Unpacking the Green Supply Chain Management: Insights from a Systematic Literature Review

Alex Permana Stendel[1], Kadarisman Hidayat[2], Cacik Rut Damayanti[3], Zahroh[4]
{alexpermanaub@gmail.com[1], kadaris_fia@ub.ac.id[2], cacik@ub.ac.id [3], zahrohza@ub.ac.id[4]}

Universitas Brawijaya, Indonesia[1,2,3,4]

Abstract. This systematic literature review employs bibliometric analysis to explore the evolving landscape of Green Supply Chain Management (GSCM). Through meticulous data extraction from Scopus and analysis using Bibliometrix, this study synthesizes research outputs, identifying key thematic developments, influential authors, and the geographical distribution of research activities. The findings reveal a marked increase in publication volume since 2014, underscoring the growing academic and practical interest in sustainable supply chain practices globally. Prominent scholars have been pivotal in shaping the discourse, with significant contributions from the United Kingdom, China, and India. A thematic analysis categorizes the research into Motor, Niche, Basic, and Emerging or Declining themes. Additionally, the study proposes a model recommendation integrating key drivers such as IT & Business Strategy Alignment, Transglobal Leadership, Product Innovation, Customer Perspective, and Risk Management, offering strategic insights for future GSCM research and practice.

Keywords: Green Supply Chain Management, Systematic Literature Review, Determinants

1 Introduction

Green Supply Chain Management (GSCM) has evolved significantly over the past few decades as a critical approach to integrating environmental concerns into supply chain management. Initially developed from the broader concept of environmental management, GSCM seeks to minimize the ecological impacts of industrial activities by enhancing resource efficiency and adopting sustainable practices across the entire supply chain [1]. The proliferation of global environmental awareness and stricter regulations has further propelled businesses to adopt GSCM strategies, not only to comply with legal requirements but also to gain competitive advantages [2].

Recent advancements in GSCM are largely driven by innovations in technology and processes that facilitate more sustainable production and distribution methods. These innovations include the use of biodegradable materials, renewable energy sources, and advanced logistics solutions that reduce carbon footprints and waste [3]. As industries continue to face pressure from stakeholders to demonstrate environmental responsibility, the strategic integration of green practices within the supply chain has become more prevalent and is now considered a crucial component of corporate sustainability [4].

In this context, the importance of GSCM can be underscored by its potential to address some of the most pressing environmental challenges of our time, such as climate change, resource depletion, and environmental degradation. Implementing green practices within the

ICOPAG 2024, October 30, Malang, Indonesia

DOI 10.4108/eai.30-10-2024.2354730

supply chain not only helps in complying with environmental regulations but also enhances the firm's image and relationships with stakeholders [5]. This strategic alignment between environmental goals and business operations fosters a sustainable business model that benefits both the environment and economic performance [6].

Moreover, the adoption of GSCM practices is not just a strategic decision for compliance and branding but a necessary shift towards operational efficiency and innovation. Companies that proactively engage in GSCM practices often experience improvements in process efficiency, resource utilization, and overall cost reductions. These benefits are critical in today's highly competitive and environmentally conscious market landscape [7]. Integration of sustainable methods into supply chain management is an essential strategy for future-proofing business operations against environmental risks and market volatility.

Understanding the factors influencing Green Supply Chain Management (GSCM) is crucial for crafting effective environmental strategies in business operations. Recent research highlights the dynamic nature of these determinants, including technological advancements, regulatory pressures, and changing consumer preferences, which all play significant roles in shaping GSCM practices [8]. Furthermore, the impact of international trade agreements on environmental supply chain policies has been a critical area of study, suggesting that global economic factors significantly influence GSCM strategies [9].

Despite extensive research on the subject, there remains a significant gap in the comprehensive understanding of how these varied factors collectively impact GSCM implementation across different industries and regions. Most studies focus on isolated aspects of GSCM or specific sectors, thereby limiting a holistic understanding of the field [10]. Additionally, there is a lack of synthesis in the literature that integrates findings from diverse geographical contexts and industries to offer a global perspective on GSCM.

This research aims to address these gaps by conducting a Systematic Literature Review (SLR) using bibliometric analysis, which allows for a quantitative and qualitative synthesis of existing studies. This method not only helps in mapping out the extensive body of literature but also in identifying the most influential studies, prevailing themes, and emerging trends in GSCM research [11]. The use of bibliometric tools will enable the identification of core areas that have been well-researched and those that require further investigation, thereby providing a comprehensive overview of the field.

2 Literature Review

2.1. Systematic Literature Review (SLR)

A Systematic Literature Review (SLR) is a structured approach used in research to collect and analyze literature related to a specific topic for informed decision-making [12]. This method involves gathering data from primary research articles published in national and international journals, utilizing electronic databases like Google Scholar, Semantic Scholar, and ERIC, as well as direct links from journal websites. The purpose of an SLR includes the identification, examination, evaluation, and interpretation of all available research concerning a particular phenomenon, guided by relevant research questions. SLRs are crucial for setting research directions, forming part of academic requirements such as dissertations or theses, and are often essential in securing research funding.

Khan [13] outline five essential phases in the process of conducting a Systematic Literature Review:

1. **Defining the research question**: This initial phase focuses on precisely outlining the research question or objective that the SLR intends to tackle.
2. **Literature search**: During this phase, a thorough search is conducted across various databases and search engines to locate articles and publications that are pertinent to the research question.
3. **Article appraisal**: After identifying relevant articles, this step involves a detailed assessment of each article to evaluate its quality, relevance, and validity. This often includes applying specific inclusion and exclusion criteria to ensure only the most relevant and high-quality studies are considered.
4. **Data synthesis**: Here, the chosen articles are comprehensively reviewed and their major findings, methodologies, and conclusions are summarized. This synthesis helps in providing a consolidated overview of the research landscape.
5. **Analysis and interpretation**: In the final phase, the results from the articles are analyzed and interpreted in the context of the research question. This involves exploring patterns, trends, and correlations among the studies to extract meaningful insights and draw conclusions.

This structured approach ensures that the SLR provides a clear and methodical examination of the existing literature, supporting effective research and informed decision-making.

2.2. Green Supply Chain Management (GSCM)

Green Supply Chain Management (GSCM) integrates environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing processes, and product delivery to the consumer, as well as end-of-life management of the product after its useful life. GSCM not only reduces environmental impact but also enhances economic performance through improved productivity and reduced costs across the supply chain [14]. Businesses adopt GSCM practices to meet regulatory requirements, reduce costs, and improve their corporate image among stakeholders [15].

The essential components of GSCM include sustainable sourcing, greener manufacturing, eco-friendly packaging, optimization of logistics and distribution, and investment in recycling processes. Sustainable sourcing involves selecting suppliers based on environmental performance criteria, while greener manufacturing focuses on reducing waste and emissions during the production process [16]. Moreover, eco-friendly packaging aims to minimize the use of harmful materials, and optimizing logistics seeks to reduce the carbon footprint of transportation activities [17].

