Review article

Mapping sustainable supply chain innovation: A comprehensive bibliometric analysis

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A B S T R A C T

This comprehensive bibliometric study investigates Sustainable Supply Chain Innovation (SSCI) research, examining its evolution, identifying key contributors, and unveiling emerging trends. Analyzing 1158 English-language SSCI articles using the robust Scopus dataset exposes noteworthy journals, authors, institutions, and global contributions. The findings suggest a consistent increase in research output since 1999, with a notable surge in the past decade. Network analysis and density-based spatial clustering identified six SSCI research clusters: Sustainability and Responsibility in Business, Navigating Innovation and Disruption, Sustainable Business Strategies, Environmental Sustainability and Innovation, Sustainable Food Systems and Environmental Impact, and Sustainable Business Dynamics. These clusters highlight the diverse nature of the evolving Sustainability and Supply Chain Management (SCM) field, contributing to a thorough understanding of the SSCI research landscape and emphasizing interconnections between sustainability and SCM themes, potentially leading to more comprehensive theoretical models. Furthermore, this understanding aids businesses in anticipating emerging trends and implementing optimal practices in SSCI. Moreover, recognizing active institutions and global contributors provides practical insights for fostering strategic collaborations.

1. Introduction

SSCI has gained significant attention recently due to heightened environmental awareness and stricter government policies [1]. This approach combines environmental, social, and economic factors in SCM to boost environmental performance and stakeholder value [2,3]. SSCI, driven by green tech, eco-design, and digital innovations [4,5], helps companies tackle environmental challenges, cut costs, and gain a competitive edge, leading to enhance efficiency, minimize environmental footprint, boost reputation, and cultivate greater customer loyalty [6]. Embracing sustainable supply chain practices helps companies manage risks tied to regulations, market demands, and stakeholder expectations [1]. Supply chain innovation (SCI) is vital for Sustainability and resilience over the long term amid global challenges such as resource depletion, climate change, and rising eco-friendly demand [6].

SSCI's development is shaped by technology advancements, supply chain collaboration, and industry best practices [7,8]. It

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includes key concepts like eco-design, green tech, and digital transformation for long-term Sustainability and resilience. Researchers [9] have pinpointed key drivers of SSCI, such as technology, collaboration, organizational capabilities, and governance. These drivers enable innovative practices and technologies, enhancing supply chain sustainability. Recent trends in SSCI literature highlight the significance of collaboration, small businesses, and green tech in achieving sustainability goals [8].

The rising interest in SSCI is driven by environmental awareness, government regulations, and competitiveness concerns [10]. Advanced technologies like Industry 4.0, big data, and green tech contribute to this interest [7,8,11–15]. Multiple bibliometric studies have analyzed SSCI literature [8]. analyzed sustainable supply chain management (SSCM) and green technologies for emerging trends [14]. studied SSCM with big data, showing its global popularity [11,12,16]. Explored Industry 4.0 and advanced manufacturing in SSCM, underscoring its global importance.

However, these studies have limitations, as they may not encompass all relevant publications and concentrate on specific areas like operational management practices [17], inventory models [18], Circular Economy [19], open Innovation and SSCM in SMEs [20], and SSCM with futuristic technologies [21]. [22] Explore servitization in circular supply chains (SCs), emphasizing SSCI, Innovation, product service systems, digital technology, and circular economy, Sustainability [23]. Used bibliometric and content analysis to study technology adoption in SSCM, focusing on digital-based SCs and proposing a framework aimed at aligning with Sustainable Development Goals within the SSCM domain.

Research in SSCI has limitations, such as narrow coverage in disciplines like business and management. This study takes a comprehensive approach to exploring SSCI across all subjects' areas, aiming to fill these gaps. However, there may still be unexplored aspects of SSCI that require further attention. Our main goal is to thoroughly examine SSCI to inform scholars, practitioners, and policymakers in advancing sustainable development goals through SCM. Researchers frequently review existing studies to uncover new insights in the dynamic SSCI field [24].

1.1. Research gap

Despite significant contributions from existing studies on SSCI, a critical gap in the literature necessitates a more thorough exploration. The previous literature in Table 1, often confined to specific niches within SSCM, has predominantly concentrated on drivers, advanced technologies, green practices, operational management, inventory models, circular economy, and futuristic technologies. However, this focus lacks a holistic perspective, leaving unexplored crucial aspects such as specific management practices, strategies, and the broader dynamics of sustainable business within the SC. Certain studies exhibit a disciplinary focus, particularly in technology adoption and risk management, limiting the interdisciplinary understanding of SSCI. This study addresses these gaps through a comprehensive approach, exploring SSCI across all subjects and providing a more inclusive view of the field. By recognizing and addressing the limitations in existing research, particularly the narrow coverage in disciplines, the intention is to bridge these gaps and contribute fresh insights that surpass the scope of previous research. Through a structured examination of review articles and bibliometric analyses, this paper aims to significantly contribute to the ongoing discourse on SSCI, offering valuable insights for scholars, practitioners, and policymakers in advancing sustainable development goals through effective SCM. The study aspires to generate new contributions, assess current trends, identify research gaps, and explore knowledge structures, ultimately filling a substantial literature gap in the complex domain of SSCI.

Table 1
Survey of review articles.

Reference	Methodology	Primary Discoveries & Contribution
Cataldo et al. [10]	Exploratory review	review of Sustainable supply chain management drivers in construction
Zhang et al. [14]; Borregan-Alvarado et al. [12]	Bibliometric analysis	Review of advanced technologies like Industry 4.0, big data, and green tech contribute to SSCI
Yu et al. [8]	Bibliometric review	Review of green technologies
Malacina & Teplov [17]	Bibliometric analysis and literature review	Review of operational management practices in SSCI
Salas-Navarro et al. [18]	Bibliometric Analysis	Review of Inventory Models in a Sustainable Supply Chain
Theeraworawit et al. [19]	Bibliometric Review	Review of Sustainable Supply Chain Management in a Circular Economy
Wangsa et al. [21]	Bibliometric and research trend analysis	SSCM with futuristic technologies
Kumar et al. [23]	Bibliometric and content analysis	technology adoption in SSCM, focusing on digital-based SCs and proposing a framework aimed at aligning with Sustainable Development Goals
Amofa & Morrison [25]	Bibliometric analysis	Mapping the trends of sustainable supply chain management research
Chen et al. [26]	Literature review	Supply chain collaboration for sustainability
Fahimnia et al. [27]	Review and bibliometric analysis	review of Green supply chain management
Paula et al. [28]	Systematic literature review	collaboration and trust sources for innovation in the reverse logistics
Touboulic & Walker [29]	Structured literature review	Review of Theories in sustainable supply chain management
Xing & Liu [30]	Systematic review	Review of Integrating product-service innovation into green supply chain management from a life cycle perspective
Aladayleh et al. [31]	Bibliometric analysis	Global trends of the research on COVID-19 risks effect in sustainable facility management fields
Kilubi [32]	Bibliometric study	Review of current paradigms in supply chain risk management
Reyes-Soriano [33]	Bibliometric Analysis	Review of Sustainable Supply Chains

Our study enhances the discourse on SSCI's knowledge evolution by using prior research and bibliometric methods to address four key research questions.

