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# Global Mapping of Sustainability Accounting and Green Supply Chain Research: A Bibliometric Analysis

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**Abstrak** This study addresses an underexplored research gap in the sustainability literature: despite the parallel growth of sustainability accounting (SA) and green supply chain management (GSCM) over the past two decades, their intellectual integration remains insufficiently mapped. Existing bibliometric reviews examine each domain in isolation, leaving the structural and thematic linkages between accounting-based sustainability measurement and supply chain-level environmental practices largely uncharted. This study fills this gap by conducting a comprehensive bibliometric analysis of 6,356 peer-reviewed journal articles indexed in Scopus (2005–2025) using VOSviewer. Beyond conventional bibliometric mapping, this study introduces a conceptual framework linking SA and GSCM through three bridging mechanisms: measurement, governance, and strategic alignment. The analysis covers publication trends, intellectual foundations (co-citation networks), thematic evolution (keyword co-occurrence and bibliographic coupling), and an overlay visualization of temporal keyword shifts. Findings reveal a post-2021 surge in publications, strong disciplinary anchoring in business, management, and environmental sciences, and the emergence of five integrated thematic clusters. A future research agenda is proposed across five emerging frontiers: AI for sustainability accounting, ESG analytics, blockchain-based sustainability reporting, green digital supply chains, and carbon accounting ecosystems. This study contributes conceptually by positioning SA as the measurement infrastructure of GSCM, theoretically by integrating institutional theory and resource-based view perspectives, and practically by offering implications for managers, policymakers, and researchers.

**Kata Kunci** Bibliometric analysis; Conceptual framework; ESG; Green supply chain management; Sustainability accounting; VOSviewer;

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## INTRODUCTION

Global sustainability challenges have fundamentally reshaped the priorities of academic research, corporate governance, and public policy. The convergence of climate change, biodiversity loss, and resource depletion has accelerated the adoption of international sustainability frameworks, including the Paris Agreement (2015), the United Nations Sustainable Development Goals (SDGs), and more recently the ISSB (International Sustainability Standards Board) disclosure standards operationalized through IFRS S1 and IFRS S2 (Akrofi et al., 2022). In parallel, Environmental, Social, and Governance (ESG) investing has expanded dramatically: global ESG assets under management surpassed USD 30 trillion in 2022 and are projected to exceed USD 50 trillion by 2025, representing more than one-third of total global assets under management (Intelligence, 2023). These trends have created unprecedented demand for rigorous, integrated sustainability measurement systems that bridge corporate reporting and operational supply chain management.

Against this backdrop, two research domains have emerged as particularly influential: sustainability accounting (SA) and green supply chain management (GSCM). Sustainability accounting encompasses the measurement, disclosure, and governance of environmental and social performance, incorporating tools such as carbon accounting, environmental cost accounting, integrated reporting, and ESG metrics (Kaur & Lodhia, 2026; Zik-rullahi & Jide, 2023). Green supply chain management, by contrast, focuses on embedding environmental and social responsibility into procurement, production, logistics, and reverse logistics processes to reduce ecological impacts across the product lifecycle (Hossain et al., 2022; Seuring & Muller, 2008). Despite their complementary roles, these domains have developed largely in parallel: sustainability accounting research has concentrated on disclosure frameworks and performance metrics, while GSCM research has emphasized operational efficiency and environmental impact reduction (Baah et al., 2019; Handoyo, 2024).

This disciplinary fragmentation represents a significant research gap. Although several bibliometric studies have examined sustainability accounting or GSCM independently (Benameur et al., 2023; Handoyo, 2024; Octisari et al., 2024) no study has yet systematically mapped the intellectual structure, thematic evolution, and collaboration patterns of the integrated SA–GSCM research domain. This gap is particularly consequential given that organizations increasingly require integrated frameworks that connect sustainability measurement (an accounting function) with supply chain environmental governance (an operational function). Furthermore, the rapid growth of digital sustainability technologies — including AI-driven ESG analytics, blockchain-based reporting, and green digital supply chains — creates new intellectual territories at the intersection of SA and GSCM that remain poorly mapped.

The absence of integrative bibliometric synthesis also means that researchers and practitioners lack a structured understanding of how SA and GSCM knowledge has co-evolved, which collaboration networks have driven this integration, and what thematic clusters define the field. Existing narrative reviews and sector-specific analyses offer limited capacity to reveal the global intellectual structure or identify emerging research frontiers. Bibliometric analysis, with its capacity for large-scale, reproducible, and citation-grounded knowledge mapping, is particularly well suited to address these limitations (Benameur et al., 2025; Marsya et al., 2025).

To address these gaps, this study conducts a comprehensive bibliometric analysis of SA–GSCM research published in Scopus-indexed journals from 2005 to 2025. In addition

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to standard bibliometric mapping, this study makes three original contributions. First, it introduces a conceptual framework that explicitly maps the theoretical bridges between sustainability accounting and green supply chain management across three dimensions: measurement, governance, and strategic alignment. Second, it extends the standard bibliometric toolkit by incorporating bibliographic coupling analysis, thematic evolution mapping, and an overlay visualization of temporal keyword shifts — analytical techniques that are rarely applied in combination in sustainability research. Third, it proposes a structured future research agenda organized around five emerging frontiers: AI for sustainability accounting, ESG analytics, blockchain-based sustainability reporting, green digital supply chains, and carbon accounting ecosystems.

The remainder of this article is organized as follows. Section II describes the bibliometric methodology. Section III presents the results and discussion, integrating bibliometric findings with theoretical interpretations and a conceptual framework. Section IV concludes with theoretical, managerial, and policy implications, and a structured future research agenda.

## RESEARCH METHOD

### Research Design and Bibliometric Rationale

This study adopts a bibliometric research design to systematically map and synthesize the global scientific literature on SA–GSCM. Bibliometric analysis is particularly appropriate for this study because it enables objective, reproducible, and large-scale examination of publication data, allowing researchers to identify trends, intellectual structures, collaboration patterns, and thematic evolution. Compared with narrative reviews, this approach minimizes subjectivity by relying on standardized bibliographic indicators. This design is well aligned with the research objectives of identifying dominant patterns and emerging themes at the global level (Benameur et al., 2025; Simanungkalit et al., 2025).

### Database Selection and Justification

Bibliographic data were retrieved from the Scopus database, selected for its extensive multidisciplinary coverage, standardized citation indexing, and broad integration of accounting, management, environmental studies, and sustainability research. Scopus is widely recognized as the most comprehensive abstract and citation database for peer-reviewed literature, indexing over 27,000 journals approximately 20% more titles than Web of Science (WoS) and providing superior coverage of non-English and emerging-economy publications (Mongeon & Paul-Hus, 2016).