Several drivers influence the adoption of GSCM practices. Regulatory pressures compel companies to comply with environmental laws and standards, which often necessitate changes to supply chain operations [18]. Consumer awareness and demand for sustainable products also drive companies to adopt green practices to enhance their brand image and marketability. Additionally, technological advancements facilitate more efficient processes and the use of alternative, less environmentally damaging resources [19].

Despite the benefits, companies face significant challenges in implementing GSCM, including high initial costs, lack of awareness, and resistance to change within the organization. The future of GSCM lies in leveraging advanced technologies like AI and IoT to enhance supply chain transparency and efficiency [20]. Furthermore, there is a growing need for collaboration among all stakeholders, including suppliers, manufacturers, and customers, to create a truly sustainable supply chain [21].

3 Methodology

This study employs the Systematic Literature Review (SLR) methodology. The analysis in this study utilizes the software tools Publish or Perish and Bibliometrics. The Publish or Perish tool is utilized to perform a Systematic Literature Review (SLR) on the research subject, specifically focusing on the GSCM. Bibliometrics facilitates the visual analysis and exploration of bibliographic data, allowing for a better understanding of the connections between publications, citations, authors, and different research domains. Therefore, bibliometrics is instrumental in informing choices in research progress, strategic decision-making, and assessing scholarly achievements.

3.1. Data Source

The researcher performed a search using the Scopus electronic database. Scopus was chosen due to its prestigious reputation as the most comprehensive scientific database, providing a wide range of peer-reviewed scholarly articles [22]. The articles utilized in this study were published within a time frame of 35 years, specifically from 1988 to 2023.

3.2. Eligibility Criteria

The Eligibility Criteria (IC) serve as guidelines for conducting the analysis using the Systematic Literature Review (SLR) method. The following criteria are used:

1) IC1: Primary and scholarly literature published in English.
2) IC2: Research focused on identifying factors that impact purchase decisions.
3) IC3: Research studies that utilize quantitative, qualitative, and mixed-methods (combining qualitative and quantitative) approaches.

3.3. Research Question

The Research Question (RQ) aims to ascertain the progress and advancement of research articles on Green Supply Chain Management (GSCM).

RQ 1 : What is the annual scientific production of research on GSCM?
RQ 2 : How is the source production over time-related to GSCM research?
RQ 3 : Who most relevant authors on the GSCM topic?
RQ 4 : Where is the corresponding author’s country in the GSCM topic?
RQ 5 : How is the country's production over time-related to GSCM research?
RQ 6 : What are the most globally cited documents about GSCM?
RQ 7 : What are the most dominant keywords related to research on GSCM?
RQ 8 : How to analyze thematic maps that emerge based on document titles related to the subject of GSCM?

3.4. Steps for Conducting Research

The procedures employed in this study utilizing Scopus and RStudio are presented as follows:

1) Determine the search keywords. In this case, the keyword is “Green Supply Chain Management”.
2) Search for the keyword “Green Supply Chain Management” based on the article title, abstract, and keywords (TITLE-ABS-KEY) in Scopus.

3) Narrow down the search outcomes by applying filters:
   - TITLE-ABS-KEY: “Green” AND “Supply” AND “Chain” AND “Management”
   - LIMIT-TO(DOCTYPE, “ar”)
   - LIMIT-TO(LANGUAGE, “English”)
4) Save the search outcomes into a file with the .bib file extension.
5) Use RStudio to organize the data according to the Research Question.
6) Get the most recent editions of RStudio and R, then install them.
7) Launch the RStudio program and enter the subsequent code:
   - install.packages(“bibliometrix”)
   - library(bibliometrix)
   - biblioshiny()
8) RStudio will shift to a fresh hyperlink.
9) Upload the saved file on that page.
10) Complete the data analysis.

4 Results and Discussions

The search was conducted in January 2024 using relevant keywords related to “Green Supply Chain Management”, here the keywords were sought within article titles, abstracts, and keywords. The method of sourcing information involved searching for articles in electronic databases. The Scopus database specifically was employed as the electronic database for this study.

4.1. Research Findings

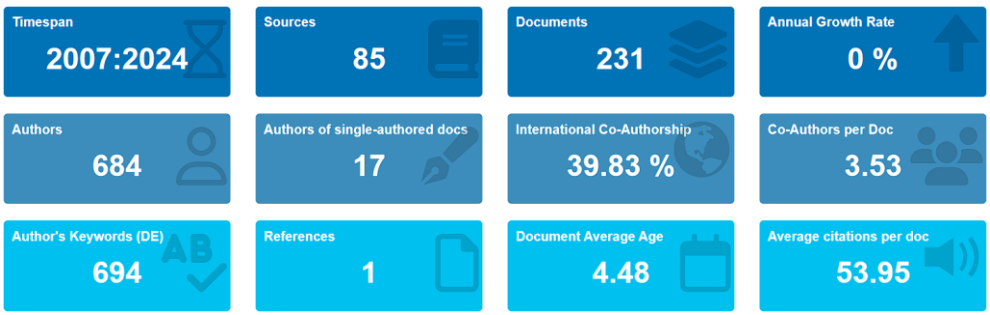

Figure 1. Main Information on Articles about GSCM

The bibliometric analysis conducted on the field of Green Supply Chain Management (GSCM) from 2007 to 2024 reveals several interesting trends and characteristics that can enrich our understanding of the research landscape in this area. The data encompasses 231 documents published across 85 sources with a total of 684 authors, indicating a healthy degree of collaboration and diversity in research contributions. Notably, the research has a stable output with an annual growth rate of 0%, suggesting a mature field with consistent scholarly interest over the years. Despite the lack of growth, the average citations per document stand at 53.95, highlighting the significant impact and continued relevance of these publications in the academic and practical realms of GSCM.

A deeper look into the collaborative nature of the field shows that 39.83% of the documents involve international co-authorship, reflecting the global importance and

interdisciplinary nature of GSCM research. The average number of co-authors per document is 3.53, further emphasizing a trend towards collaborative research efforts. However, there are only 17 single-authored documents, which might indicate a move away from individual to collective research endeavours in tackling complex issues within GSCM. The data, coupled with the high number of author's keywords (694) despite only one document keyword, suggests a wide array of topics and sub-themes being explored, pointing towards a rich diversity in research foci within the overarching theme of green supply chain management. This diversity and collaboration are essential for driving innovation and addressing the multifaceted challenges of integrating sustainability into supply chain practices globally.

4.2. Data Compilation and Visualization

The data that has been collected is then visualized with the help of Bibliometrics. The data compilation is conducted based on the research question.

RQ 1: What is the annual scientific production of research on GSCM?