RQ1 How has the literature on Sustainable Supply Chain Innovation (SSCI) evolved, and what are the prevailing research subjects and conversations within it?

RQ2 Which countries are at the leading edge of contributing to academic SSCI literature?

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

RQ4 What are the prevailing trends in the field of SSCI literature?

This paper is structured into multiple segments. Section 2 investigates the current literature within the SSCI. Section 3 provides an overview of the methodology. Section 4 offers the findings from the analysis. Section 5 delves into the research's implications and discoveries. Finally, the paper concludes by summarizing its contributions and acknowledging its limitations.

2. Literature review

2.1. Sustainable supply chain innovation

SSCI integrates new concepts, technologies, and methods to enhance the environmental, social, and economic aspects of SC operations, including advanced data analytics, eco-friendly innovations, and digital transformation [1,3,6]. Considering economic benefits and environmental concerns, a strategic green SCM approach is crucial in achieving SSCI [1,5], leading to long-lasting positive outcomes for organizations. Sustainability awareness, tech advances, and eco-friendly demand drive recent SCM shifts. Key trends include circular economy interest and e-procurement adoption, especially in ISO 14001-certified organizations [34]. Sustainable logistics is crucial in multinational SC collaboration [35]. Industrial agroforestry represents an innovative sustainable value chain [16, 36], and there is a focus on CSR and Innovation [37]. Researchers explore carbon policy impacts on sustainable biofuel SCs [38], highlighting SCM's growing commitment to Sustainability.

According to Ref. [39], SSCI can delivers social benefits such as reducing inequalities, improved working conditions, stakeholder engagement, and health and safety standards. It also offers environmental advantages such as a lower carbon footprint, resource efficiency, and biodiversity conservation [40]. Economically, it leads to cost savings, enhanced brand value, and long-term value creation [41,23]. These benefits vary by industry and approach.

Current SCI literature covers various areas, including the link between environmental Innovation, SSCM, and performance [42]. Nature-based solutions in SCs gain prominence due to COVID-19, highlighting the need for Sustainability [31,13]. Green tech in SC operations reduces environmental impact and promotes Sustainability [8]. Organizations increasingly use AI, Blockchain, and IoT for sustainable SCM [4]. Collaboration and alignment are vital for sustainable SC strategies [43], and organizational Innovation enhances SSCM [20]. These studies utilize the triple-bottom-line approach to balance environmental, economic, and social performance [40].

The SSCI literature shows trends shifting toward a stronger focus on social and transformational Sustainability and knowledge and innovation management integration [44]. However, economic Sustainability remains a priority for many companies, especially successful SMEs [40,20]. Ongoing research and literature reviews help identify trends, concepts, and models for future research and practical use. As these trends can differ across industries and regions, it is advisable to conduct thorough research to obtain a comprehensive understanding of the evolving SSCI landscape.

Sustainable supply chain management faces theory-building limitations, mainly relying on a few macro theories like the Resource-Based View (RBV) [29]. Several theories related to SSCI, including Institutional Theory, Nature Resource-Based View, Social Innovation, Organizational Learning, Stakeholder Theory, and Social Learning, have emerged [45]. RBV focuses on environmental SCI [46]. Using Design Thinking is a promising approach for collaboratively developing more sustainable SCs with diverse stakeholders [47]. Leveraging these frameworks improves the ability to address sustainability challenges effectively, including measuring sustainable performance, overcoming barriers, and integrating Innovation and Sustainability [48,49].

Researchers have identified various challenges in SSCI, including implementation barriers like a lack of knowledge, resources, and organizational support [50], distribution channel choice difficulties [51], and collaboration challenges stemming from differences in organizational culture, goals, and communication [43]. Globalization, outsourcing, and offshoring complicate SSCI by dispersing SCs geographically, making sustainability performance monitoring and control more intricate [52]. Integrating new technologies with existing processes presents challenges for companies [41]. Environmental concerns [53], knowledge management barriers [54], technological challenges like Blockchain adoption [55] are key issues. Collaboration and partnership challenges [26] and implementation obstacles [50] are also significant, especially in emerging economies with higher uncertainty [49,52].

Interest in bibliometric studies, especially in SC research, has risen. Literature review and bibliometric analysis provide strong literature support due to their effectiveness in comprehensively understanding existing knowledge, identifying research gaps, and mapping the intellectual landscape of a specific field [27,17,21]. These methods help researchers situate their work within the broader scholarly context, assess the state of current knowledge, and contribute to ongoing academic conversations [56]. Table 1 compiles noteworthy review articles in the SSCI field, encompassing topics such as key drivers, technological advancements, and specific management practices. For instance Ref. [33], highlighted vital contributors to sustainable SCs (SSCs), such as China, the UK, the US, Italy, and the Netherlands [17]. focused on green SC innovation and knowledge management [25]. noted exponential growth in SSCM research but called for more attention to developing economies and SMEs [21]. reviewed futuristic technologies in SSCs. These studies inform SCM, Innovation, Sustainability, and technology trends for future research and practices. Identifying potential gaps in SSCI

research could enhance our understanding and reveal key exploration avenues, such as industry variations, advanced technology integration challenges, global vs. local SSCI practices, human behavior and culture influence, and long-term organizational outcomes, all while adopting interdisciplinary perspectives.

3. Research methodology

The research methodology utilized in this study is rooted in the extensive application of bibliometric analysis to assess SSCI. Drawing from notable studies, this method provides a systematic and quantitative approach to discern influential researchers, identify critical keywords, and unveil interconnections within academic works, thus offering valuable insights into collaboration dynamics and critical indicators in the field [56,17].

Bibliometric analysis, recognized as a well-established statistical tool [32], facilitates a nuanced understanding of shifts in the quality and quantity of research areas. Widely acknowledged and applied across diverse disciplines, including sustainability [25,33], advanced technologies [21], and green SCM [27], bibliometric analysis plays a pivotal role in our exploration of SSCI at the intersection of SCM and Sustainability.

This methodological choice ensures a thorough examination of the existing literature, enabling us to map the landscape of SSCI, identify critical contributors and trends, and contribute valuable insights to the ongoing discourse in the field. Using bibliometric analysis provides a structured and data-driven assessment of the scholarly landscape surrounding SSCI.

3.1. Data collection

This study used the Scopus database to conduct a robust research trend analysis of the literature on sustainable supply chain innovation (SSCI). We chose Scopus as the data source for its extensive coverage of academic publications, ensuring a rich and diverse dataset for bibliometric analysis in the SSCI field. We adopted the literature review method for its systematic and rigorous approach, which enabled us to examine the existing knowledge base, identify the research gaps, trends, and influential authors, and synthesize the findings from various perspectives. We preferred this method over experimental methods that might be constrained by the specific contexts and settings of the studies and thus might not capture the broader and dynamic aspects of SSCI [57].

To collect the relevant literature, we designed a careful and focused search strategy based on the following criteria.

- The articles must contain the keywords ("Sustainable" AND "Supply" AND "Chain" OR "Logistics" OR "SC" AND "innovation" * AND "SSCI" *) in their titles, abstracts, or keywords.
- The articles must be published in peer-reviewed English journals indexed by Scopus.
- The search included all articles published under the specified keywords to capture the field's most recent and relevant developments.