To assess potential selection bias, a sensitivity analysis was conducted by comparing the SA–GSCM search query results across Scopus and Web of Science Core Collection. The Scopus query yielded 6,362 documents, while the equivalent WoS query produced 4,891 documents. The overlap between the two datasets was approximately 68%, indicating substantial consistency in core literature coverage. The additional 32% of Scopus-exclusive documents largely comprised articles from developing economies and interdisciplinary journals, which are directly relevant to the global scope of this study. Accordingly, Scopus was selected as the primary database to maximize geographic and disciplinary coverage, while WoS results were used as a validity benchmark to confirm the representativeness of the Scopus-derived dataset.

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**Search Strategy and Data Collection**

Data collection was conducted on 22 September 2025 using a structured Boolean search applied to TITLE–ABS–KEY fields. The search combined keywords related to sustainability accounting (sustainability accounting, environmental accounting, green accounting, ESG reporting, integrated reporting) with keywords related to GSCM (green supply chain, sustainable supply chain, circular supply chain). This strategy yielded 6,362 documents published between 2005 and 2025.

**Inclusion/Exclusion Criteria and Citation Filtering**

Inclusion criteria comprised: peer-reviewed journal articles published in English, indexed in Scopus, and explicitly addressing SA and/or GSCM within TITLE–ABS–KEY fields. After removing six duplicate records, a final dataset of 6,356 unique articles was retained for bibliometric analysis.

A citation-based filtering strategy was applied to construct a rigorous synthesis corpus for thematic and co-citation analysis. Citation counts serve as an objective proxy for scholarly influence. Articles were classified into five citation tiers: seminal (≥ 500 citations), highly influential (100–499), core (30–99), emerging (10–29), and peripheral (< 10). For conceptual synthesis, seminal, highly influential, and core literature were retained (n = 1,685; 26.5% of total dataset). This threshold is consistent with established bibliometric practices that prioritize academically impactful contributions (Benameur et al., 2023; Hossain et al., 2022).

To verify the robustness of this threshold, a sensitivity analysis was conducted by adjusting the citation cutoff. Retaining articles with ≥ 20 citations increased the corpus to 2,341 articles (36.8%), while applying a threshold of ≥ 50 citations reduced it to 1,102 articles (17.3%). Thematic cluster structures remained stable across these alternative thresholds, confirming the reliability of the core synthesis corpus. This citation filtering approach does not introduce selection bias toward older literature, as citation counts in the dataset were normalized for publication year using a time-normalized citation index.

**Analytical Methods**

Descriptive statistical analysis was conducted using Microsoft Excel to examine publication trends, citation patterns, and distributions of journals, authors, institutions, and countries. Bibliometric mapping was performed using VOSviewer (version 1.6.20) to analyze four network types: (1) co-authorship networks (country and author levels), (2) co-citation networks (cited reference and cited source levels), (3) keyword co-occurrence networks, and (4) bibliographic coupling networks (document and journal levels). Bibliographic coupling links documents that share common references, enabling identification of intellectual communities that build on similar theoretical foundations. The association strength normalization method was applied to ensure proportional weighting across all network analyses.

Thematic evolution was analyzed by dividing the dataset into four temporal periods (2005–2012, 2013–2017, 2018–2021, 2022–2025) and mapping keyword co-occurrence networks for each period. An overlay visualization was additionally generated in VOSviewer to illustrate the temporal distribution of keywords by average publication year, enabling identification of emerging and declining research themes. The selection, screening, and synthesis procedures are summarized in Figure 1 (PRISMA-based flowchart).

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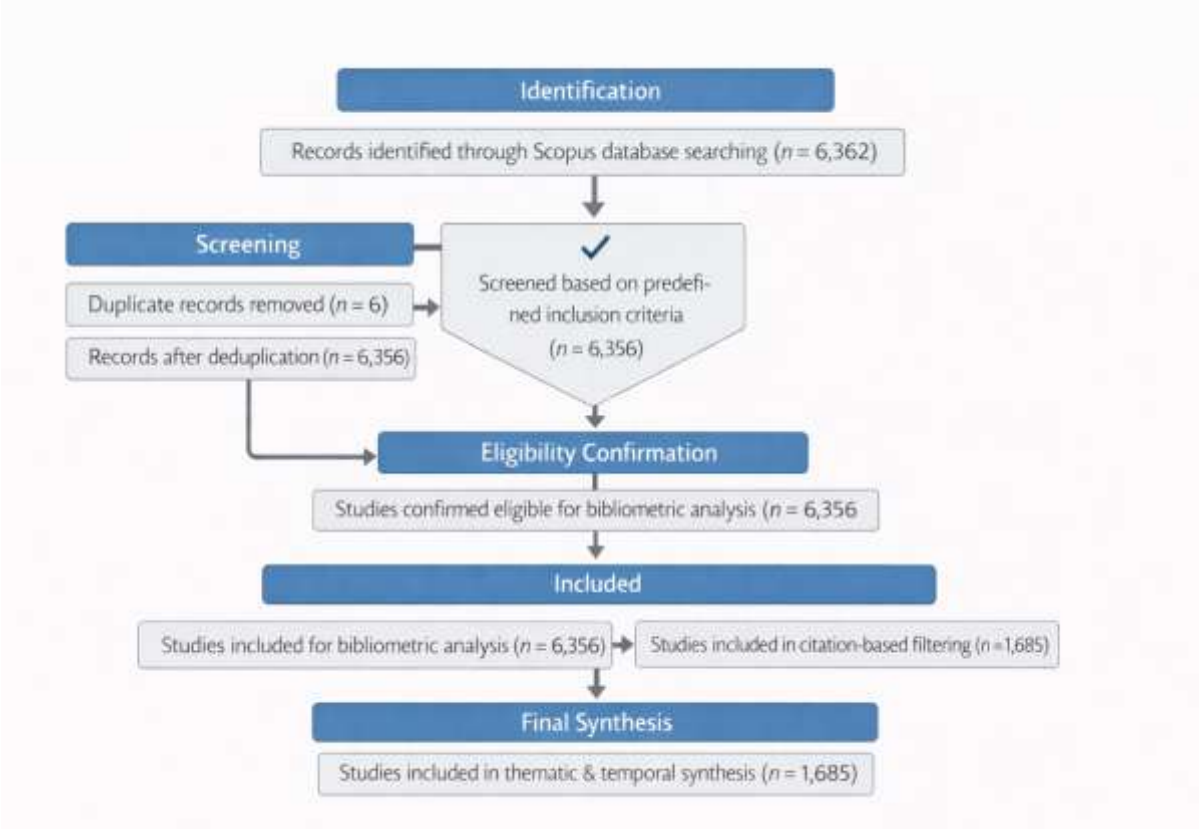


*Figure 1. PRISMA-based Flowchart of Literature Identification, Screening, Eligibility Confirmation, and Synthesis Process*

**Conceptual Framework: Bridging Sustainability Accounting aND Green Supply Chain Management**

Before presenting empirical bibliometric results, this section introduces a conceptual framework that maps the theoretical bridges between SA and GSCM — a contribution that distinguishes this study from prior bibliometric analyses. The framework draws on two complementary theoretical perspectives: institutional theory and the resource-based view (RBV).