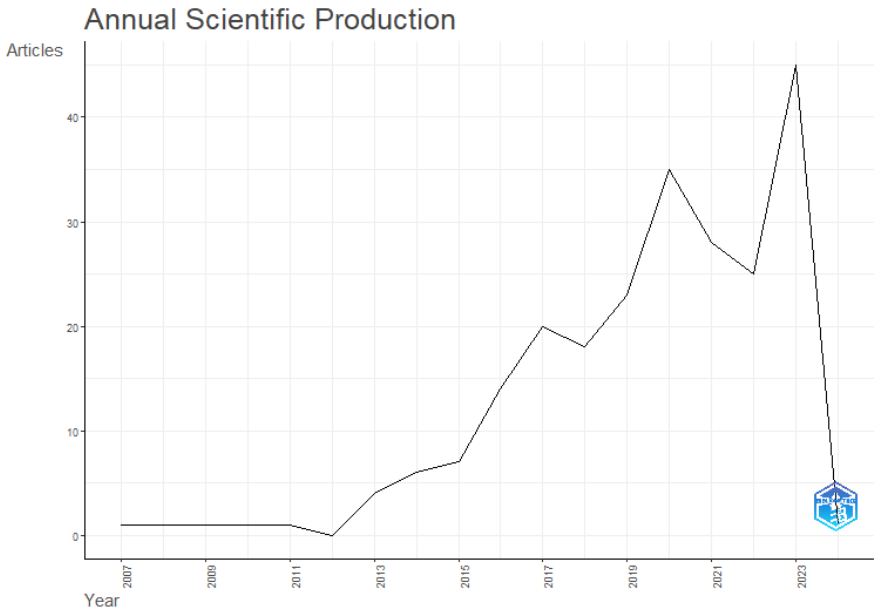

Figure 2. Annual Scientific Production of Research on GSCM

The provided bibliometric analysis graph illustrates the annual scientific production in the field from 2007 to 2024, displaying a trend of increasing publication output over the period, with a few notable fluctuations. The graph starts with a modest number of publications from 2007 to 2013, showing minimal activity with one article per year, except for 2012 where there were no articles published. This plateau suggests either a nascent stage of research interest or limited scholarly attention to the subject during these years.

From 2014 onwards, there was a noticeable uptick in publication volume, peaking initially in 2017 with 20 articles, then slightly decreasing in 2018. The growth resumes markedly in 2019 and reaches its peak in 2023 with 45 publications, indicating a robust interest and significant research efforts in the field during this period. This surge could be attributed to

increased awareness of environmental issues, advances in sustainable practices, or a response to new regulatory pressures and market demands related to green supply chain management.

Overall, the data points to a growing scholarly interest in the field of Green Supply Chain Management, punctuated by periods of rapid growth and occasional declines. This pattern underscores the dynamic nature of research interest driven by evolving academic, industry, and regulatory landscapes. Such insights could be instrumental in researchers and practitioners identifying periods of significant advancements and potential gaps in the literature.

RQ 2: How is the source production over time-related to GSCM research?

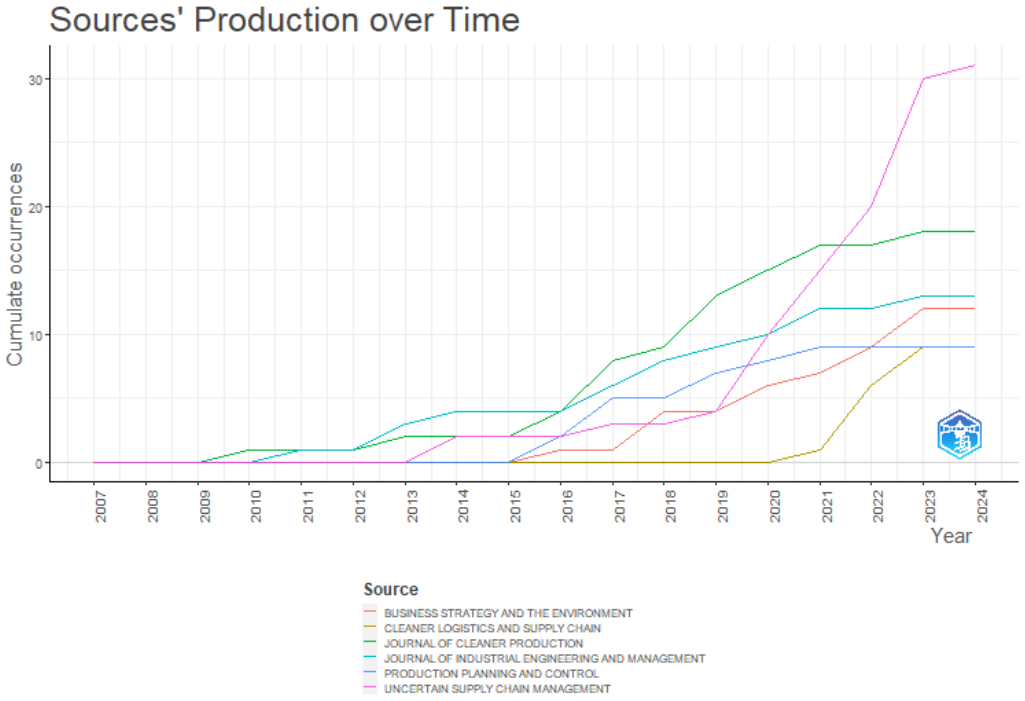

Figure 3. Sources Production over Time Related to GSCM Research

Initially, the publication output across all sources was minimal up until 2013, indicating either a nascent interest in GSCM or limited avenues for dissemination. From 2014 onwards, there has been a noticeable increase in activity, reflecting a growing academic and industrial interest in green supply chain practices. Specifically, journals such as “Cleaner Logistics and Supply Chain” and “Journal of Cleaner Production” show significant growth, underlining an enhanced focus on environmental aspects within the logistics and supply chain disciplines. These journals, particularly from 2020 onwards, exhibit steep curves in the graph, suggesting rapid developments and heightened contributions to the literature in these areas.

The “Journal of Industrial Engineering and Management” and “Production Planning and Control” also show steady increases, albeit at a slower pace compared to the aforementioned journals. This trend may indicate a broader acceptance and integration of GSCM principles across various facets of industrial engineering and production management. The consistent

output in these journals emphasizes the interdisciplinary nature of GSCM, bridging traditional supply chain management with sustainable and environmentally friendly practices.

Moreover, the table highlights the diverse focus of these journals, with some concentrating more on business strategy and environmental issues ("Business Strategy and the Environment"), while others delve into technical and operational aspects of cleaner logistics and production processes. The cumulative occurrences in the graph provide a clear indication of the increasing relevance and scholarly interest in sustainable practices within the supply chain management field, suggesting not only a response to global sustainability demands but also an academic commitment to advancing research in this critical area.

Overall, this bibliometric analysis underscores the dynamic evolution of GSCM research, reflecting both the increasing complexity of the field and the expanding scope of academic inquiry into sustainable and environmentally conscious supply chain practices. The data illustrates how various research communities contribute to the broader understanding and implementation of GSCM, highlighting key journals as platforms for disseminating cutting-edge research in this vital area.

RQ 3: Who are the most relevant authors on the GSCM topic?