This search strategy resulted in an initial pool of 1341 documents, which we screened for relevance and quality. We excluded the documents unrelated to SSCI, duplicates, or incomplete or incorrect bibliometric information. After this screening process, we obtained a final dataset of 1158 documents in CSV format containing the following bibliometric details: title, authors, year, source, abstract, keywords, citations, and references. We used this dataset for our comprehensive and in-depth analysis of the SSCI literature.

To analyze the dataset and extract meaningful insights, we used VOS Viewer, a powerful software tool that can visualize bibliometric data through term maps and keyword co-occurrence networks [58]. VOS viewer can create and visualize networks of scientific
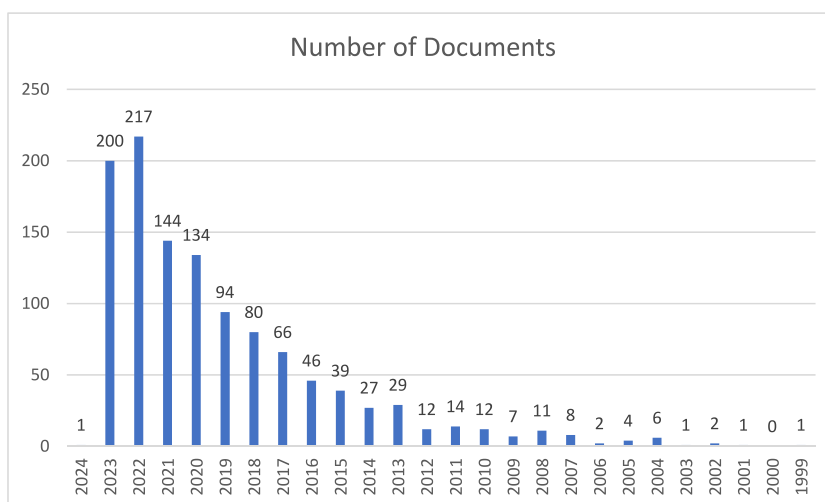

Fig. 1. The annual distribution of research within the field of SSCI.

publications, researchers, and terms based on bibliometric data, such as citation, bibliographic coupling, co-citation, or co-authorship relations. It also supports text mining, extracting and analyzing essential terms from literature, and creating co-occurrence networks. This analytical approach helped us gain a more nuanced and holistic understanding of the SSCI field, its evolution, and future directions. VOS viewer was also a valuable tool for exploring and understanding the structure and dynamics of SSCI and identifying the main topics, trends, and gaps in the literature.

We validated the results of our study by following the best practices of literature review methodology. Specifically, we ensured that our search strategy was comprehensive and focused, that our sources were relevant and authoritative, that our themes, debates, and gaps were identified and discussed, and that our structure and writing were coherent and consistent. We also compared our findings with other literature reviews on SSCI and verified the consistency of our findings with the literature in the same field.

4. Results derived from the descriptive analysis

In the following sections, we will unveil the primary findings derived from the bibliometric analysis.

4.1. Descriptive statistics

To understand the evolution of SSCI literature (Research Question 1), we analyzed its historical progression (Fig. 1). Research distribution has been consistent since 1999, with limited activity in 1999 and 2000. The early 2000s saw gradual growth, spiking in 2012–2013, nearly doubling publications from 12 to 29. This upward trend continued, reaching a peak of 217 documents in 2022, with 200 documents as of September 2023, indicating sustained interest [59]. attribute this growth to addressing poverty challenges and emerging market dynamics, emphasizing the role of technology and innovative SC solutions [60] in advancing sustainable development in these markets.

Table 2 summarizes the top 15 journals in SSCI and their article counts. Leading is Sustainability Switzerland, with 140 articles, followed by the Journal Of Cleaner Production (88) and the International Journal Of Production Economics (30). Other notable journals include Business Strategy and the Environment (25), Environmental Science and Pollution Research (15), and Resources Conservation and Recycling (12). Several journals have 11 articles each, highlighting technological advancements and social change. IEEE Transactions On Engineering Management and Science Of The Environment has ten articles. In contrast, others like the International Journal Of Environmental Research And Public Health, SC Management, and Environment Development And Sustainability contribute 9, 9, and 8 articles, respectively. Together, these journals account for 35% of the total 1158 articles in our sample, demonstrating a diverse and interdisciplinary approach to SSCI research across economic, environmental, technological, and managerial dimensions. Table 3 lists the top 15 scholars known for their significant contributions to SSCI research in leading Scopus journals.

Table 4 highlights leading academic institutions in SSCI research. Wageningen University & Research tops the list with 18 publications, followed by the University of Southampton (14) and Syddansk Universitet (12). Several institutions share the 11-article category. Additionally, multiple institutions with eight publications are noted. These institutions are mainly in developed countries with robust research networks. Meanwhile, institutions in developing countries also contribute to sustainability research but may need help in global recognition.

Table 5 outlines the top 15 countries in SSCI research. China leads with 214 articles (17%), followed by the UK (167, 14%) and the US (160, 13%). Italy and India contribute significantly, with 118 (10%) and 104 (8%) articles, respectively. Other nations like Australia, Germany, Spain, Taiwan, and the Netherlands collectively represent 28%. France, Canada, Brazil, Malaysia, and Iran complete the top 15, accounting for 16%. These findings underscore global interest in SSCI research, emphasizing the universal nature of sustainability challenges and the importance of collaborative research.

Table 6 displays the top 10 subject areas in SSCI: "Business, Management, and Accounting" leads with 509 occurrences, followed by

Table 2
The 15 most pertinent journals within the SSCI.

Source Title	Number of articles
Sustainability Switzerland	140
Journal Of Cleaner Production	88
International Journal Of Production Economics	30
Business Strategy And The Environment	25
Environmental Science And Pollution Research	15
Resources Conservation And Recycling	12
Energies	11
International Journal Of SC Management	11
Sustainable Production And Consumption	11
Technological Forecasting And Social Change	11
IEEE Transactions On Engineering Management	10
Science Of The Total Environment	10
International Journal Of Environmental Research And Public Health	9
Supply Chain Management	9
Environment Development And Sustainability	8

Table 3

The top 15 scholars with the highest research Production.

Authors Name	Number of Articles
Tseng, M.L.	11
Govindan, K.	7
Bag, S.	6
Gupta, H.	6
Kusi-Sarpong, S.	6
Lim, M.K.	6
Liou, J.J.H.	6
Ahmadi, H·B.	5
Frey, M.	5
Gong, Y.	5
Gunasekaran, A.	5
Mangla, S·K.	5
Sarkis, J.	5
Wu, K.J.	5
Geissler, B.	4

Table 4

Academic Institutions with more than 7 publications on SSCI.

Institution	No. of Articles
Wageningen University & Research	18
University of Southampton	14
Syddansk Universitet	12
Chinese Academy of Sciences	11
Southampton Business School	11
The University of Manchester	9
Dalian University of Technology	9
Politecnico di Milano	9
Asia University	9
Aston Business School	9
Università degli Studi di Torino	8
Chongqing University	8
Universidad Politécnica de Madrid	8
University of Cambridge	8
University of East Anglia	7

Table 5

Top 15 contributing countries to SSCI research.