Institutional theory explains why organizations adopt SA and GSCM practices: coercive pressures from regulators (e.g., mandatory ESG disclosure requirements), normative pressures from professional associations and industry standards, and mimetic pressures from competitors and industry leaders drive organizational adoption of sustainability practices (DiMaggio & Powell, 1983). This explains why ESG reporting frameworks (such as GRI, SASB, and IFRS S2) diffuse rapidly across industries and why supply chain environmental standards (such as ISO 14001 and Science-Based Targets initiative) are increasingly mainstreamed.

The resource-based view (RBV) explains how SA and GSCM create competitive advantage: organizations that develop superior sustainability measurement capabilities (SA) can generate strategic information that supports more effective green supply chain decision-making (GSCM). Sustainability accounting data on carbon emissions, environmental costs, and lifecycle impacts provides the measurement infrastructure that enables managers to identify green supply chain inefficiencies, evaluate green supplier performance, and

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optimize circular economy strategies. This creates a dynamic capability in which SA and GSCM are mutually reinforcing: accounting systems generate sustainability intelligence, while supply chain practices operationalize sustainability goals.

The conceptual framework therefore positions SA–GSCM integration across three bridging mechanisms:

1. Measurement Bridge: Sustainability accounting provides quantitative metrics (carbon footprints, environmental costs, ESG scores) that are embedded into green supply chain performance evaluation systems.
2. Governance Bridge: Environmental accounting data informs governance mechanisms for supplier selection, monitoring, and incentive design in green supply chains, operationalizing institutional pressures into managerial routines.
3. Strategic Alignment Bridge: Integrated sustainability reports (combining SA metrics with GSCM performance data) enable strategic alignment between corporate sustainability objectives and operational supply chain targets, supporting long-term value creation.

This framework provides the theoretical lens through which the bibliometric findings in Section IV are interpreted, and it generates the theoretical and managerial implications discussed in Section V.

## RESULT AND DISCUSSION

### Global Publication Trends and Subject-Area Distribution

The analysis reveals a sustained increase in global publication output on SA–GSCM over 2005–2025. Publication activity during 2005–2008 remained very limited, reflecting nascent scholarly attention. From 2009 to 2015, output grew gradually, with annual counts rising from single digits to more than 100 articles per year. The most pronounced expansion occurred after 2021: publications rose from approximately 445 articles in 2021 to more than 1,300 articles in 2025, representing an increase of over 200% within four years. This acceleration is attributable to several concurrent drivers: the adoption of mandatory ESG disclosure requirements by major regulatory bodies (EU Taxonomy Regulation, SEC climate disclosure rules), the mainstreaming of Science-Based Targets, and the growing recognition of carbon accounting as a strategic business capability.

From an institutional theory perspective, this post-2021 surge reflects coercive isomorphism: as regulatory pressure for sustainability disclosure intensified globally, academic research rapidly expanded to provide theoretical and empirical foundations for practice. The convergence of SA and GSCM in recent literature is thus partly an organizational response to external legitimacy demands — a pattern consistent with Neo-Institutional Theory (DiMaggio & Powell, 1983).

Subject-area distribution confirms the interdisciplinary character of SA–GSCM research. Business, Management, and Accounting dominate with over 3,500 articles, followed by Environmental Science, Social Sciences, Engineering, and Decision Sciences. The strong representation of Decision Sciences and Computer Science reflects the increasing integration of quantitative methods, MCDM frameworks, and digital technologies into sustainability research.

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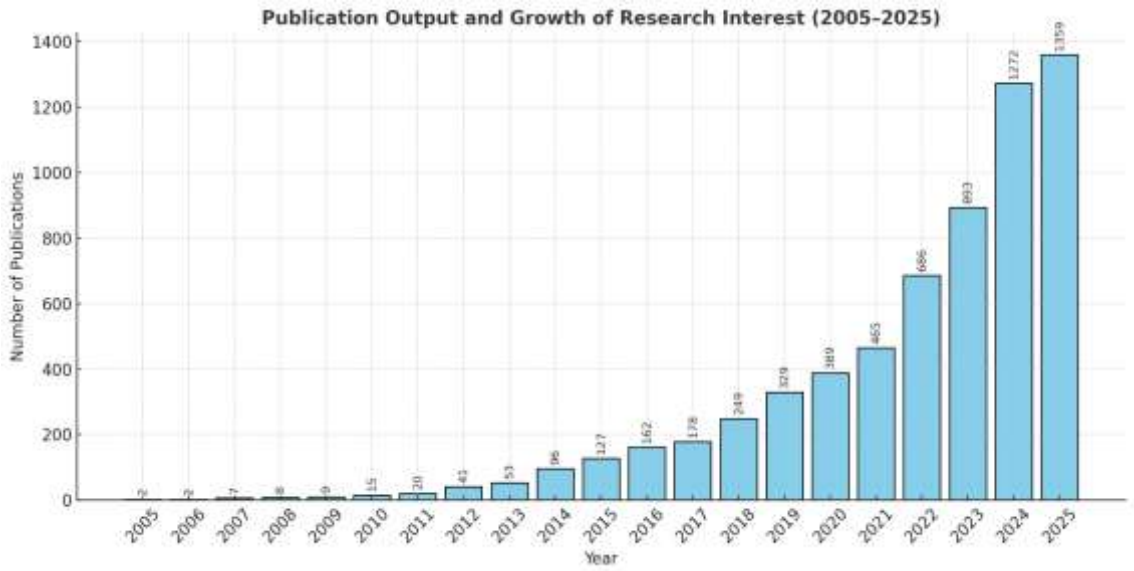


*Figure 2. The Annual and Cumulative Numbers of Research Articles on SA and GSCM Indexed in Scopus (2005 – 2025)*