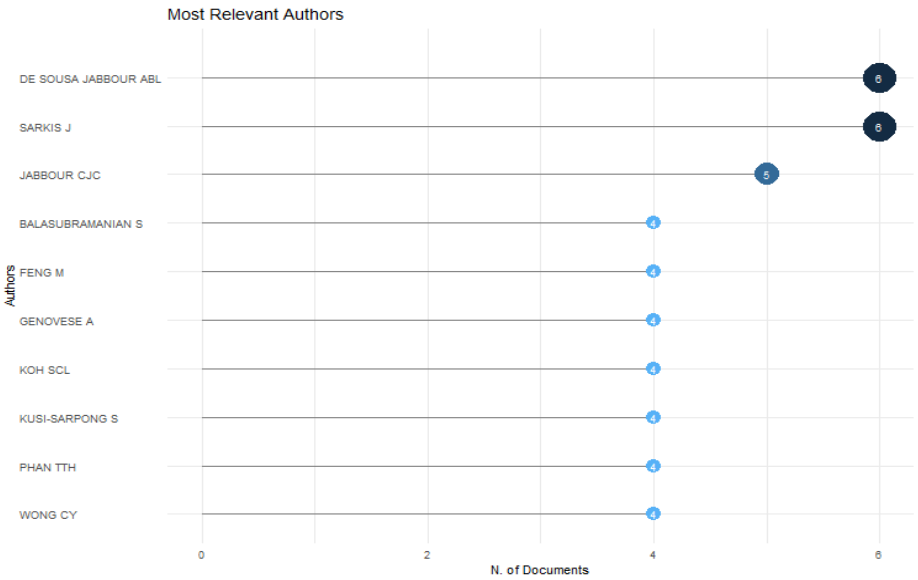

Figure 4. Most Relevant Authors in GSCM Topic

De Sousa Jabbour ABL and Sarkis J stand out as the most prolific authors, each contributing to six documents, as indicated by their prominent position in the graph. Their significant contributions not only underscore their expertise but also indicate their central role in advancing the GSCM literature. The impact of their work is further reflected in the high number of citations their publications receive, which suggests that their research is foundational and highly regarded within the academic community.

Close behind them is Jabbour CJC, with contributions to five documents. His work, while slightly less voluminous compared to the leading authors, still marks a significant influence on the field, particularly in integrating environmental management concepts with supply chain

processes. This highlights a robust contribution to the theoretical and practical aspects of GSCM.

Other notable authors like Balasubramanian S and Feng M, each with contributions to four documents, also play crucial roles in shaping the research landscape of GSCM. Their contributions, although not as extensive as the top authors, still represent significant nodes of intellectual output that contribute to the evolving complexity of green supply chain studies.

These authors collectively form a core group that significantly influences research in GSCM, guiding the discourse and development of new knowledge in this field. Their works are likely interlinked through citations and shared research interests, fostering a rich academic network that supports the growth and dissemination of innovative GSCM practices and theories. This chart not only identifies who is leading the field in terms of publication volume but also hints at the collaborative nature of GSCM research, suggesting that these key authors may serve as pivotal points for academic partnerships and knowledge exchange.

RQ 4: Where is the corresponding author's country in the GSCM topic?

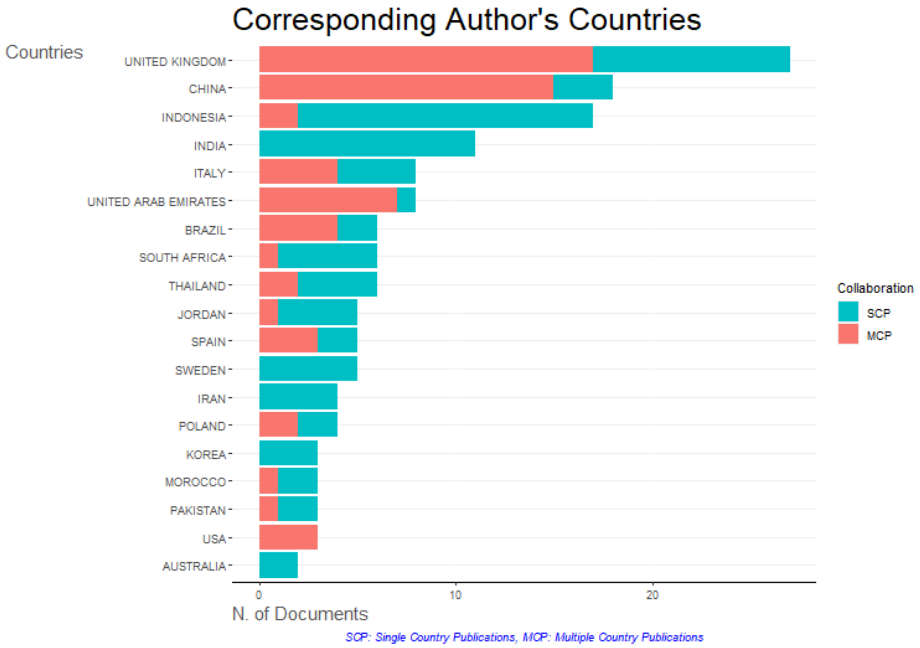

Figure 5. Corresponding Author's Country in GSCM topic

The bibliometric visualization focuses on the distribution of corresponding authors' countries in the field of Green Supply Chain Management (GSCM). The chart effectively displays both single-country publications (SCP) and multiple-country publications (MCP), offering insights into the global collaboration patterns within this research area.

The United Kingdom emerges as a significant contributor with the highest number of SCPs and a considerable presence in MCPs, indicating a strong national focus on GSCM as well as collaborative endeavors with other countries. This prominence might be due to well-established research institutions and funding mechanisms that support GSCM research.

China and Indonesia are also notable for their contributions, with a balanced mix of SCP and MCP. This suggests a growing interest and capacity in GSCM research within these regions, coupled with international collaborations that enhance their global research footprint. The robust involvement of these countries in both SCP and MCP underscores their strategic importance in the global discourse on sustainable supply chain practices.

India and Italy follow with fewer contributions but maintain a presence in both SCP and MCP, illustrating ongoing research activities and international cooperation. This reflects broader geographical engagement in GSCM research, highlighting the global recognition of the importance of integrating environmental considerations in supply chain management.

The graph's distinction between SCP and MCP is crucial as it not only illustrates where GSCM research is being independently developed but also shows how countries are collaborating internationally to advance knowledge in this area. High levels of MCP in countries like the United Kingdom and China indicate strong international ties and a willingness to work across borders to tackle global challenges associated with green supply chains.

RQ 5: How is the country's production over time-related to GSCM research?

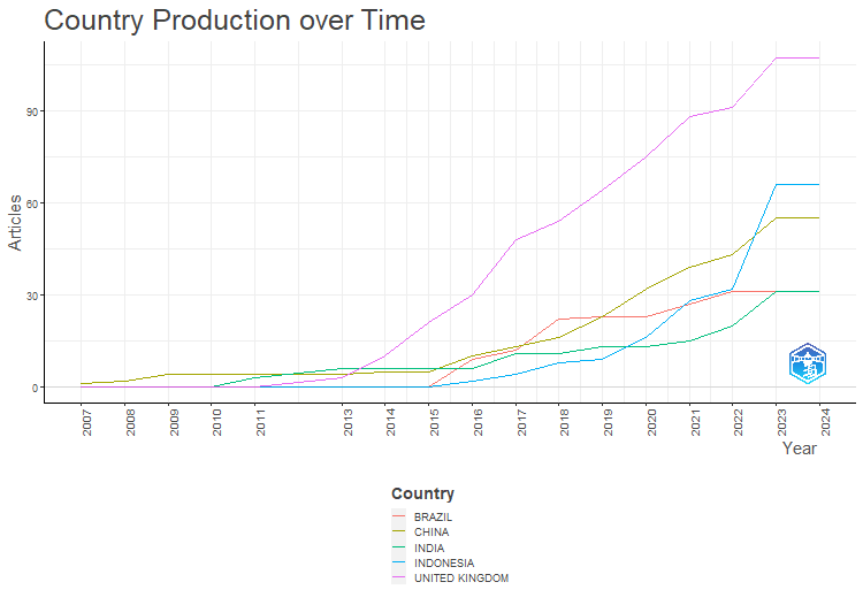

Figure 6. Country Production Over Time-Related to GSCM Research

The graph displayed illustrates the progression of academic output concerning Green Supply Chain Management (GSCM) research over time, specifically highlighting contributions from China, India, Indonesia, Brazil, and the United Kingdom. Each line represents the trajectory of publications from these countries, providing a visual reflection of their research intensity and focus on GSCM from 2007 to 2024.

