all of which require deeper empirical validation across regions and industries. There is also a need for more longitudinal studies, comparative country-level analyses, and integration of behavioral theories into GSCM-CS research. For practitioners, the findings highlight the importance of aligning sustainability efforts not only with operational performance but also with customer satisfaction and brand perception. Managers can draw insights from these trends to develop integrated strategies that position sustainability as a competitive advantage rather than a compliance requirement.

6.1 Managerial Implications

The findings of this study offer actionable insights for supply chain managers seeking to enhance customer satisfaction (CS) through green supply chain management (GSCM) strategies. The bibliometric trends reveal that firms are increasingly expected to integrate sustainability not just in operations but also in customer-facing aspects of the supply chain.

First, the rise of clusters focused on **sustainable e-commerce** and **closed-loop supply chains** suggests that companies can improve CS by implementing environmentally friendly logistics, such as green delivery options, return/reuse programs, and eco-packaging. These measures contribute directly to customer trust and loyalty, especially among environmentally conscious consumers.

Second, clusters emphasizing **corporate social responsibility (CSR)** and **environmental performance** highlight the value of transparent communication. Firms that publicly disclose their sustainability efforts and engage in environmental certifications or eco-labeling can strengthen brand perception and customer satisfaction. As emphasized by Saini and Dangi (2019), social media analytics offers valuable insights into customer preferences and brand perception—an increasingly relevant source for gauging satisfaction in sustainability-oriented supply chains.

Third, the integration-focused clusters point to the need for **cross-functional alignment** within firms. Managers should ensure that sustainability objectives are shared across procurement, production, logistics, and marketing — creating a consistent customer experience. Inter-firm collaboration (e.g., with green-certified suppliers or logistics partners) further enhances value delivery.

Finally, the emergence of **data-driven and model-based strategies** (e.g., using SEM or performance optimization tools) implies that firms should invest in analytical capabilities to track and predict how green practices affect customer satisfaction metrics. This enables evidence-based decision-making and continuous improvement.

By aligning green initiatives with customer values and operational performance, firms can turn sustainability from a compliance necessity into a source of competitive advantage.

6.2 Finding Summary

GSCM and CS were analyzed in this study using 230 English-language journal articles from various domains and across multiple publication years. It has found a steady surge in research work since the last decade, showing growing importance in addressing global sustainability and consumption behavior. Key contributors were “Sustainability (Switzerland)”, with 32 articles, and the second prominent journal, “The Journal of Cleaner Production”, with 26 documents, demonstrating the interdisciplinary nature of GSCM and CS.

Network analysis was used in this study to identify six research clusters in GSCM and CS: *Sustainable E-commerce and supply chain optimization*, *Integrated Sustainable Commerce and Supply Chain Dynamics*, *Optimizing Closed-Loop Supply Chains for Environmental Sustainability and Customer Satisfaction*, *Sustainable Industrial Management for Customer Satisfaction*

and Societal Impact, Sustainable Environmental Management and Green Supply Chain Performance, Competitive Supply Chain Management Strategies: Insights from Structural Equation Modelling.

From a theoretical standpoint, the findings suggest that **integrating stakeholder theory, service-dominant logic, and dynamic capabilities theory** could provide a more holistic understanding of how GSCM initiatives affect both firm performance and customer satisfaction. Future studies could develop a theoretical framework by exploring the **interaction effects** between green practices, customer trust, and perceived value creation.

On the policy front, the dominance of emerging economies in recent GSCM literature indicates a need for **government-led incentive structures**, such as **green procurement mandates, carbon credit systems**, and **eco-labeling standards**, to support and scale sustainable practices. Policymakers can also facilitate industry-wide data sharing and performance benchmarking to promote transparency and consumer trust in green supply chains.

6.3 Limitations and avenues for future Research

While our analysis of GSCM has highlighted valuable insights about the domain, there are several limitations also.

- i. **Sample Bias:** Although extensive, the data included in our analysis comes from the Scopus database, which could only include a portion of pertinent research. Our sample may be biased due to the selection criteria we employed. For example, prioritizing academic journal articles written in English may unintentionally leave out groundbreaking studies that have been released in other languages or through alternative media.
- ii. **Limited Scope:** It is important to recognize that the majority of the research we perform consists of scholarly findings. Research arranged according to affiliation or geography does not provide a complete picture of the industry's level of GSCM and CS innovation or the advancement of certain nations.
- iii. **Data Sources:** The Web of Science is just one reliable scientific database that should be included in future research projects to expand their reach. Including supplementary information sources can help advance our understanding of the area. Examples of these include books, book chapters, and conference papers.

Overall, green supply chain management and customer satisfaction are growing and maturing. Although there is still significant room for development, the existing research provides a good starting point for future research. In particular, there are opportunities for additional research on the strategic implementation of green supply chain management with practical applications.

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