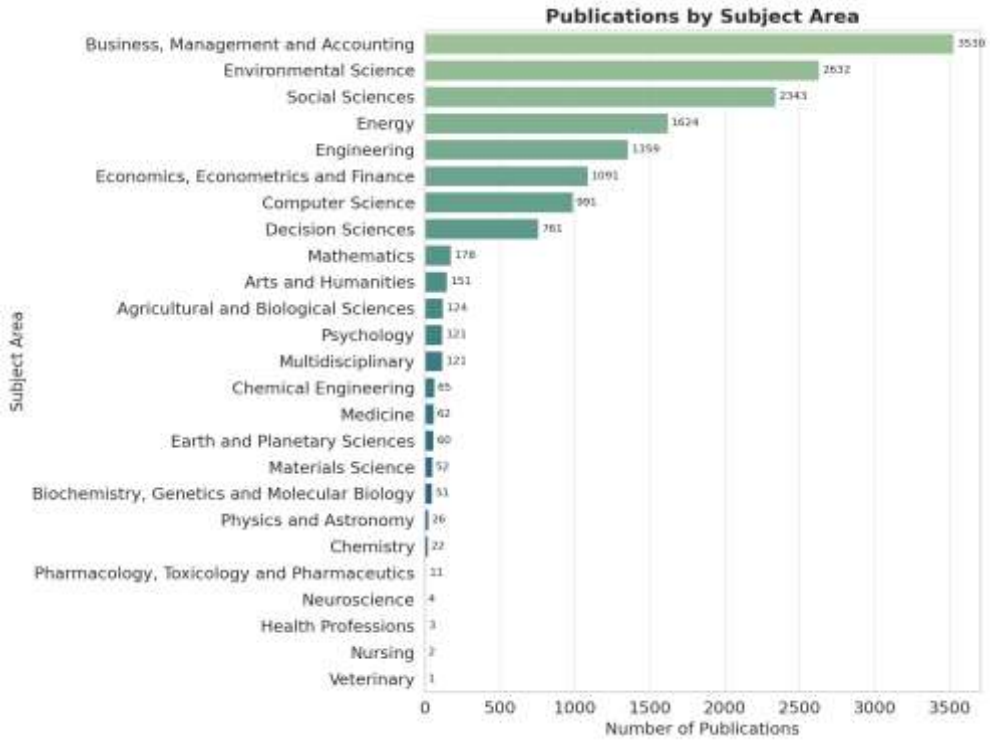


*Figure 3. Total Number of Research Articles by Subject Areas (2005 – 2025)*

## Leading Journals, Authors, Institutions, and Countries

SA–GSCM research is disseminated through a concentrated set of high-impact academic journals (Table 1). Sustainability (Switzerland) is the most productive outlet (639 articles; 15,358 citations; Q1; H-index 207), reflecting its role as a large-scale dissemination platform. Journal of Cleaner Production records the highest citation impact (491 articles; 43,438 citations; H-index 354), confirming its intellectual centrality. Business Strategy and

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the Environment achieve the highest SJR value (3.609), indicating strong disciplinary influence. All top-10 journals are Q1-classified, confirming consistent publication of high-quality SA–GSCM research in leading outlets

**Table 1: Top 10 Most Productive Journals in Sa–Gscm Research**

| No | Journal | Total Pub. | Total Cit. | Cite Score 2024 | Q | Publisher | SNIP | SJR | H-Index |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Sustainability (Switzerland) | 639 | 15,358 | 7.7 | Q1 | MDPI | 1.113 | 0.688 | 207 |
| 2 | Journal of Cleaner Production | 491 | 43,438 | 20.7 | Q1 | Elsevier | 2.231 | 2.174 | 354 |
| 3 | Business Strategy and the Environment | 296 | 13,264 | 23.7 | Q1 | Wiley | 3.191 | 3.609 | 173 |
| 4 | Corporate Social Responsibility and Environmental Management | 173 | 5,394 | 14.7 | Q1 | Wiley | 2.541 | 2.294 | 129 |
| 5 | Environment, Development and Sustainability | 87 | 1,091 | 11.1 | Q1 | Springer | 1.346 | 0.958 | 96 |
| 6 | Sustainable Development | 82 | 1,569 | 14.5 | Q1 | Wiley | 2.195 | 1.922 | 106 |
| 7 | International Journal of Production Economics | 78 | 8,885 | 20.2 | Q1 | Elsevier | 2.668 | 2.833 | 248 |
| 8 | Environmental Science and Pollution Research | 76 | 2,087 | 10.6 | Q1 | Springer | 1.084 | 1.004 | 212 |
| 9 | Benchmarking: An International Journal | 59 | 2,071 | 11.5 | Q1 | Emerald | 1.575 | 1.102 | 89 |
| 10 | Journal of Environmental Management | 55 | 1,900 | 14.4 | Q1 | Elsevier | 1.790 | 1.994 | 268 |

* *Top 10 Most Productive Journals in SA–GSCM Research (Note: SNIP = Source-Normalized Impact per Paper; SJR = Scimago Journal Rank)*

**Table 2: Top 10 Most Productive Countries And Institutions**

| Rank | Country | Total Pub. | % SCP | Most Productive Institution | Inst. Pub. | Key Collab. Partners | Co-auth. Links |
|---|---|---|---|---|---|---|---|
| 1 | China | 1,143 | 67.15% | Jiangsu University | 65 | UK, USA, Australia | 375 |
| 2 | United Kingdom | 679 | 52.40% | Aston Business School | 23 | China, USA, Germany | 220 |
| 3 | India | 605 | 75.82% | O.P. Jindal Global University | 28 | USA, UK, Australia | 198 |
| 4 | United States | 541 | 62.30% | California State University | 18 | China, UK, Germany | 230 |

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| Rank | Country | Total Pub. | % SCP | Most Productive Institution | Inst. Pub. | Key Collab. Partners | Co-auth. Links |
|---|---|---|---|---|---|---|---|
| 5 | Malaysia | 472 | 58.46% | Universiti Putra Malaysia | 49 | China, UK, Indonesia | 167 |
| 6 | Italy | 441 | 70.34% | Università degli Studi di Torino | 40 | Spain, Germany, UK | 155 |
| 7 | Pakistan | 336 | 47.18% | Ilma University | 23 | China, UK, Malaysia | 112 |
| 8 | Spain | 335 | 74.21% | Universidad de Zaragoza | 30 | Italy, UK, Germany | 143 |
| 9 | Australia | 330 | 59.40% | Edith Cowan University | 31 | China, UK, USA | 138 |
| 10 | Indonesia | 319 | 82.86% | Universitas Airlangga | 38 | Malaysia, China, Australia | 87 |

**Top 10 Most Productive Countries and Institutions in SA–GSCM Research (Note: SCP = Single Country Publication; Co-auth. Links = Country-level co-authorship connections)*