Country/Territory	Number of articles	(%)
China	214	17%
United Kingdom	167	14%
United States	160	13%
Italy	118	10%
India	104	8%
Australia	62	5%
Germany	61	5%
Spain	51	4%
Taiwan	50	4%
Netherlands	47	4%
France	43	4%
Canada	42	3%
Brazil	40	3%
Malaysia	34	3%
Iran	33	3%
Top 15 Countries	1226	100%

"Environmental Science" (466), "Engineering" (367), "Social Sciences" (344), "Energy" (300), "Computer Science" (189), "Decision Sciences" (147), "Economics, Econometrics, and Finance" (133), "Agricultural and Biological Sciences" (104), and "Materials Science" (52). This table highlights the interdisciplinary nature of SSCI research, emphasizing the importance of integrating various subject areas to address SC sustainability complexities.

The descriptive analysis provides a historical overview and underscores the global, interdisciplinary, and sustained interest in SSCI. This information is crucial for researchers, policymakers, and practitioners aiming to stay abreast of trends, contributors, and critical

Table 6
To 10 subject area occurrence in SSCI field.

Subject Area	Occurrence
Business, Management and Accounting	509
Environmental Science	466
Engineering	367
Social Sciences	344
Energy	300
Computer Science	189
Decision Sciences	147
Economics, Econometrics and Finance	133
Agricultural and Biological Sciences	104
Materials Science	52

focus areas in the dynamic field of SSCI.

The consistent growth in research output since 1999, particularly the notable spike in 2012–2013, indicates a sustained and increasing interest in addressing sustainability challenges. The peak of 217 documents in 2022, maintained at 200 documents as of September 2023, reflects the ongoing relevance and dynamism of SSCI in response to emerging market dynamics and poverty challenges.

Moreover, the significant role played by countries such as China, the UK, and the US emphasizes the global interest and collaborative efforts dedicated to addressing sustainability challenges through innovative SC practices. The distribution of subject areas highlights the interdisciplinary approach inherent in SSCI, stressing the integration of business, environmental science, engineering, social sciences, and various other fields.

4.2. Keywords and citations

Analyzing keyword occurrences in Table 7 provides critical insights into SSCI's frequently discussed topics and emerging themes. Notably, "sustainable development" (413 occurrences) and "sustainability" (352 occurrences) take center stage, reflecting a robust emphasis on these overarching concepts [61]. The research delves into various sustainable development facets, including resource security, ecological stability, and sustainability research [62]. Equally prominent are "SC management" (345 occurrences), "innovation" (317 occurrences), and "SCs" (282 occurrences), underlining keen interest in enhancing SC processes [15] and employing innovative strategies to achieve sustainability goals [63]. Less frequently discussed yet pertinent topics include "decision-making" (79 occurrences), focusing on sustainable development decision-making methods [64], and "circular economy" (66 occurrences), examining its connection to sustainable development goals and implementation challenges [43]. Research on "sustainable SCs" (60 occurrences) explores aspects like green SC management, fairness perceptions, advanced technologies, embeddedness, knowledge sharing, and their impact on Sustainability [65]. Studies in "manufacturing" (60 occurrences) scrutinize sustainable development through decision-making and triple bottom lines to assess Sustainability and enhance performance. "Human-centric research" (55 occurrences) encompasses social Sustainability, gender equality, and the role of human behavior in sustainability achievement [66],

Table 7
Top 25 frequent keywords in the SSCI research.

Keyword	Occurrences
sustainable development	413
sustainability	352
SC management	345
innovation	317
SCs	282
decision making	79
circular economy	66
sustainable SCs	60
manufacturing	60
human	55
competition	55
food supply	54
environmental management	52
commerce	49
environmental impact	46
manufacture	43
sustainable SC management	40
technological Innovation	39
industry 4.0	37
climate change	37
life cycle	36
covid-19	35

indicating avenues for further exploration. Finally, "climate change" (37 occurrences) and "COVID-19" (35 occurrences) reflect global events' influence on research [67], hinting at emerging research domains and the need for interdisciplinary approaches to address these challenges innovatively.

Table 8 highlights top-cited articles, led by Ref. [68] with 764 citations, followed by Ref. [69] with 579 citations [68]. Explored green supplier influence and Innovation's impact on environmental performance and competitiveness, aligning with the global trend towards sustainable practices for competitive advantage [69]. Article challenged conventional thinking and sparked debate in sustainable SCM [70]. Ranked third with 557 citations, focusing on the circular economy's business models and SCs [71]. received 524 citations for their smart manufacturing and demand dynamics study [72]. Garnered 506 citations for their work on green Innovation, big data, and organizational performance. These top-cited articles cover diverse SSCM topics, from the impact of green practices on competitiveness to circular economy exploration and innovative SC models.

5. Discussion the results of network analysis

5.1. Keyword Co-occurrence analysis

Keyword co-occurrences, a bibliometric measure, reveal knowledge relationships [73], forming clusters that provide insight into diverse research areas [74]. Using VOSviewer, we established a network using density-based spatial clustering [58]. Maintaining a keyword count of 200–500 [75], we set a threshold of 8 for keyword appearances on the map, resulting in the consideration of 252 keywords classified into six clusters (Fig. 2). Every node in the network symbolizes a keyword, where node size reflects the frequency of co-occurrence and proximity signifies associations. The keywords network in Fig. 2 indicates that each cluster contains related keywords and concepts that provide a snapshot of the thematic areas within sustainability and business. The clusters cover various topics, including supply chain management, innovation, environmental impact, and social responsibility. This network helps identify key themes and explore connections within sustainable business practices.

We analyzed the top ten keywords in each cluster (Table 9) and labeled clusters based on characteristics and recurring themes. Note that cluster 6 included 11 keywords, all of which were retained.

5.2. Research clusters discussion

5.2.1. Cluster 1: Sustainability and responsibility in business

Cluster 1 reflects the growing relevance and urgency of Sustainability and corporate responsibility in the business world. The cluster covers various aspects of this theme, such as resource management, Innovation, stakeholder engagement, and environmental economics. The cluster also illustrates the theme with examples from different sectors and regions, specially manufacturing and China. The cluster aims to provide a comprehensive and critical perspective on the opportunities and challenges of Sustainability and corporate responsibility in business.