China's line, displaying a steep upward trajectory, indicates a significant and growing focus on GSCM research. Starting from 2007 with a minimal number of articles, there is a remarkable increase, particularly noticeable from 2016 onward, peaking at 55 articles in 2023 and 2024. This trend may reflect China's increasing industrial base and a corresponding growing

academic and governmental focus on sustainable practices due to environmental pressures and policy shifts towards sustainability.

India shows a consistent yet more moderate increase in GSCM publications over the years. The growth becomes more pronounced after 2015, suggesting a strengthening focus on sustainable supply chain practices, possibly influenced by economic growth and enhanced environmental regulations.

Indonesia and Brazil demonstrate similar trends with a gradual increase in publications, although the numbers are considerably lower compared to China and India. This may suggest a developing interest and evolving research capacity in GSCM within these regions, likely driven by local environmental challenges and increasing global integration of sustainability standards.

The United Kingdom's graph exhibits a more mature but variable pattern of publication output, with noticeable increases and plateaus over the period. The relatively high level of contributions throughout may indicate established research interests and capabilities in GSCM, supported by longstanding academic and policy frameworks geared towards environmental sustainability.

Overall, the graph not only illustrates the quantitative contributions of these countries to GSCM research but also reflects broader global trends and shifts towards sustainability in supply chain management. The increasing trajectories, particularly from rapidly developing economies like China and India, underscore the global recognition of the importance of integrating environmental considerations in supply chain practices. This trend is crucial for addressing global environmental challenges and for the evolution of sustainable industrial practices worldwide.

RQ 6: What are the most globally cited documents about GSCM?

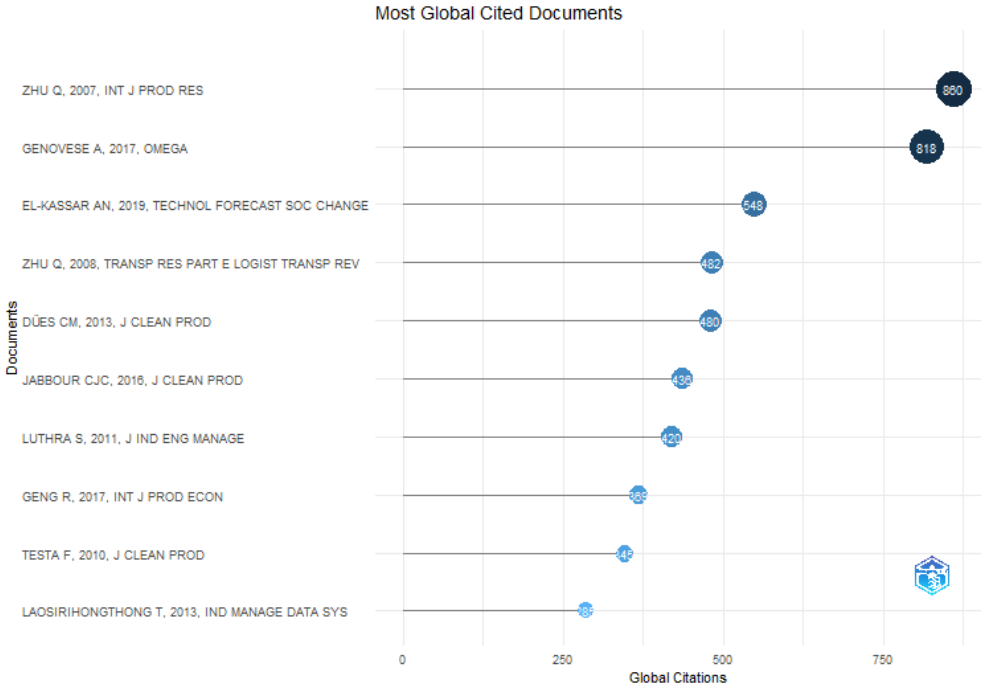

Figure 7. Most Global Cited Documents about GSCM

The document by Zhu & Sarkis [23], titled " The moderating effects of institutional pressures on emergent green supply chain practices and performance" stands out with the highest number of citations, amounting to 880. This indicates that the research findings presented in this document have been highly influential and widely referenced within the GSCM community, likely offering fundamental insights or breakthroughs in supply chain sustainability practices.

Following closely is the work by Genovese [24], in "Omega," which has accrued 818 citations. The substantial citation count signifies the importance of this research in advancing the theoretical and practical understanding of GSCM, potentially addressing critical aspects such as the integration of sustainability into supply chain strategies and operations.

Another notable document is by El-Kassar [25], that published by "Technological Forecasting and Social Change," which has been cited 548 times. This suggests that the research has made significant contributions to the discourse on how technological advancements and forecasting might impact the sustainability of supply chains.

The visualization also shows a cluster of documents with citations ranging from approximately 400 to 500, indicating a strong foundational body of research that supports and propels the field of GSCM forward. These documents collectively represent a vital knowledge base for academics, practitioners, and policymakers interested in integrating environmental sustainability into supply chain management.

Overall, the chart effectively highlights the most influential research within the GSCM domain, showcasing works that have not only shaped academic understanding but also influenced practical applications in industries across the globe. These key documents serve as benchmarks and reference points for ongoing and future research in the area, illustrating the dynamic and evolving nature of GSCM scholarship.

RQ 7: What are the most dominant keywords related to research on GSCM?

Figure 8. Most Dominant Keywords Related to Research on GSCM

The word cloud presented in the bibliometric analysis provides a visual representation of the most dominant keywords associated with research on Green Supply Chain Management (GSCM). The size of each term in the word cloud corresponds to its frequency across the literature, highlighting the emphasis and focus areas within the field.

The term "supply chain management" appears with the highest frequency, followed closely by "green supply chain management." This indicates that while the general topic of supply chain management remains central to the discourse, the specific focus on its green or sustainable aspects is also heavily emphasized in recent research. This aligns with the increasing global awareness and implementation of environmentally friendly and sustainable practices within supply chains.

The keywords “environmental management” and “sustainable development” are also prominently featured, suggesting a strong linkage between GSCM and broader environmental and sustainability goals. These terms underscore the multidisciplinary nature of GSCM, bridging areas like environmental science, sustainability studies, and traditional supply chain management.