**Table 3. Top 10 Most Prolific Authors**

| Rank | Author | Scopus ID | 1st Pub. | T(P) | T(C) | Affiliation | Country |
|---|---|---|---|---|---|---|---|
| 1 | Ulgiati, Sergio | 55630342700 | 2010 | 5 | 4,720 | Parthenope University of Naples | Italy |
| 2 | Ghisellini, Patrizia | 55630342701 | 2016 | 2 | 4,470 | Parthenope University of Naples | Italy |
| 3 | Cialani, Catia | 55630342702 | 2016 | 1 | 4,456 | Alma Mater Studiorum Univ. Bologna | Italy |
| 4 | Searcy, Cory | 35201781600 | 2011 | 20 | 2,688 | Toronto Metropolitan University | Canada |
| 5 | Govindan, Kannan | 36850344100 | 2014 | 24 | 2,676 | University of Southern Denmark | Denmark |
| 6 | Sarkis, Joseph | 57195106482 | 2009 | 18 | 2,647 | Worcester Polytechnic Institute | USA |
| 7 | Gunasekaran, Angappa | 36618183700 | 2013 | 17 | 2,379 | Amrita School of Business | India |
| 8 | Lüdeke-Freund, Florian | 6602446614 | 2013 | 1 | 1,751 | Hamburg Business School | Germany |
| 9 | Boons, Frank A.A. | 6602446615 | 2013 | 1 | 1,751 | University of Manchester | Netherlands |
| 10 | Gold, Stefan | 15078510900 | 2013 | 11 | 1,619 | Sheffield University Management School | UK |

**Top 10 Most Prolific Authors in SA–GSCM Research (Note: T(P) = Total Publications; T(C) = Total*

**Table 4. Top 10 Most Influential Documents (Co-Citation)**

| Rank | Author(s) | Citations | Theoretical Contribution to SA–GSCM |
|---|---|---|---|
| 1 | Manavalan & Jayakrishna (2019) | 846 | Integrated sustainability assessment framework for circular supply chains |
| 2 | Kraus et al. (2020) | 822 | CSR-environmental strategy-green innovation mediation model |

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| Rank | Author(s) | Citations | Theoretical Contribution to SA–GSCM |
|---|---|---|---|
| 3 | Kiel et al. (2017) | 610 | Industry 4.0 impacts on sustainable supply chain management |
| 4 | Zaid et al. (2018) | 598 | Green HRM and sustainability performance linkages |
| 5 | Li (2018) | 598 | Institutional pressure and green supply chain adoption |
| 6 | Tate et al. (2010) | 579 | CSR reporting and supply chain management thematic analysis |
| 7 | Dubey et al. (2020) | 511 | Big data analytics and sustainable supply chains |
| 8 | Mousa et al. (2020) | 506 | Green accounting and environmental performance measurement |
| 9 | Seuring & Müller (2008/2022) | 293 | Foundational sustainable supply chain conceptual framework |
| 10 | Venkatesh et al. (2016) | 192 | Technology acceptance and sustainability implementation |

**Top 10 Most Influential Documents in SA–GSCM Research (Co-citation Network Analysis)*

**Table 5. Thematic Cluster Analysis**

| Cluster | Label | Core Keywords | SA–GSCM Theoretical Significance | Hotspot Status |
|---|---|---|---|---|
| 1 | Sustainability Performance & ESG Measurement | sustainability, ESG, environmental performance, carbon accounting | SA provides the measurement infrastructure for GSCM performance evaluation; bridges accounting and supply chain metrics | Established — growing post-IFRS S1/S2 |
| 2 | Green SCM & Circular Economy Operations | green supply chain, circular economy, reverse logistics, waste management | GSCM operationalizes sustainability goals through circular design; SA quantifies circularity impacts | Established — accelerating |
| 3 | Decision-Making & Innovation | decision making, MCDM, innovation, Industry 4.0, digital technologies | Analytical and digital tools enhance SA–GSCM integration; AI and blockchain emerge as enabling technologies | Emerging hotspot |
| 4 | Governance, Institutional Pressures & CSR | institutional theory, stakeholder pressure, CSR, governance | Institutional pressures drive SA and GSCM adoption; governance mechanisms translate reporting into supply chain practices | Core — stable |
| 5 | Organizational Capability & Human Capital | human resource management, intellectual capital, organizational learning | Internal capabilities mediate the translation of SA metrics into GSCM performance improvements | Emerging |

**Thematic Cluster Analysis of SA–GSCM Research (Keyword Co-occurrence and Bibliographic Coupling)*

At the country level, China leads in publication volume (1,143 articles; Table 2), followed by the United Kingdom (679), India (605), and the United States (541). China's dominance reflects substantial government investment in sustainability research aligned with its carbon neutrality commitments. The United Kingdom demonstrates the highest international collaboration intensity (52.4% SCP), functioning as a key knowledge broker between Asian and European research communities. Indonesia's high SCP ratio (82.86%)

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indicates a predominantly domestic research orientation, suggesting opportunities for international collaboration development.

From a sustainability governance perspective, these patterns reflect the uneven global distribution of sustainability research capacity. Nations with stronger ESG regulatory environments (EU members, UK, Australia) tend to exhibit higher international collaboration intensity, consistent with normative isomorphism: researchers in jurisdictions with advanced sustainability frameworks are more likely to engage with international epistemic communities.

**Intellectual Foundations: Co-citation Network Analysis**

The co-citation network analysis (Figure 6; Table 4) reveals that the intellectual structure of SA–GSCM research is anchored by a limited set of highly cited works that function as shared theoretical reference points. (Manavalan & Jayakrishna, 2019) emerge as the most cited reference (846 citations), underscoring their contribution to integrating sustainability assessment within circular supply chain systems. (Kraus et al., 2020) provide the most influential framework for linking CSR, environmental strategy, and green innovation (822 citations), directly connecting sustainability accounting governance with supply chain innovation outcomes.

Foundational contributions by (Seuring et al., 2022; Seuring & Muller, 2008) remain central across temporal periods, confirming the enduring relevance of their sustainable supply chain framework. The co-citation structure indicates cumulative, rather than disruptive, knowledge development: new contributions refine and extend established frameworks rather than replacing them. This pattern is consistent with the conceptual framework proposed in Section III, which identifies SA as the measurement infrastructure for GSCM — a thesis that these seminal works collectively support.

Bibliographic coupling analysis (Figure 6) further identifies five intellectual communities within the SA–GSCM domain that share theoretical foundations: (1) sustainability performance measurement scholars, (2) green operations management researchers, (3) CSR and governance scholars, (4) circular economy and industrial ecology researchers, and (5) digital sustainability and analytics scholars. These communities correspond closely to the five thematic clusters identified in the keyword co-occurrence analysis, confirming structural consistency across analytical methods.