This cluster explores the theme of Sustainability and responsibility in business, which encompasses three main sub-themes: Sustainability, SC management, and innovation [76]. The cluster investigates how businesses can achieve Sustainability and corporate responsibility by managing their resources efficiently [77], understanding the economic implications of their actions [78], and integrating environmental and social considerations into their strategy and operations [79]. The cluster also highlights the increasing adoption of sustainable practices by businesses, as they recognize their impact and influence on the environment and society [80], and the role of SCM and logistics in optimizing the production and distribution of goods [81], reducing waste and enhancing the Sustainability of the SC. Another sub-theme of the cluster is Innovation, which is a crucial driver of business performance and competitiveness [82] and a source of creative solutions for addressing environmental and social issues [83,84]. The cluster pays special attention to the case of manufacturing and China, which illustrates the importance and challenges of Sustainability in a global context

Table 8
Top 15 most cited articles.

| Document	citations
chiou t.-y.; chan h.k.; lettice f.; chung s.h. (2011)	764
pagell m.; Shevchenko a. (2014)	579
geissdoerfer m.; morioka s.n.; de carvalho m.m.; evans s. (2018)	557
davis j.; edgar t.; porter j.; bernaden j.; sarli m. (2012)	524
el-kassar a.-n.; singh s.k. (2019)	506
matos s.; hall j. (2007)	451
klassen r.d.; vereecke a. (2012)	445
faceto l.f.; grillo r.; de medeiros g.a.; scognamiglio v.; rea g.; bartolucci c. (2016)	340
Silvestre b.s. (2015a)	331
tseng m.-l.; chiu a.s.f.; tan r.r.; siriban-manalang a.b. (2013)	326
chen l.; zhao x.; tang o.; price l.; zhang s.; zhu w. (2017)	316
tura n.; hanski j.; ahola t.; ståhle m.; piiparinen s.; valkokari p. (2019)	294
zhu q.; geng y.; fujita t.; hashimoto s. (2010)	266
zailani s.; govindan k.; iranmanesh m.; shaharudin m.r.; sia chong y. (2015)	265
bag s.; wood l.c.; xu l.; dhamija p.; kayikci y. (2020)	262
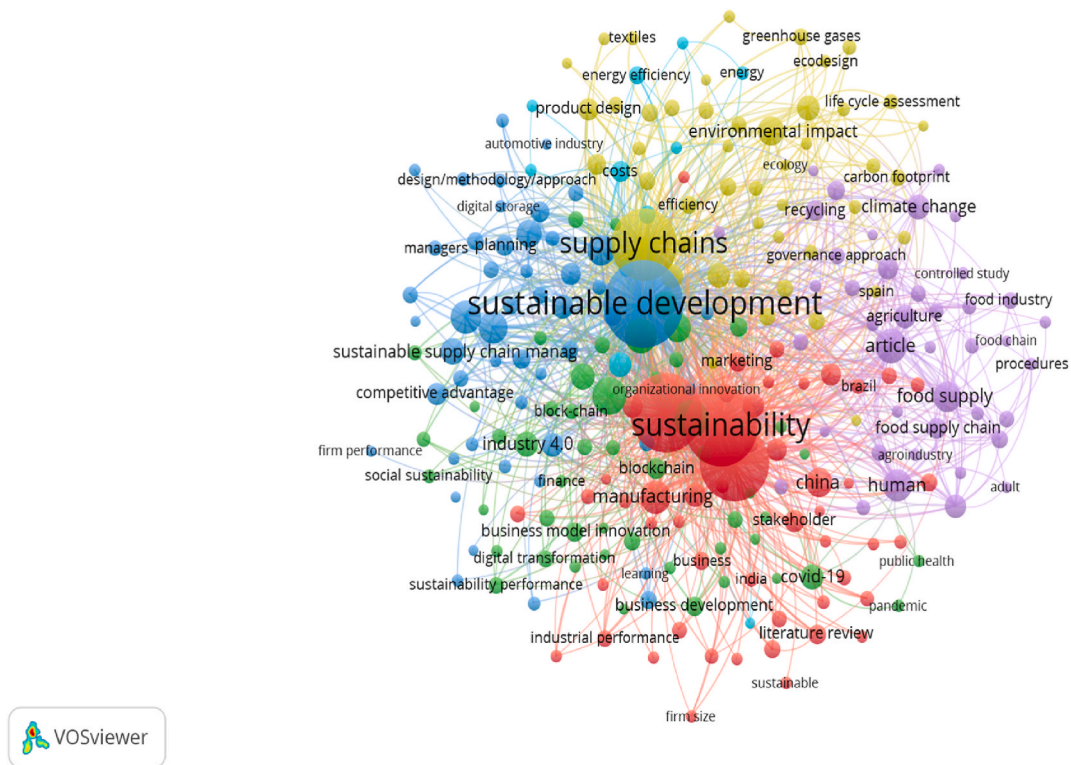
Fig. 2. The network of keyword co-occurrences.

Table 9
Clusters selected based on keyword co-occurrence.

Cluster 1. Sustainability and Responsibility in Business	Cluster 2. Navigating Innovation and Disruption	Cluster 3. Sustainable Business Strategies	Cluster 4. Environmental Sustainability and Innovation	Cluster 5. Sustainable Food Systems and Environmental Impact	Cluster 6. Sustainable Business Dynamics
sustainability	decision making	sustainable development	supply chains	food supply chain	sustainable Innovation
supply chain management	supply chain	sustainable supply chains	environmental impact	human	costs
innovation	circular economy	competition	life cycle	climate change	energy efficiency
manufacturing	commerce	environmental management	eco-innovation	humans	game theory
China	technological Innovation	manufacture	Environmental Sustainability	agriculture	closed-loop supply chain
technological development	industry 4.0	sustainable supply chain management	product design	environmental protection	energy
environmental economics	covid-19	green Innovation	investments	recycling	energy policy
logistics	economic and social effects	sustainable supply chain	environmental technology	economics	cost-effectiveness
stakeholder	blockchain	competitive advantage	industry	catering service	energy utilization
corporate social responsibility	business development	green supply chain management	efficiency		remanufacturing
					leadership

[82,85]. China is a major global manufacturing player but faces significant environmental and social problems due to its rapid industrialization and urbanization. This cluster discusses how China can balance its economic growth with its Sustainability goals and what lessons other countries can learn from its experience. The cluster also emphasizes the role of environmental economics in informing and influencing environmental decision-making by providing a framework for assessing the costs and benefits of different policies and practices related to Sustainability [86]. Environmental economics can help businesses and policymakers to make more rational and practical choices and to align their incentives with the public interest. Finally, the cluster underlines the importance of

stakeholder engagement in achieving Sustainability and corporate responsibility by highlighting the need for businesses to communicate and collaborate with their various stakeholders, such as customers, employees, and local communities [87]. This cluster suggests that stakeholder engagement can help businesses build trust, reputation, and loyalty, as well as align their practices with the expectations and values of their stakeholders.

5.2.2. Cluster 2: Navigating Innovation and disruption

Cluster Two reflects the theme of Navigating Innovation and Disruption in Business, which covers various topics related to how businesses can cope with and benefit from the disruptive forces that shape the business environment, such as technological innovation, Environmental Sustainability, and social change. The cluster covers sub-themes such as SC resilience, circular economy, blockchain and commerce, and COVID-19. This cluster provides an insightful and comprehensive perspective on the opportunities and challenges of Navigating Innovation and Disruption in Business.

The cluster also discusses how businesses can leverage new technologies and adopt sustainable practices to enhance performance and competitiveness. One sub-theme of the cluster is SC resilience, which refers to the ability of an SC to withstand and recover from various shocks and uncertainties, such as natural disasters, demand fluctuations, or supplier failures. The cluster investigates how businesses can improve their SC resilience by adopting agile and flexible strategies, such as risk management, contingency planning, and collaboration [88]. This cluster also highlights the role of Innovation and Industry 4.0 in enhancing SC resilience by enabling businesses to monitor, control, and optimize their SC operations using technologies such as AI, robotics, and IoT [16,13].