Other significant terms such as “environmental performance” and “sustainable supply chains” reflect specific research focuses within the field. These indicate that the effectiveness of GSCM practices is often measured in terms of their environmental outcomes and contributions to sustainability goals.

Furthermore, the appearance of terms like “economic and social effects” alongside environmental terms suggests that the research in GSCM not only addresses environmental concerns but also considers the broader economic and social implications of greener supply chain practices. This reflects an understanding of the need for a holistic approach to sustainability that encompasses not just environmental but also economic and social dimensions.

Overall, the word cloud effectively highlights the key thematic areas and terminologies that are currently prevailing in the field of GSCM research. The prominence of these terms illustrates the complex interplay between managing supply chains efficiently while also addressing critical environmental and sustainability challenges.

RQ 8: How are the thematic maps that emerge based on document titles related to the subject of GSCM?

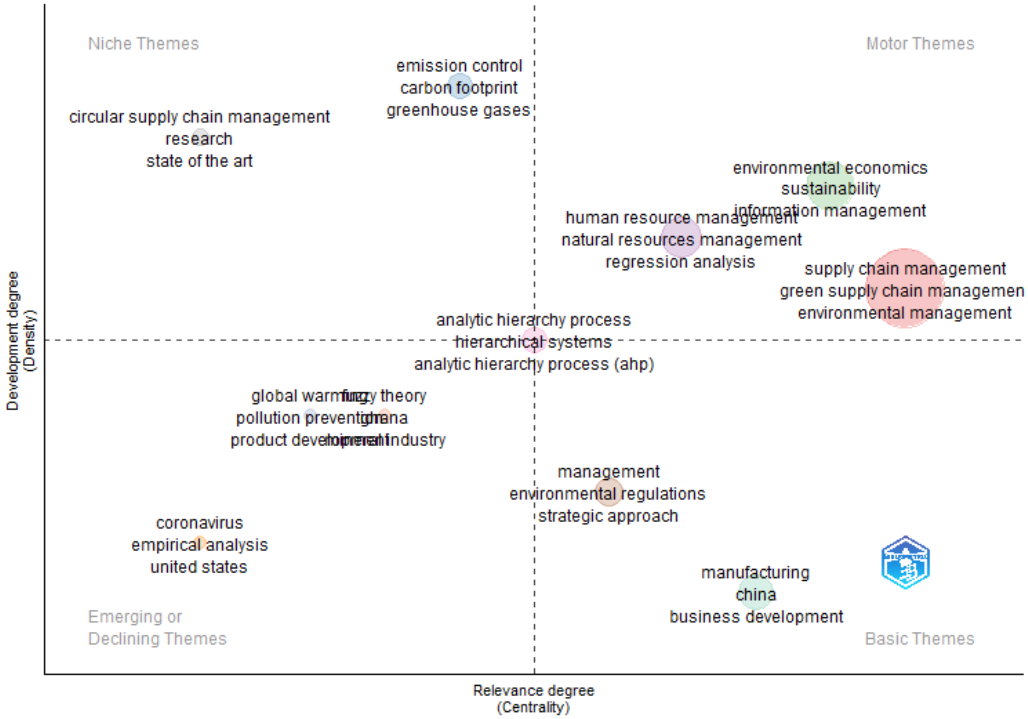

Figure 9. The Thematic Maps about GSCM

The thematic map visualizes the central themes and relationships between them within the domain of Green Supply Chain Management (GSCM) research, based on document titles. This map categorizes themes into four quadrants: Motor Themes, Niche Themes, Emerging or Declining Themes, and Basic Themes, each representing different levels of development and centrality in the research field.

Motor Themes: These themes are positioned in the upper right quadrant, indicating high centrality and strong development within the GSCM literature. Themes like "supply chain management," "green supply chain management," and "environmental management" dominate this quadrant, underscoring their pivotal role as foundational and extensively developed concepts within the field. The presence of "information management" and "sustainability" alongside these themes suggests that integration of information systems and sustainability metrics are crucial in advancing GSCM practices.

Niche Themes: Located in the upper left quadrant, Niche Themes like "circular supply chain management" and "state of the art" represent specialized areas within GSCM that, while less developed, possess a high degree of specialization. The inclusion of "circular supply chain management" highlights the increasing focus on closed-loop and regenerative supply chain processes which are critical for advancing sustainability agendas.

Emerging or Declining Themes: Themes such as "coronavirus," "empirical analysis," and "united states" are placed in the lower left quadrant, suggesting these areas are either emerging or losing relevance within the field of GSCM. The presence of "coronavirus" indicates recent research focus, likely driven by the global pandemic's impact on supply chains, demonstrating the field's responsiveness to contemporary global challenges.

Basic Themes: Situated in the lower right quadrant, these themes have high centrality but are less developed compared to Motor Themes. This includes "manufacturing," "china," and "business development," indicating these are fundamental to GSCM research but may lack comprehensive development within the current literature. The focus on "China" and "manufacturing" is particularly relevant given China's significant role in global manufacturing and supply chains, impacting GSCM practices globally.

Overall, the thematic map serves as a strategic tool for researchers to identify well-established areas, pinpoint emerging trends, and recognize niche topics within GSCM research. It helps in understanding the structural dynamics of the field, guiding future research directions, and fostering collaborations across thematic boundaries to address complex challenges in green supply chain management.

4.3. Model Recommendation

In the pursuit of sustainable business operations, Green Supply Chain Management (GSCM) has emerged as a critical area of study, drawing significant scholarly attention. This section aims to explore and recommend models that have been identified in prior research as influential in shaping and enhancing GSCM practices. By examining these established frameworks, we can provide a synthesized understanding of the factors that drive successful GSCM implementation. This review not only highlights the diversity of approaches taken by researchers but also offers insights into the most effective strategies for integrating green practices within supply chain management.

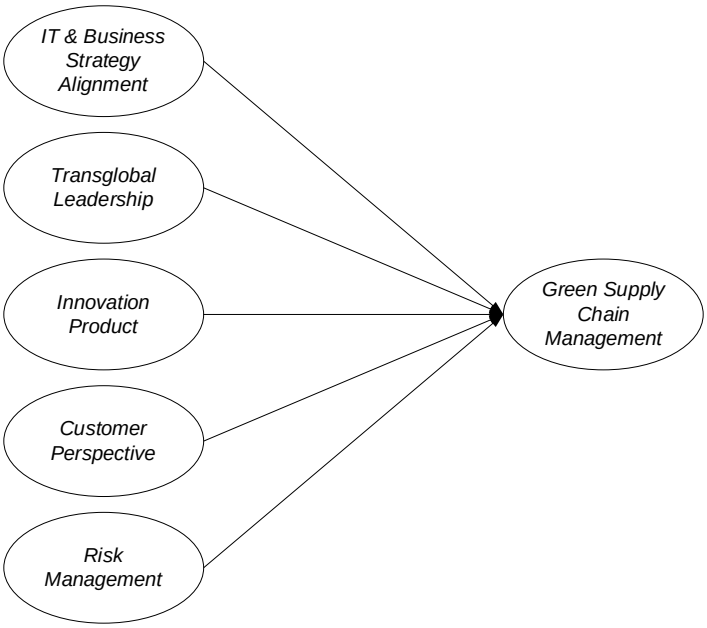

Figure 10. The Determinan Factors of Green Supply Chain Management

The relationship between IT & Business Strategy Alignment and Green Supply Chain Management (GSCM) is well-documented in the literature, particularly in the context of Industry 4.0. Integrating digital technologies with business strategies has been shown to significantly enhance GSCM practices by optimizing resources and minimizing environmental impacts. For instance, Ghadge [26] found that in the automotive industry, the alignment of IT with business strategies facilitated the effective implementation of GSCM by streamlining operations and improving environmental performance. Similarly, Trujillo-Gallego [27] emphasized the role of digital technologies, supported by green human resource management, in adopting GSCM practices, leading to enhanced organizational performance. This body of work highlights the importance of aligning IT and business strategies as a foundational step towards achieving sustainable supply chain management.