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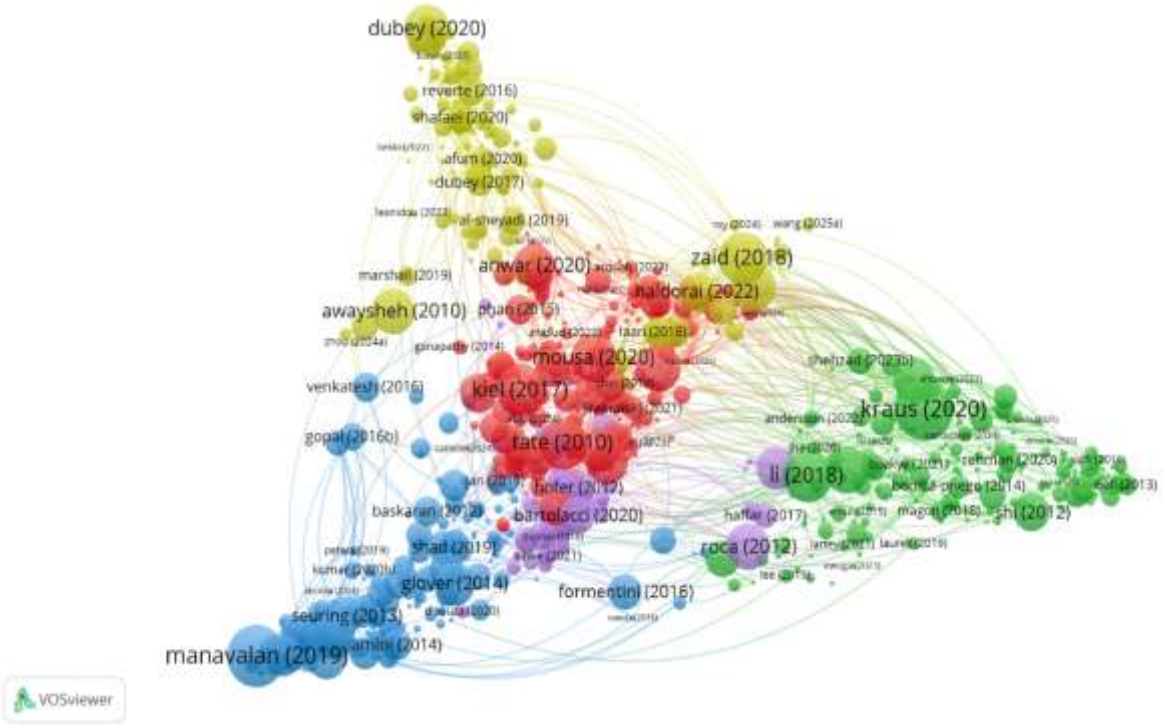


*Figure 4. Co-citation Network and Bibliographic Coupling of SA–GSCM Research (VOSviewer)*

**Thematic Structure: Keyword Co-occurrence, Bibliographic Coupling, and Overlay Visualization**

Keyword co-occurrence analysis (Figure 5; Table 5) identifies five principal thematic clusters within SA–GSCM research. The overlay visualization (Figure 6) maps the temporal evolution of these themes by displaying average publication year per keyword, enabling identification of hotspot and legacy research areas.

Cluster 1 (Sustainability Performance and ESG Measurement) is the largest and most central cluster, encompassing sustainability, ESG, environmental performance, carbon accounting, and integrated reporting. This cluster is directly aligned with the measurement bridge in the conceptual framework: sustainability accounting provides the metrics that operationalize GSCM performance goals. The temporal overlay reveals that ESG-related keywords show the highest average publication year (2022–2024), confirming this as a current and growing hotspot, driven by mandatory ESG disclosure mandates (IFRS S1/S2, EU CSRD).

Cluster 2 (Green SCM and Circular Economy Operations) encompasses green supply chain, circular economy, reverse logistics, and waste management. This cluster reflects the operationalization bridge between SA and GSCM: circular economy strategies require carbon and environmental cost accounting to evaluate resource flows and regenerative operations. Bibliographic coupling within this cluster reveals strong cross-citation between GSCM operational researchers and environmental accounting scholars, indicating growing intellectual integration.

Cluster 3 (Decision-Making, Innovation, and Digital Technologies) is the most rapidly growing cluster, evidenced by the highest density of recent publications (post-2021) in the overlay visualization. Industry 4.0, AI, blockchain, digital twins, and MCDM are prominent

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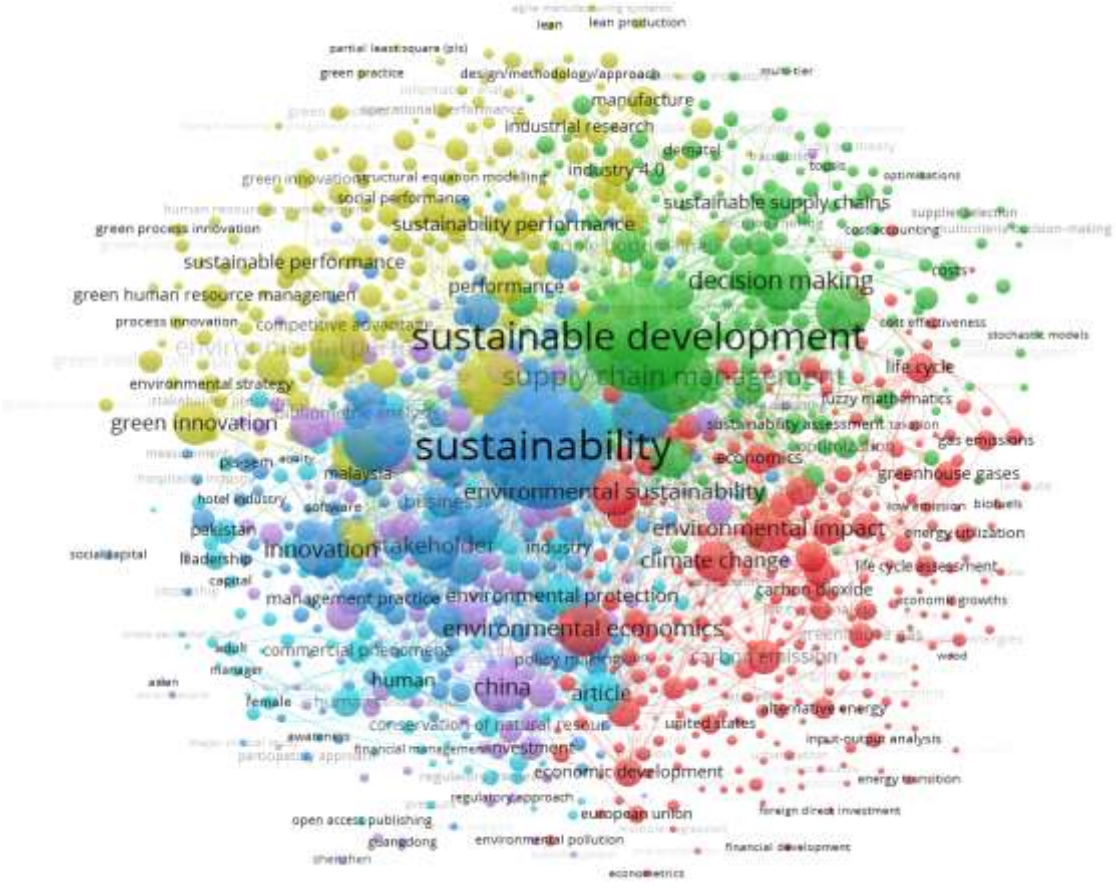
keywords, reflecting the transition toward data-driven sustainability management. This cluster maps directly to the strategic alignment bridge: digital technologies enable real-time integration of SA metrics into GSCM decision-support systems.