Another sub-theme of the cluster is the circular economy, a model of production and consumption that aims to minimize waste and maximize resource efficiency by reusing, repairing, refurbishing, and recycling materials and products [89]. The cluster discusses how businesses can benefit from adopting circular economy principles, such as reducing costs, increasing revenues, improving customer loyalty, and creating social and environmental value. This cluster also emphasizes the importance of effective SC management for implementing circular economy practices by ensuring the coordination and integration of material and information flows across the SC [90].

A third sub-theme of the cluster is blockchain and commerce, which signifies the application of blockchain technology to various aspects of commercial activities, such as transactions, contracts, payments, and supply chain tracking [60,16]. *Blockchain* is a decentralized ledger technology that securely records and verifies data and transactions without intermediaries or central authorities [91,92]. The cluster explores how blockchain can transform commerce by increasing transparency, efficiency, security, and trust among business partners and customers [91].

The final sub-theme of the cluster is COVID-19, which represents the impact of the coronavirus pandemic on the economy and society, as well as the responses and adaptations of businesses to the crisis. The cluster illustrates how COVID-19 has disrupted various business activities, such as SC operations, consumer behavior, and labor market dynamics [93]. The cluster also discusses how businesses can cope with and overcome the challenges posed by COVID-19 by innovating and adapting their products, services, processes, and strategies [7,13].

5.2.3. Cluster 3: sustainable business strategies

Cluster Three explores how sustainable business strategies can create environmental and competitive benefits for organizations. The main topics covered in this cluster are sustainable development, green supply chains, competition, and innovation. Sustainable development and environmental management examine the concept of environmental sustainability and its implications for business practices [5,94]. Green SCs and supply chain management (SCM) discuss how sustainability can be incorporated into the design and management of SCs and how it can improve SC performance and efficiency [95]. Competition and competitive advantage analyze the sources and strategies of gaining a competitive edge over other firms and how sustainable innovation can be a critical factor in achieving this goal [96]. The keywords "Manufacture" and "Green Innovation" emphasize the importance of innovation in the manufacturing sector, especially in terms of developing and implementing environmentally friendly processes and products [5,97]. "Green SCM" refers to integrating sustainability principles and practices into the planning and execution of SC activities [96]. These keywords from Cluster Three illustrate the growing relevance of sustainability in the business world, particularly in the SCM field, and the role of innovation and competition in driving business growth and success.

5.2.4. Cluster 4: environmental Sustainability and innovation

This cluster explores how environmental sustainability and innovation can be integrated into business strategies and practices. It explores the environmental impacts of supply chains and how they can be assessed and reduced through various methods and tools. It also investigates the role of innovation in creating and implementing sustainable solutions for environmental challenges. Some of the main topics and themes in this cluster are:

Life cycle assessment and environmental management: This topic evaluates the environmental effects of a product or service throughout its life cycle, from raw material extraction to disposal. It also covers managing environmental aspects in business operations, such as greenhouse gas emissions, resource consumption, and waste generation [98–100].

Eco-innovation and environmental technology: This theme focuses on developing and adopting innovative technologies and practices to improve environmental performance and sustainability. It includes eco-design, eco-efficiency, eco-labeling, and eco-marketing [101].

Sustainable investments and economic development: This topic highlights the importance of investing in sustainable businesses and projects that generate long-term economic and environmental benefits. It also emphasizes the link between environmental sustainability and economic development and how they can support each other [102].

Industry and efficiency: This theme emphasizes the role of industry sectors and efficiency measures in achieving environmental sustainability and innovation. It discusses how different industries can improve their environmental performance and competitiveness by adopting more efficient processes and technologies and reducing waste and emissions [103].

The keywords from Cluster 4 characterize the growing relevance of environmental sustainability and innovation in the business context, especially in SCM and product design. They also stress the need to invest in sustainable solutions and technologies and enhance efficiency in industrial sectors to achieve economic and environmental advantages.

5.2.5. Cluster 5: Sustainable Food Systems and Environmental Impact

This cluster explores the topic of sustainable food systems and how they affect and are affected by the environment. It covers various aspects and stages of the food supply chain, from production to consumption, and the environmental and social impacts they entail. It also explores the challenges and opportunities of climate change and its economic implications for the food sector. Moreover, it discusses the practices and strategies of recycling and sustainable catering services in reducing waste and enhancing sustainability. Some of the main topics and themes in this cluster are:

Food SC and agriculture: This topic examines the processes and activities involved in the food SC, such as farming, processing, distribution, and consumption. It also analyzes the role of agriculture as a vital component of the food SC and its environmental and social consequences, such as land use, water consumption, biodiversity loss, greenhouse gas emissions, food security, and rural development [104,105].

Human impact and environmental protection: This theme addresses the impact of human activities on the environment, especially about the food SC and the need for environmental protection and conservation. It emphasizes the importance of preserving the natural resources and ecosystems that support the food SC and the well-being of future generations [106].

Climate change and economics: This topic explores the link between climate change and economics and how they affect the food SC and the food sector. It examines climate change's economic costs and risks, such as crop failures, price volatility, food insecurity, and adaptation and mitigation expenses [107]. It also considers climate change's economic opportunities and benefits, such as new markets, technologies, and policies [108].

Recycling and catering services: This theme focuses on the practices and strategies of recycling and sustainable catering services in the food service industry. It discusses how recycling can improve waste management and resource efficiency in the food SC [104,109]. It also analyzes how catering services can reduce food waste and promote sustainability by adopting practices such as sourcing local and organic food, offering vegetarian and vegan options, and using biodegradable packaging [110].

The keywords from Cluster 5 illustrate the growing relevance of sustainability in the food system and the environmental and economic challenges and opportunities it faces. They also highlight the importance of environmental protection and waste reduction in the food SC and the need to adopt sustainable practices and strategies in the food service industry.

5.2.6. Cluster 6: Sustainable Business Dynamics

This cluster investigates the topic of sustainability in the context of energy and supply chain management (SCM) and how it relates to various aspects of business performance and strategy. It covers different dimensions and challenges of implementing and managing sustainable practices and innovations in the energy and SCM sectors, such as costs, efficiency, policy, and leadership. Some of the main topics and themes in this cluster are:

Sustainable innovation and energy efficiency: This topic concerns developing and adopting eco-friendly technologies and practices that can enhance energy efficiency and reduce environmental impact. It also analyzes the costs and benefits of sustainable innovation and how it can create competitive advantages and long-term savings for businesses [111].

Sustainable practices and closed-loop SC: This theme discusses the implementation and management of sustainable practices in the SCM sector, such as sourcing, production, distribution, and consumption. It also explores the concept and advantages of closed-loop SC, which involves minimizing waste and maximizing resource utilization by reusing, recycling, and remanufacturing materials and products [112].

Energy and energy policy: This topic explores the role and importance of energy and energy policy in the business context and how they affect and are affected by sustainability. It examines energy sources, uses, and impacts and the policies and regulations governing them. It also considers the opportunities and challenges of transitioning to renewable and low-carbon energy sources [113].