Leadership, particularly in a transglobal context, also plays a crucial role in influencing GSCM practices. Ahmad and Karadas [28] explored how managers' perceptions of leadership affect organizational performance through the mediating role of GSCM practices. Their findings suggest that effective leadership is key to fostering a culture that prioritizes sustainability within an organization. Additionally, research by Ahmed [29] in developing countries illustrates that strong leadership significantly impacts both green and economic performance, particularly when GSCM is integrated into the strategic framework of an organization. This evidence underscores the pivotal role that leadership plays in driving the adoption and success of GSCM across different organizational contexts.

Product innovation is another critical factor that influences GSCM. Companies that engage in eco-innovation—developing environmentally friendly products and processes—are better positioned to implement GSCM effectively. Bag [30] demonstrated that eco-innovations significantly enhance the circular economy capabilities and overall performance of small and medium enterprises (SMEs), making them more sustainable. In the tourism sector, Sunarya [31] found that collaborative innovation in green supply chains, influenced by socio-demographic

factors, plays a significant role in achieving GSCM objectives. These studies collectively highlight the importance of product innovation as a driver of sustainability in supply chains.

Customer perspectives have also become increasingly influential in the adoption of GSCM practices. Companies are responding to the growing demand for sustainable products by integrating customer-driven sustainability initiatives into their supply chains. For instance, Ahmed [32] analyzed the impact of environmental collaboration among supply chain stakeholders and found that it significantly enhances a firm's sustainable performance. Furthermore, research by Jum'a [33] on manufacturing firms in Jordan showed that customer expectations heavily influence managers' intentions to adopt GSCM practices. Laari [34] similarly demonstrated that customer-driven GSCM practices directly contribute to improved firm performance. These findings illustrate how customer expectations are increasingly shaping the direction of GSCM practices within firms.

Finally, risk management plays a critical role in ensuring the success of GSCM by helping organizations mitigate the various environmental, social, and economic risks inherent in their supply chains. Effective risk management strategies enable companies to anticipate, assess, and address potential disruptions that could compromise the sustainability of their supply chains. For instance, Kara & Edinsel [35] highlight that incorporating risk management into GSCM practices enhances supply chain resilience, allowing organizations to better withstand environmental and economic uncertainties. Furthermore, Qorri [36] argue that risk management is essential for maintaining the long-term viability of sustainable supply chains, particularly in the face of global challenges such as climate change and resource scarcity. These studies underscore the importance of integrating comprehensive risk management frameworks into GSCM to achieve sustained environmental and operational performance.

5 Conclusion

The primary objective of this article was to employ bibliometric analysis to systematically review the evolution and thematic development within the field of Green Supply Chain Management (GSCM). Through a variety of bibliometric outputs, this study has provided a multi-faceted overview of the trends, influential research, and thematic categorizations defining GSCM.

The annual scientific production related to GSCM depicted a pronounced growth in research output over the years, particularly highlighting an intense surge in publications post-2014, which indicates a heightened global interest and academic focus in integrating environmental considerations into supply chain management. The data from the most relevant authors suggested a concentrated academic effort from a select group of researchers, who have significantly shaped the GSCM discourse, indicating the central role of these individuals in advancing this field.

The analysis of corresponding authors' countries showed that GSCM is a global concern, with significant contributions from the United Kingdom, China, and India. Each region's research output mirrors its industrial growth and environmental policy shifts, reflecting the global nature of supply chain sustainability issues. Further exploration into the most cited documents revealed key articles that have formed the foundational backbone of GSCM research, offering critical insights and methodologies that have propelled the field forward.

Lastly, the thematic map analysis categorized the keywords into Motor, Niche, Basic, and Emerging or Declining themes, providing a structured understanding of the research focus within GSCM. This categorization helped in pinpointing the areas that are well-established, those that are specialized, and themes that are either gaining traction or losing relevance.

Furthermore, the proposed model recommendations in this study offer a comprehensive framework for understanding the key drivers that influence Green Supply Chain Management (GSCM). By synthesizing insights from previous research, the model emphasizes the critical roles of IT & Business Strategy Alignment, Transglobal Leadership, Product Innovation, Customer Perspective, and Risk Management in enhancing GSCM practices. These elements collectively contribute to the effective implementation and sustainability of supply chains, ensuring that organizations can meet environmental goals while maintaining operational efficiency. This model serves as a strategic guide for future research and practical applications, reinforcing the importance of an integrated approach to managing green supply chains within the global context.

In conclusion, the bibliometric analysis performed in this study not only highlighted the robust and dynamic nature of GSCM research but also emphasized the interdisciplinary approach required to tackle the complexities of sustainable supply chain management. By mapping out how various themes have evolved and identifying key contributions and contributors, this article offers invaluable insights into the strategic directions for future research, ensuring that academic endeavors are aligned with practical needs to effectively contribute to sustainable development within the global supply chain framework. This comprehensive overview serves as a foundational guide for academia and industry stakeholders, charting the course for future initiatives and research in this vital area.

References

[1] S. K. Srivastava, "Green supply-chain management: A state-of-the-art literature review," International Journal of Management Reviews, vol. 9, no. 1, pp. 53-80, 2007.

[2] Q. Zhu, J. Sarkis, and K. H. Lai, "Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective," Journal of Environmental Management, vol. 183, pp. 162-172, 2016.

[3] S. Seuring and M. Müller, "From a literature review to a conceptual framework for sustainable supply chain management," Journal of Cleaner Production, vol. 16, no. 15, pp. 1699-1710, 2008.

[4] P. Beske and S. Seuring, "Putting sustainability into supply chain management," Supply Chain Management: An International Journal, vol. 19, no. 3, pp. 322-331, 2014.

[5] H. Walker, L. Di Sisto, and D. McBain, "Drivers and barriers to environmental supply chain management practices: Lessons from the public and private sectors," Journal of Purchasing and Supply Management, vol. 14, no. 1, pp. 69-85, 2008.

[6] P. Ahi and C. Searcy, "A comparative literature analysis of definitions for green and sustainable supply chain management," Journal of Cleaner Production, vol. 52, pp. 329-341, 2013.

[7] P. R. Kleindorfer, K. Singhal, and L. N. Van Wassenhove, "Sustainable operations management," Production and Operations Management, vol. 14, no. 4, pp. 482-492, 2005.