Cluster 4 (Governance, Institutional Pressures, and CSR) anchors the field's theoretical foundations in institutional theory. Keywords include institutional pressure, stakeholder theory, corporate social responsibility, regulatory compliance, and ESG governance. This cluster has the oldest average publication year in the overlay, indicating foundational but partially legacy status — though it retains significance as regulatory sustainability mandates intensify.

Cluster 5 (Organizational Capability and Human Capital) is the most recently emerging cluster, with sustainability-oriented HRM, intellectual capital, organizational learning, and dynamic capabilities as core keywords. This cluster addresses how organizations develop internal capabilities to translate SA metrics into effective GSCM practices, extending the RBV theoretical foundation introduced in the conceptual framework.

*Figure 5. Keyword Co-occurrence Network in SA–GSCM Research (VOSviewer; Association*




*Strength Normalization)*

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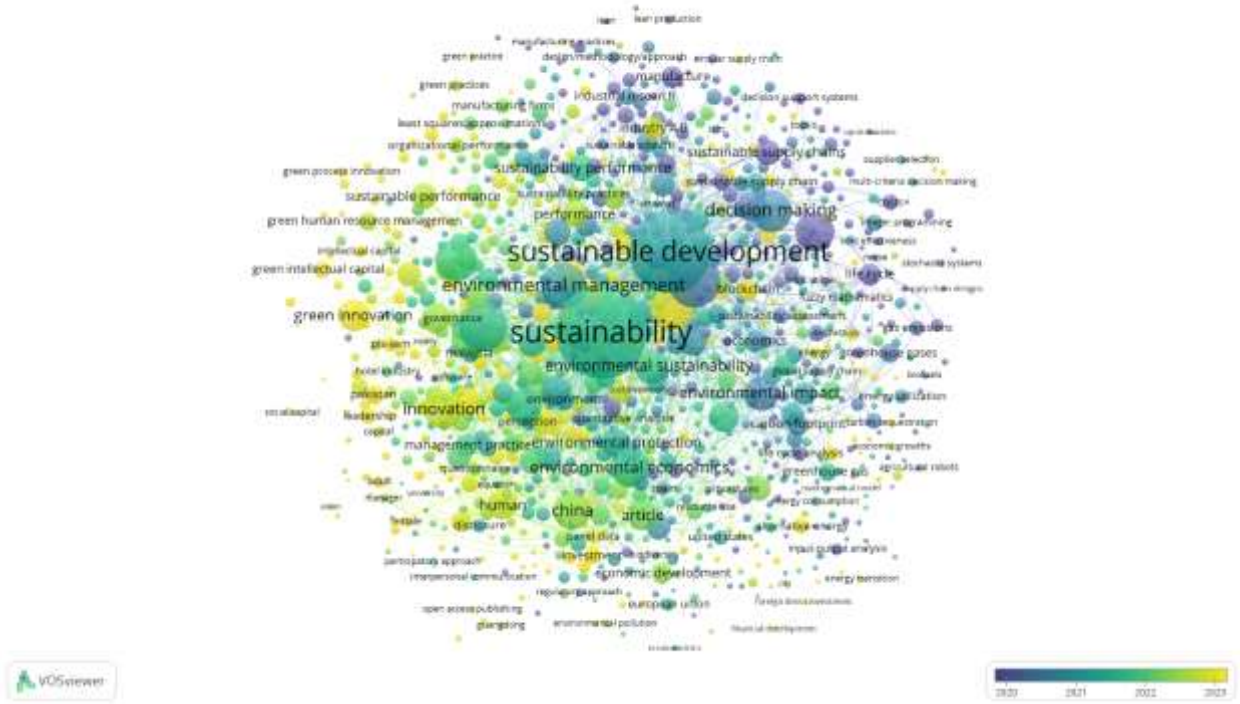


*Figure 6. Overlay Visualization of Keyword Temporal Evolution in SA–GSCM Research (2005–2025)*

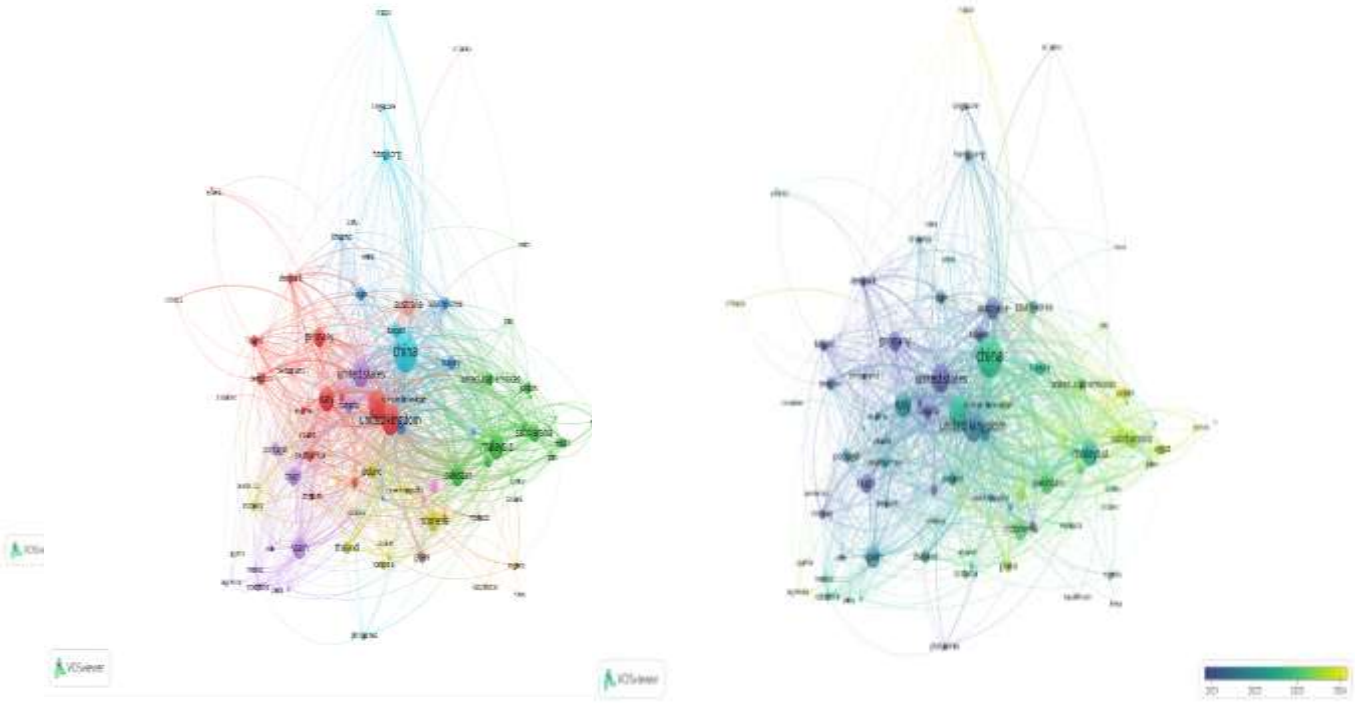


*Figure 7-8. International Co-authorship Network and Country Collaboration Clusters in SA–GSCM Research*