Energy utilization and remanufacturing: This theme focuses on the efficient and sustainable use of energy and materials in production. It discusses how energy utilization and remanufacturing can improve environmental performance and resource efficiency and reduce costs and emissions [114,30].

Leadership and game theory: This topic analyzes the role and influence of leadership in promoting and implementing sustainability in the energy and SCM sectors [115]. It also applies game theory to study the strategic decisions and interactions of different actors and stakeholders in the sustainability context [116].

The keywords from Cluster 6 illustrate the growing relevance of sustainability in the energy and SCM sectors and its economic and strategic implications for businesses. They also emphasize the role of leadership and innovation in driving change and creating sustainable solutions.

This study adeptly addresses each research question, providing comprehensive insights into the evolution, geographical contributions, influential figures, and prevailing trends within the dynamic field of SSCI. The historical overview of SSCI literature since 1999 addresses the evolution and preceding subjects (RQ1). The descriptive analysis highlights consistent growth, identifying critical years of increased activity and emphasizing sustained interest, notably peaking at 217 documents in 2022. Exploring subject areas underscores the interdisciplinary nature of SSCI, offering insights into its evolving focus. For RQ2, focusing on Leading Countries in

Academic SSCI Literature, the study effectively answers this question by presenting a detailed analysis of the top 15 contributing countries. China, the UK, and the US emerge as leaders, highlighting global interest and collaborative efforts.

Regarding Influential Researchers and Impactful Articles (RQ3), the study identifies the top 15 scholars and their contributions, recognizing leading journals. Finally, for Prevailing Trends in SSCI Literature (RQ4), the study identifies six research clusters, providing a nuanced understanding of the evolving landscape and emphasizing critical themes like resource management, stakeholder engagement, circular economy adoption, and the intersection of environmental sustainability and innovation. Each cluster reflects the multidisciplinary nature of SSCI, portraying significant trends in contemporary business practices.

6. Conclusions, implications, and limitations

6.1. Finding summary

This study analyzed SSCI using 1158 English-language journal articles from various subjects and years. It found a consistent increase in research output since 1999, particularly in the last decade, reflecting growing relevance in addressing global sustainability and SCM challenges. Key contributors were "Sustainability Switzerland" (140 articles) and "Journal Of Cleaner Production" (88 articles), Demonstrating the interdisciplinary nature of SSCI. The study also identified the top 15 productive SSCI scholars, active involvement from institutions like Wageningen University & Research, the University of Southampton, and Syddansk Universitet, and dominant contributions from China, the UK, and the US (214 articles from China), demonstrating global interest and relevance to both developed and emerging economies.

The study used network analysis to identify six research clusters in SSCI: *Sustainability and Responsibility in Business*, *Navigating Innovation and Disruption*, *Sustainable Business Strategies*, *Environmental Sustainability and Innovation*, *Sustainable Food Systems and Environmental Impact, and Sustainable Business Dynamics*. The identified clusters reveal significant trends in SSCI. For instance, Cluster 1 underscores the importance of sustainability and corporate responsibility, emphasizing resource management, innovation, and stakeholder engagement. Cluster 2 navigates innovation and disruption, highlighting decision-making, the circular economy, and Blockchain's transformative power. Cluster 3 stresses sustainable business strategies, indicating the increasing importance of sustainability in business, particularly in SCM. Cluster 4 explores the intersection of environmental sustainability and innovation, emphasizing the growing significance of sustainable practices in SCM and product design—cluster 5 delves into sustainable food systems, highlighting environmental preservation and waste reduction. Cluster 6 covers sustainability in energy and SCM, emphasizing economic and strategic aspects and the role of leadership. Collectively, these clusters depict a dynamic landscape where sustainability, innovation, and strategic decision-making play pivotal roles in shaping contemporary business practices.

This study highlights the importance of bibliometric analysis for understanding research trends in SSCI. These clusters demonstrate the multidisciplinary nature of the field.

This study stands out due to its thorough analysis, revealing six unique research clusters in SSCI. The study goes beyond traditional examinations by utilizing bibliometric and network analysis to uncover interconnected themes and emerging trends in SSCI. The identified clusters, such as "Navigating Innovation and Disruption" and "Sustainable Business Dynamics," provide a nuanced understanding of the field's multidisciplinary nature, contributing to a more in-depth exploration of specific subtopics and research directions. The study's emphasis on collaboration among researchers, identification of prolific authors and institutions, and implications for practitioners and policymakers adds a practical dimension, offering a holistic approach to understanding and advancing SSCI. Recognizing key contributors, journals, and the global landscape of SSCI further enhances the novelty, providing valuable insights for future research agendas and industry practices. As Sustainability and SCM evolve, more extensive bibliometric reviews are needed to keep up with emerging trends and research directions.

Recent research developments in these domains have emphasized the importance of integrating sustainability into business operations, exploring the role of innovation in promoting sustainability and understanding the environmental impact of business activities. Opportunities for impactful research include studying the drivers of sustainability in business strategy, exploring the impact of disruptive technologies on supply chain management, and understanding the role of leadership in driving sustainability.

Sustainability and responsibility in the Business domain focuses on corporate sustainability and responsibility. The research in this area has emphasized the importance of integrating sustainable practices into business operations [96], including supply chain management [25], corporate governance [107], and stakeholder engagement [2]. A lot of potential research trends in this field concentrate on exploring the role of sustainability in corporate decision-making [64], assessing the effectiveness of sustainability initiatives, and understanding how businesses can balance profitability with social and environmental responsibility [77].

Navigating Innovation and Disruption domain explores how businesses can sustainably navigate innovation and disruption. Recent research has examined the role of emerging technologies, such as blockchain and artificial intelligence, in promoting sustainability [7,13,91]. Research trends in this domain should understand the impact of disruptive technologies on supply chain management [13], explore new business models that promote sustainability [60], and understand the role of innovation in driving sustainable development [23].

Sustainable Business Strategies domain focuses on developing and implementing sustainable business strategies. Recent research has emphasized the importance of integrating sustainability into business strategy [43], including adopting circular economy principles and developing sustainable supply chains [19]. Potential research Opportunities should include studying the role of sustainability in competitive advantage [68], exploring the impact of sustainable business practices on financial performance [68], and understanding the drivers of sustainability in business strategy [9].

The Environmental Sustainability and Innovation domain explores the intersection of environmental sustainability and

innovation. Recent research has focused on the development of sustainable technologies [94], such as renewable energy and green infrastructure [105], as well as the impact of environmental regulations on business operations [10]. The research and impactful understanding should include studying the role of innovation in promoting environmental sustainability, exploring the impact of environmental policies on business behavior [86], and understanding the barriers to adopting sustainable technologies [55].

Sustainable Food Systems and Environmental Impact domain focuses on sustainable food systems and their environmental impact. Recent research has emphasized the importance of sustainable agriculture [105], food waste reduction [110], and the impact of food production on climate change [108]. There is potential in understanding the role of sustainable agriculture in promoting food security [62], exploring the impact of food production on biodiversity [40], and understanding the drivers of food waste [110].