[8] K. Govindan, A. Rajeev, M. L. Tseng, and A. Tan, "A review of multi-criteria decision-making applications to solve energy management problems: Two decades from 1999 to 2019," Renewable and Sustainable Energy Reviews, vol. 104, pp. 446-481, 2020.

[9] C. J. Chiappetta Jabbour, J. Sarkis, A. B. Lopes de Sousa Jabbour, D. W. Renwick, S. K. Singh, O. Grebinevych, I. Kruglianskas, and M. G. Filho, "Who is in charge? A review and a research agenda on the 'human side' of the circular economy," Journal of Cleaner Production, vol. 280, pp. 124299, 2021.

[10] R. De Angelis, M. Howard, and J. Miemczyk, "Supply chain management and the circular economy: Towards the circular supply chain," Production Planning & Control, vol. 31, no. 1, pp. 115-127, 2020.

[11] S. Arya and A. Mittal, "Bibliometric analysis of global research on green supply chain management: Trends, challenges, and opportunities," Resources, Conservation and Recycling, vol. 174, pp. 105891, 2022.

[12] B. Kitchenham, O. P. Brereton, D. Budgen, M. Turner, J. Bailey, and S. Linkman, “Systematic literature reviews in software engineering–a systematic literature review,” Information and Software Technology, vol. 51, no. 1, pp. 7-15, 2009.
[13] K. S. Khan, R. Kunz, J. Kleijnen, and G. Antes, “Five steps to conducting a systematic review,” Journal of the Royal Society of Medicine, vol. 96, no. 3, pp. 118-121, 2003.
[14] S. K. Srivastava, “Green supply-chain management: A state-of-the-art literature review,” International Journal of Management Reviews, vol. 19, no. 1, pp. 53-80, 2017.
[15] P. Rao and D. Holt, “Do green supply chains lead to competitiveness and economic performance?” International Journal of Operations & Production Management, vol. 27, no. 9, pp. 898-916, 2017.
[16] Q. Zhu, J. Sarkis, and K. H. Lai, “Confirming the operational practices and performance improvement of green supply chain management: A Chinese context,” Transportation Research Part E: Logistics and Transportation Review, vol. 71, pp. 1-14, 2018.
[17] M. P. De Brito and E. A. van der Laan, Supply chain management, Routledge, 2018.
[18] Y. Chen, G. Tang, J. Jin, J. Li, and P. Paillé, “Linking market orientation and environmental performance: The influence of environmental strategy, employee’s environmental involvement, and environmental product quality,” Journal of Business Ethics, vol. 150, no. 2, pp. 407-424, 2018.
[19] K. Govindan, A. Rajeev, S. S. Padhi, and R. K. Pati, “Evolution of sustainability in supply chain management: A literature review,” Journal of Cleaner Production, vol. 162, pp. 299-314, 2019.
[20] M. L. Tseng, R. R. Tan, A. S. F. Chiu, C. F. Chien, and T. C. Kuo, “Sustainable consumption and production in the food supply chain: A conceptual framework,” International Journal of Production Economics, vol. 195, pp. 419-431, 2018.
[21] S. A. R. Khan, Z. Yu, H. Golpîra, A. Sharif, and M. Peris-Ortiz, “Environmental management practices and green supply chain management in the construction industry,” Journal of Cleaner Production, vol. 245, pp. 118751, 2020.
[22] B. P. Chhatoi, S. P. Sahoo, and D. P. Nayak, “Assessing the academic journey of 'Financial Inclusion' from 2000 to 2020 through bibliometric analysis,” Journal of Scientometric Research, vol. 10, no. 2, pp. 148-159, 2021.
[23] Q. Zhu and J. Sarkis, “The moderating effects of institutional pressures on emergent green supply chain practices and performance,” International Journal of Production Research, vol. 45, no. 18-19, pp. 4333-4355, 2007.
[24] A. Genovese, A. A. Acquaye, A. Figueroa, and S. L. Koh, “Sustainable supply chain management and the transition towards a circular economy: Evidence and some applications,” Omega, vol. 66, pp. 344-357, 2017.
[25] A. N. El-Kassar and S. K. Singh, “Green innovation and organizational performance: The influence of big data and the moderating role of management commitment and HR practices,” Technological Forecasting and Social Change, vol. 144, pp. 483-498, 2019.
[26] A. Ghadge, D. G. Mogale, M. Bourlakis, L. M. Maiyar, and H. Moradlou, “Link between Industry 4.0 and green supply chain management: Evidence from the automotive industry,” Computers & Industrial Engineering, vol. 169, pp. 108303, 2022.
[27] M. Trujillo-Gallego, W. Sarache, and A. B. L. de Sousa Jabbour, “Digital technologies and green human resource management: Capabilities for GSCM adoption and enhanced performance,” International Journal of Production Economics, vol. 249, pp. 108531, 2022.
[28] A. F. Ahmad and G. Karadas, “Managers’ perceptions regarding the effect of leadership on organizational performance: Mediating role of green supply chain management practices,” Sage Open, vol. 11, no. 2, 2021.
[29] W. Ahmed, W. Ahmed, and A. Najmi, “Developing and analyzing framework for understanding the effects of GSCM on green and economic performance: Perspective of a developing country,” Management of Environmental Quality: An International Journal, vol. 29, no. 4, pp. 740-758, 2018.

[30] S. Bag, P. Dhamija, D. J. Bryde, and R. K. Singh, "Effect of eco-innovation on green supply chain management, circular economy capability, and performance of small and medium enterprises," Journal of Business Research, vol. 141, pp. 60-72, 2022.
[31] E. Sunarya, T. Nur, I. Rachmawati, D. Suwiryo, and M. Jamaludin, "Antecedents of green supply chain collaborative innovation in tourism SMEs: Moderating the effects of socio-demographic factors," Uncertain Supply Chain Management, vol. 11, no. 1, pp. 161-168, 2023.
[32] W. Ahmed, M. S. Ashraf, S. A. Khan, S. Kusi-Sarpong, F. K. Arhin, H. Kusi-Sarpong, and A. Najmi, "Analyzing the impact of environmental collaboration among supply chain stakeholders on a firm's sustainable performance," Operations Management Research, vol. 13, pp. 4-21, 2020.
[33] L. Jum'a, M. Ikram, Z. Alkalha, and M. Alaraj, "Factors affecting managers' intention to adopt green supply chain management practices: Evidence from manufacturing firms in Jordan," Environmental Science and Pollution Research, vol. 29, no. 4, pp. 5605-5621, 2022.
[34] S. Laari, J. Töyli, T. Solakivi, and L. Ojala, "Firm performance and customer-driven green supply chain management," Journal of Cleaner Production, vol. 112, pp. 1960-1970, 2016.
[35] K. Kara and S. Edinsel, "The mediating role of green product innovation (GPI) between green human resources management (GHRM) and green supply chain management (GSCM): Evidence from automotive industry companies in Turkey," in Supply Chain Forum: An International Journal, vol. 24, no. 4, pp. 488-509, 2023.
[36] A. Qorri, Z. Mujkić, and A. Kraslawski, "A conceptual framework for measuring sustainability performance of supply chains," Journal of Cleaner Production, vol. 189, pp. 570-584, 2018.