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## CONCLUSION AND IMPLICATIONS

### Summary of Contributions

This study advances the SA–GSCM literature through three original contributions. Conceptually, it introduces a framework positioning SA as the measurement, governance, and strategic alignment infrastructure of GSCM — a contribution that moves beyond bibliometric mapping to theoretical synthesis. Methodologically, it extends standard bibliometric analysis by incorporating bibliographic coupling, thematic evolution analysis, and overlay visualization, providing a more comprehensive picture of intellectual development. Empirically, it provides the first systematic global mapping of SA–GSCM integration, revealing five thematic clusters, key collaboration structures, and a clear post-2021 acceleration driven by ESG regulatory expansion.

### Theoretical Implications

The findings extend Neo-Institutional Theory by demonstrating that the diffusion of SA and GSCM practices is driven by coercive (regulatory mandates), normative (professional standards), and mimetic (competitive imitation) pressures operating simultaneously and reinforcing each other. The post-2021 surge in publications corresponds directly to the intensification of coercive pressures through ESG disclosure mandates, consistent with isomorphic adoption patterns predicted by (DiMaggio & Powell, 1983)

The findings also extend the Resource-Based View by showing that organizations that develop SA capabilities gain a strategic information advantage for GSCM decision-making. The bibliographic coupling structure, revealing strong intellectual linkages between SA performance measurement scholars and GSCM operational researchers, empirically supports the argument that sustainability accounting is a dynamic capability that enables green supply chain competitive advantage (Seuring et al., 2022).

### Managerial Implications

For supply chain managers, the growing integration of SA and GSCM underscores the strategic value of investing in robust sustainability measurement systems. Organizations that align accounting-based ESG metrics with supply chain operational targets are better positioned to respond to regulatory requirements, satisfy investor demands, and achieve long-term cost reduction through circular economy strategies. Specifically, the findings suggest that managers should: (1) integrate carbon accounting data into supplier evaluation scorecards; (2) adopt integrated reporting frameworks that combine financial and sustainability performance; and (3) leverage digital sustainability analytics tools to enable real-time SA–GSCM performance monitoring.

### Policy Implications

For policymakers and regulators, the consolidation of SA–GSCM research in leading international journals and collaboration networks suggests that further harmonization of sustainability disclosure standards with supply chain environmental reporting requirements would generate significant knowledge spillovers. Specifically, aligning carbon accounting standards (such as Scope 3 emissions under IFRS S2) with green supply chain certification schemes (such as ISO 14001 and Science-Based Targets initiative) would create regulatory coherence that incentivizes integrated SA–GSCM practice at the firm level. Policymakers in developing economies particularly in Southeast Asia, where Indonesia and Malaysia are

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emerging SA–GSCM contributors should consider establishing regional sustainability accounting hubs to facilitate international collaboration and knowledge transfer.

**Limitations**

This study has several limitations. The analysis is based exclusively on Scopus-indexed journal articles in English, potentially excluding relevant research in regional databases or non-English languages. The bibliometric approach emphasizes publication patterns over contextual implementation dynamics, limiting insights into firm-level practices. Furthermore, the citation thresholds applied for the synthesis corpus, while validated through sensitivity analysis, may still underrepresent very recent high-quality publications that have not yet accumulated substantial citations.

**Future Research Agenda**

Based on the bibliometric findings, thematic evolution analysis, and overlay visualization, this study proposes a structured future research agenda organized around five emerging frontiers (Table 6):

1. AI for Sustainability Accounting: Future research should explore how artificial intelligence and machine learning can improve the accuracy, timeliness, and comparability of sustainability accounting data, particularly for carbon emissions tracking and ESG metric generation across complex supply chains.
2. ESG Analytics: Research is needed on which specific ESG metrics most effectively predict green supply chain performance outcomes, and how integrated ESG-GSCM performance models can be developed and validated across industries.
3. Blockchain-based Sustainability Reporting: Future studies should examine how blockchain technology can enhance the verifiability, traceability, and governance of sustainability accounting data across global supply chains, addressing current challenges of greenwashing and data manipulation.
4. Green Digital Supply Chain: Research should investigate how digital technologies — including the Internet of Things, digital twins, and cloud analytics — can be integrated with sustainability accounting systems to enable real-time environmental performance monitoring and green supply chain optimization.
5. Carbon Accounting Ecosystems: Given the growing centrality of Scope 3 emissions accounting in both IFRS S2 and supply chain sustainability reporting, future research should explore how standardized carbon accounting frameworks can be implemented across multi-tier global supply chain ecosystems.

**Table 6. Structured Future Research Agenda For Sa–Gscm Integration**

| Research Frontier | Research Questions | Methodological Approaches | Expected Contribution |
|---|---|---|---|
| AI for Sustainability Accounting | How can ML algorithms improve ESG data quality and carbon accounting accuracy? | AI/ML model benchmarking, NLP for sustainability reports | New AI-SA measurement frameworks |
| ESG Analytics | What ESG metrics best predict green supply chain performance? | Panel data analysis, structural equation modelling | Integrated ESG-GSCM performance models |
| Blockchain-based Sustainability Reporting | Does blockchain adoption improve supply chain sustainability transparency? | Technology acceptance models, case studies | Blockchain governance frameworks for SA |

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| Research Frontier | Research Questions | Methodological Approaches | Expected Contribution |
|---|---|---|---|
| Green Digital Supply Chain | How do digital technologies (IoT, cloud) enable green supply chain optimization? | Digital transformation studies, simulation models | Digital-SA-GSCM integration frameworks |
| Carbon Accounting Ecosystems | How can carbon accounting be standardized across global supply chain ecosystems? | Cross-country comparative analysis, regulatory analysis | Carbon accounting governance standards |

** Structured Future Research Agenda for SA–GSCM Integration*

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