Finally, The Sustainable Business Dynamics domain explores sustainability dynamics in business. Recent research has examined the role of corporate culture, leadership, and organizational change in promoting sustainability. There is room for more research in understanding the impact of sustainability initiatives on employee engagement, exploring the role of leadership in driving sustainability, and understanding the barriers to organizational change [115,106,87].

The study's originality lies in its thorough and multifaceted analysis of SSCM literature. The study reveals interconnected themes and emerging trends using bibliometrics and network analysis. The six areas identified offer several avenues for theoretical development and guide future research in sustainability and SCM. For example, Sustainability and Responsibility in Business connect to corporate sustainability theories, focusing on integrating sustainability into operations and stakeholder engagement. Navigating innovation and disruption, explore how emerging technologies drive sustainability. Sustainable Business Strategies contribute to strategic management theories, examining how sustainable practices affect profitability. Environmental Sustainability and Innovation study the intersection between innovation and environmental sustainability, exploring sustainable technology adoption. Sustainable Food Systems and Environmental Impact focus on sustainable agriculture and supply chain management. Sustainable Business Dynamics explores corporate culture and leadership in promoting sustainability. These areas can influence each other, leading to a comprehensive approach to sustainability and SCM challenges. Collaboration and interdisciplinary research efforts across these areas can foster innovation and drive positive change in business practices toward more sustainable and responsible outcomes.

6.2. Research implications

6.2.1. Theoretical implications

This comprehensive study provides profound theoretical implications, significantly enriching the theoretical landscape of SSCI. Identifying and exploring six distinct research clusters deepens our understanding of interconnected themes and contributes to advancing theoretical frameworks within SSCI. The study prompts theoretical inquiries by revealing knowledge gaps, encouraging scholars to examine specific subtopics and emerging trends, and fostering the evolution of theoretical paradigms in sustainability and SC literature.

Furthermore, it stimulates theoretical discussions on collaborative research dynamics, interdisciplinary cooperation, and the evolution of knowledge networks within the academic domain, potentially leading to new theoretical constructs that capture the intricacies of interdisciplinary collaboration and its impact on advancing sustainable practices.

6.2.2. Practical implications

In terms of practical implications, this study delivers valuable insights for practitioners and policymakers alike. Identifying research clusters serves as a practical guide for practitioners, offering benchmarks for sustainability initiatives and facilitating the alignment of business practices with industry standards. Policymakers can leverage the study's insights to formulate effective sustainability policies informed by a holistic view of evolving research trends. Adopting the study's methodology, including bibliometric and network analysis, can be a practical tool for researchers in various domains seeking to understand the landscape of emerging trends. Additionally, this study is foundational for shaping future trends in SSCI, providing actionable insights for practitioners and policymakers, and emphasizing the importance of interdisciplinary collaboration in addressing complex challenges within Sustainability and SCM.

The six domains identified have significant practical implications for researchers, policymakers, and managers. According to Sustainability and Responsibility in Business, researchers must investigate more in-depth to understand how sustainability practices can be integrated into various business operations. It also involves investigating the effectiveness of existing sustainability initiatives and identifying new strategies for balancing profitability with social and environmental responsibility. Policymakers can also advise regulatory frameworks that incentivize sustainable practices. At the same time, Managers can improve their organization's sustainability performance and reputation.

Furthermore, Navigating Innovation and Disruption intensifies researchers' exploration of the potential of emerging technologies, such as blockchain and AI, in promoting sustainability and understanding the specific applications of these technologies in sustainable business practices. On the other hand, Policymakers can use this knowledge to create policies that encourage the development and adoption of innovative, sustainable technologies. Managers can leverage these technologies to enhance the sustainability of their supply chains and operations.

Moreover, Sustainable Business Strategies encourage Researchers to focus on understanding how sustainability can drive competitive advantage and financial performance—analyzing the impact of sustainability on consumer preferences, market positioning, and overall business strategy. Therefore, policymakers can use this knowledge to establish incentives that encourage businesses to embrace sustainable practices. Conversely, managers can devise and execute sustainable business strategies that resonate with their organization's objectives and ethos.

According to Environmental Sustainability and Innovation, researchers need to study the role of innovation in promoting

environmental sustainability, identifying and developing sustainable technologies, and exploring the impact of environmental policies on business behavior. Policymakers can use this research to design policies encouraging businesses to innovate sustainably. Moreover, Managers can adopt and implement sustainable technologies and practices that align with their environmental goals.

Moreover, the Sustainable Food Systems and Environmental Impact domain compels researchers to comprehend the underlying causes of food waste and the ramifications of food production on climate change and biodiversity, agricultural practices, supply chain management, and consumer behavior. Policymakers can use this research to create policies that promote sustainable agriculture and reduce food waste. Also, Managers can implement sustainable practices in their food production and supply chain operations.

Finally, for Sustainable Business Dynamics, researchers need to explore the impact of sustainability initiatives on employee engagement and organizational change, studying corporate culture, leadership, and organizational structures that promote sustainability. Policymakers can create policies that encourage businesses to prioritize sustainability in their operations. At the same time, Managers can foster a culture of sustainability within their organizations and implement sustainable practices that align with their strategic goals.

6.3. Limitations and avenues for future Research

While our analysis of SSCI has provided valuable insights into the field, there are several limitations to consider.

1. **Sample Bias**: Our study relies on data from the Scopus database, which, while comprehensive, may only capture some relevant research. The selection criteria we used could introduce bias into our sample. For instance, Emphasizing English-language academic journal articles may inadvertently omit pioneering research published in different languages or through other channels.
2. **Limited Scope**: It is crucial to acknowledge that our research predominantly encompasses academic discoveries. Organizing research based on affiliation or region does not offer a comprehensive view of the state of SSCI Innovation in the industry or individual countries' progress.
3. **Data Sources**: Future research endeavors should broaden their scope by incorporating data from other reputable scientific databases, including but not limited to the Web of Science. Including additional sources of knowledge, such as books, book chapters, and conference papers can yield further understandings into the field.
4. **Advanced Techniques**: In future bibliometric evaluations, a more comprehensive understanding of the relationships between research topics can be achieved by delving deeper and employing clustering methods like bibliographic coupling or article co-citation.
5. **Non-English Research**: The exclusion of non-English SSCI research limits the scope of our analysis. Future studies should explore non-English literature to recognize its contribution to the research domain and ensure a more comprehensive understanding.
6. **Emerging Research**: Our analysis highlights the vibrancy of SSCI as a research area, but it is essential to acknowledge that it is still evolving. Future research should delve into emerging and critical topics within this field to stay at the forefront of this trendsetting domain.

Despite the attention it has garnered, SSCI remains in its infancy. We urge the research community to invest more significant resources and attention in this dynamic and influential facet of IoT research.

Data availability statement

The datasets generated during and/or analyzed during the current study are available from the corresponding author. Data available in file inventory.

CRediT authorship contribution statement

Mohammad J. Aladaileh: Writing – original draft, Visualization, Validation, Project administration, Methodology, Funding acquisition, Data curation. **Eva Lahuerta-Otero:** Writing – review & editing, Visualization, Validation, Supervision, Project administration, Funding acquisition, Conceptualization. **Khaled Jameel Aladayleh:** Visualization, Software, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e29157.

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